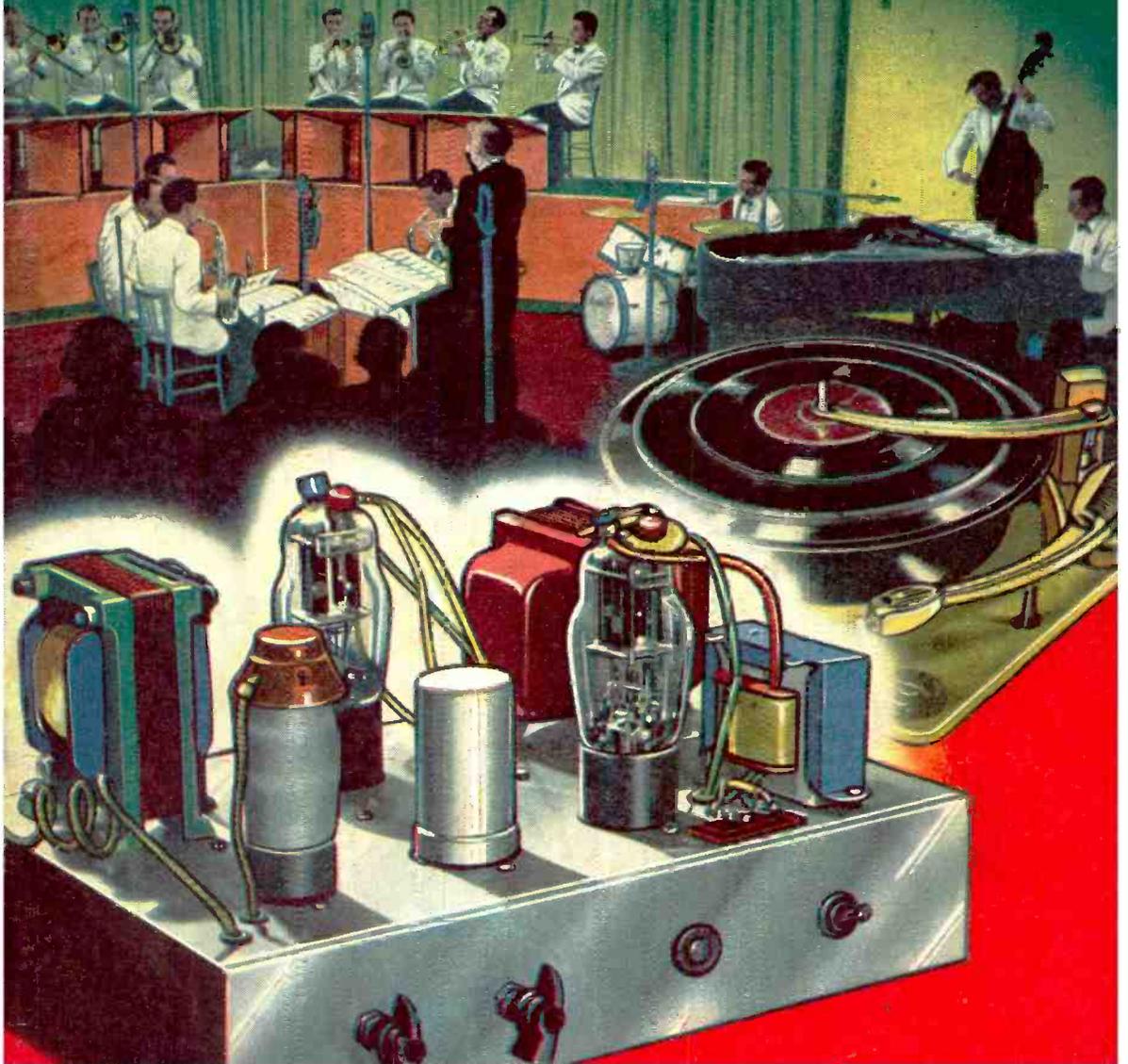


An Economical Gramophone Amplifier

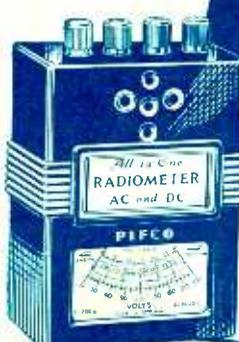
PRACTICAL WIRELESS

JUNE
1955

EDITOR: F.J. CAMM



BACK AT LAST



CIRCUIT TEST
L.T. TEST
H.T. TEST
M.A. TEST
VALVE TEST

PIFCO ALL-IN-ONE RADIOMETER
FOR ALL ELECTRICAL TESTS

With internal battery and multi-scale the PIFCO All-in-One Radiometer tests everything electrical. Radio and P.A. Equipments, Household appliances of all kinds, Car Lighting Systems, Bell and Teleprinter Circuits. May be used on AC or DC mains.

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 and at **36-37 UPPER THAMES ST., LONDON, E.C.4**

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Wherever precision soldering is essential, manufacturers, engineers and handymen rely on MULTICORE. There's a MULTICORE SOLDER just made for the job you have in hand. Here are some of them.

SIZE 1 CARTON
 4 specifications for radio enthusiasts.

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HANDYMAN'S CARTON
 Sufficient for 200 average joints. **6d.**

TAPE SOLDER
MELTS WITH A MATCH!
 Real tin/lead solder containing cores of Ersin Flux. Needs no soldering iron or extra flux.

1/- PER CARD



BIB WIRE STRIPPER AND CUTTER
 The 3 in 1 tool. For stripping insulation without nicking wire, cutting without leaving rough edges and splitting extruded flex. **3/6 EACH**



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MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS (BOXMOOR 3636)

World-wide testimony

EVERY CLAIM we have made for these remarkable units has been substantiated by users and experts (including F. J. Camm, John Gilbert, P. Wilson, H. J. Barton-Chapple and L. Ormond Sparkes)—they have produced the largest volume of unsolicited testimony ever known in the history of loudspeaker manufacture.

From every part of the world we are told that the quality of reproduction is unrivalled except at many times the price—that these units have enabled everyone to enjoy High Fidelity at realistic cost.

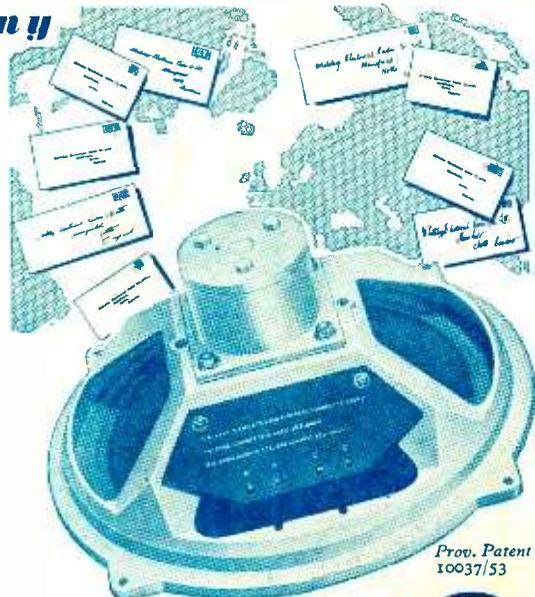
We are truly grateful for this amazing response.

Points to note: patented Cambric Cone, high flux density Alcomax magnet, die-cast chassis, Universal impedance speech coil (at 3, 7.5 and 15 ohms) on 8, 9 and 10 inch models.

Prices from **37/6** to **£9.15.6** (tax paid).

Ready-to-assemble Bass Reflex Console Cabinet for 10" or 12" unit, **£10.10.0.** Corner Console Cabinet for 8" unit, **£5.10.0.**

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Prov. Patent 10037/53

Stentorian

CAMBRIC CONE HI-FI UNITS



WHITELEY ELECTRICAL RADIO CO. LTD., MANSFIELD, NOTTS

!! HOME CONSTRUCTORS !!

You can assemble the Stern's Fidelity Tape Recorder for only £40

!! IT ONLY NEEDS CONNECTING UP !!



illustrated below form the complete equipment.

TRUVOX TAPE DECK MODEL Mk. III/TR7u

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

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

PORTABLE ATTACHE CASE

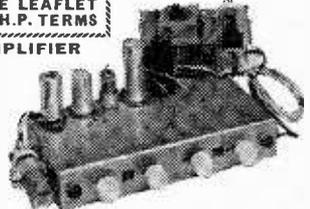
This, as may be judged from the illustration above, is a neat, compact and attractively finished case, being covered with maroon rexine and having an ivory coloured speaker escutcheon. It contains concealed pockets to accommodate the Microphone, Mains Lead and a spare 1,200ft. reel of tape.

This 2-Speed Twin Track Recorder although supplied at a Genuinely Low Price, provides absolute Fidelity Recordings, and in addition to being completely dependable has a performance at least equal to Recorders marketed at a far higher price. The actual assembly of the Recorder is simple, and only involves a few connections. The Truvox Tape Deck and the Quality Amplifier are supplied tested and ready for use, and all that is required to complete the Recorder is to connect the two together (a connection chart is supplied for this purpose) and secure them by the screws provided into the Attache Case. The items

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

MODEL TRIF QUALITY AMPLIFIER

Expressly designed to correctly operate with the above Truvox Deck for recording and playback. Supplied complete with Elliptical Speaker and has level response from 60-10,000 c.p.s. Hum level 50 db down at 4 watts. Incorporates efficient tone control arrangement and MAGIC EYE LEVEL INDICATOR. Valve line-up: EF86, ECC83, EL84, 5Y3, EM34. provides 4 watts undistorted.



MODEL MIC33/1 ACOS CRYSTAL MICROPHONE

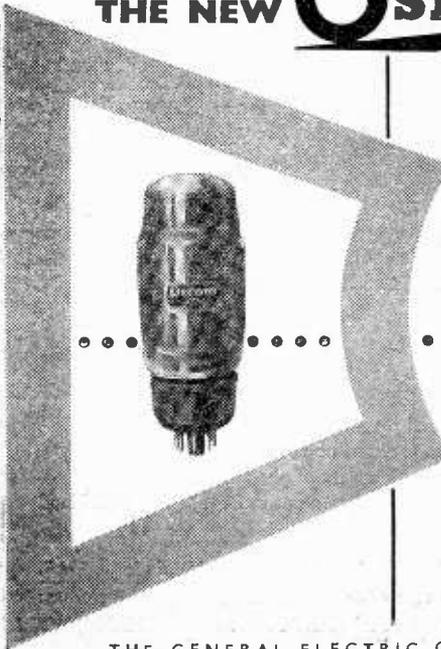
A highly sensitive Mike which accurately matches the input arrangement of the Amplifier.

It can be supplied complete and ready for use for £50 as illustrated above

STERN RADIO LTD.

109 & 115, FLEET STREET, E.C.4
Tel.: CENTRAL 5812-3-4.

THE NEW Osram KT55 output valve



The new Osram KT55 beam tetrode has a heater rating of 0.3A, 52V. It is intended for use in a series heater chain for either DC or AC/DC mains amplifiers.

Outstanding characteristic is its high power output (25 watts per pair) with minimum distortion at comparatively low H.T. voltage (200V).

The Osram KT55 will form a popular companion-type to the well-known KT66. Two valves, type KT55, will supersede the need for four valves, type KT33C, in AC/DC amplifiers required to deliver up to 25 watts at 200 volts.

KT55. List price: 25/- plus P. Tax 8/2

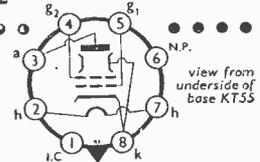
HEATER

I_h 0.3 A
V_h 52 V

TYPICAL OPERATION

Tetrode connection. Push-pull.
Data per pair unless otherwise stated.

	Quiescent	Max signal	
V _a (b)	225	215	V
V _a	200	190	V
V _{g2}	200	190	V
V _{in} (g ₁ -g ₁) (pk)		28.8	V
V _{g1} (approx.)	-20.5	-23.5	V
I _a	220	225	mA



	Quiescent	Max signal	
I _{g2}	15	45	mA
R _k (per valve)	175	175	Ω
RL (a-a)		2	kΩ
P _{out}		25	W
D		2	%
Z _{out}		9	kΩ

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

PREMIER RADIO COMPANY

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

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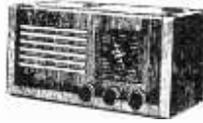
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AMBASSADOR 4033
PADDINGTON 3271-2

BUILD THESE NEW PREMIER DESIGNS

3-BAND SUPERHET RECEIVER

MAY BE BUILT FOR **£7.19.6** Plus 2/6 Pk. & Carr.

Latest type Superhet Circuit using 4 valves and metal rectifiers for operation on 200/250 volts A.C. mains. Waveband coverage—short 16-50 metres, medium 180-550 metres, and long 900-2,000 metres. Valve line-up 6K8 freq. changer, 6K7 IF, 6G7 Detector AVC and first AF, 6V6 output. The attractive cabinet to house the Receiver size 12in. long, 6 1/2in. high, 5 1/2in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD.



INSTRUCTION BOOKS 1/- each, (post free) also a detailed Stock List of priced components.

CABINETS—PORTABLE

Model PC/1
Brown Rexine covered, 15 1/2in. Overall dimensions 15in. x 13 1/2in. x 5 1/2in. Clearance under lid when closed 2 1/2in.

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

Model PC/3
Rexine type covering in various colours, 69/6. Overall dimensions 18 1/2in. x 14 1/2in. x 10 1/2in. Clearance under lid when closed 2 1/2in.

All the above Cabinets are supplied with Panel Carrying Handle and Clips. Packing and Postage 2/6. Send for details of the Premier Wide angle Telescop design which may be built for £30.

TRF RECEIVER

MAY BE BUILT FOR **£5.15.0** Plus 2/6 Pk. & Carr.

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

free) which includes Assembly and List of priced components.

DECCA MODEL 37A

DUAL SPEED RECORD PLAYER
Includes turnover crystal pick-up with sapphire stylus and a light-weight plastic spring-balanced arm. Heavy gauge pressed steel case with brown enamel finish in good quality for operation on A.C. mains 200/250 v. 50 c.p.s. Supplied complete. £8.19.6. Plus pkg. and carr. 5/-.

GARRARD \$5

GARRARD Rim Drive 78 r.p.m., complete with magnetic pick-up and turntable. £4.19.6, plus 2/6 pkg. and carr.

SEND 2/6 STAMP FOR OUR 1955 CATALOGUE.

COMPONENTS AVAILABLE FOR THE MULLARD AND OSRAM AMPLIFIER DESIGN

4-WATT AMPLIFIER

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

Valve line-up 6SL7, 6V6 and 6X5. FOR A.C. MAINS 200/250 VOLTS. The output Valve is of the beam type and feeds 4 watts into a specially designed output Transformer



which is suitable for either 3-ohm or 15-ohm Speakers. Negative feedback is applied from the secondary of the output Transformer over the whole Amplifier to the input stage giving an excellent frequency response. Due to the high gain and wide range tone controls any type of pick-up may be used. Overall size 9 x 7 x 5 1/2in. Price of Amplifier complete, tested and ready for use, £5/5/-, plus 3/6 pkg. and carr.

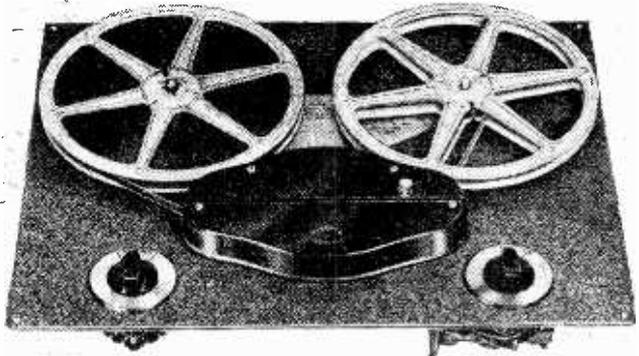
INSTRUCTION BOOK 1/- (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

C. R. TUBES

VCR 517C 6 1/2in. picture. This tube is a replacement for the VCR57 and VCR517. Guaranteed full size picture. PRICE, 35/- Plus 2/6 pkg., carr. ins. **VCR 518 9in.** Blue picture. Heater Volts 4, Anode 4 Kv., in Manufacturer's original Carton. Plus 5/- pkg., carr., ins. PRICE, £1.19.6.

New!

A QUALITY
TAPE DECK
for only **18 gns**



BRIEF SPECIFICATION:

- Heavy Duralumin Baseplate 15" x 11 1/2"
- Three independent motors
- Three speeds: 3 3/4, 7 1/2 and 15 i.p.s.
- Twin-track recording, 7" reels (1,200 ft.)
- Foolproof "drop in" tape loading
- Simple two-knob control
- Positive mechanical braking
- Interlocked switching
- Visual playing time indication
- Fast forward or reverse in 45 seconds
- Plays all makes of pre-recorded Tapes
- Azimuth adjustment to Record/Playback Head

Brenell

BRENELL RECORDING AMPLIFIER ALSO AVAILABLE 16 1/2 GNS.

From your Wireless Dealer or in case of difficulty write to sole manufacturers:

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ALPHA FOR VALVES

GUARANTEED NEW AND BOXED

AC/P	0/0	EF80	11/6	MS PEN	5/-	UCB42	13/6	1R5	7/8	6AM6	7/6	6K6GT	6/6	7B5	9/6	12AU7	9/-
AC/P/PEN	5/8	EK32	8/-	N87	12/-	UF41	11/-	184	7/8	6AQ5	8/6	6K7G	6/6	7B7	8/6	12AX7	10/-
ATP4	6/6	EL33	12/6	PC84	12/6	UJ41	11/6	185	7/8	6AT6	8/-	6K7GT	6/6	7C6	8/6	12B7	8/-
E36	14/-	EL41	11/6	PC80	12/6	UY41	10/6	174	7/8	6B4	6/-	6K7M	6/9	7HT	8/-	12C6	5/-
HD320	7/-	EL42	12/6	PEN25	8/-	VR105/30	5/6	216SG	7/-	6BA6	8/-	6K8GT	9/6	7B7	8/6	12D5	6/-
DD14	4/-	EL84	12/3	PEN46	8/6	VR116	4/-	220V8G	6/9	6B6	8/-	6L1	11/6	7B7	8/6	12K8GT	9/-
DH73M	10/-	EL91	9/-	PL81	14/6	VR150/30	9/-	2A3	6/9	6BR7	9/6	6L19	12/6	7Y4	8/6	12Q7GT	9/-
EH81	10/-	EM31	9/-	PL82	10/-	VT32 (EL32)	2X2	3A4	5/-	6BW6	8/6	6L6G	9/-	75	10/-	12S67	7/6
EL148	2/-	EN51	14/6	PL83	12/-	VT32 (KT44)	8/-	3A4	8/-	6BX6	14/6	6L7M	7/8	77	8/-	12SH7	5/6
E50	2/-	EN91	7/6	PM2M	10/-	VT75 (KT44)	8/-	306	6/-	6C4	8/-	6N7	7/6	80	8/6	12SJ7	5/6
ER34	2/-	EZ40	10/-	PM2B	5/6	7/6	3/4	304	9/-	6C5GT	7/6	6Q7G	9/-	807	7/6	12SK7	6/6
EB41	11/-	EZ41	11/-	PV30	7/6	VT501 (TT11)	3/5	305	10/-	6C6	6/6	6Q7GT	9/-	812	2/9	12SL7	9/-
ERC33	7/6	B30	5/-	PY80	9/6	6/-	384	8/6	6C9	8/-	6R7G	8/-	9001	5/6	12SQ7	8/6	
EB41	11/-	H63	7/9	PY81	10/6	VU30 (MU12)	3/4	401	8/-	6C16G	13/6	6SA7GT	8/-	9002	5/6	12SK7	7/6
BIP30	11/6	HL1320	3/9	PK25	15/-	14	8/6	401	3/-	6D3	6/-	6S47	7/8	9003	5/6	29D1	9/-
EC32	6/3	HL231D	7/6	SL30	9/6	VT111	3/6	42	8/-	6D6	7/3	6SH7	6/-	9004	5/6	20P2	12/6
EC91	7/6	HP210	6/9	SP220	6/9	VU120A	3/-	5U4 (U52)	6/6G	7/6	6SJ7GT	8/-	9003	6/-	20L1	11/6	
EC33	8/6	HP21C	7/6	SP61	3/9	WG1	9/-	384	8/6	6F6M	6/6	6SK7	6/3	954	2/-	20P2	11/6
EC35	8/6	HR210	6/9	SH41	2/6	WG1M	10/6	5Y3GT	8/6	6F8G	7/-	6S17	8/-	953	4/9	20P4	11/-
HC35	13/-	KT2	5/-	TH235	7/9	W75	9/6	5Z3	8/6	6F13	13/6	6SN7GT	9/-	956	3/6	25A4G	9/-
EC42	10/6	KT2	10/-	TP25	9/-	W77	8/6	5Z44	8/6	6F14	12/6	6S47	9/-	10C2	13/6	25L6GT	8/6
EC180	14/6	KT38C	11/6	U10	9/-	W81	10/-	6A7	10/6	6F15	11/6	6S87	8/-	10F1	10/-	25T4GT	12/-
EP8	6/6	KT66	11/6	U22	8/-	X78	14/-	6A8G	10/6	6GG6	6/6	6S77	7/6	10F9	13/-	25Z4G	9/-
EP36	6/-	KT74	8/-	U25	14/6	OZ4	6/-	6AC7	6/6	6H6	3/6	6U3G	8/6	10LD11	11/-	25Z5	7/9
EP39	6/6	KTW61	7/9	U281	10/6	L43	9/-	6AG5	7/6	6J3G	5/-	6V04	7/6	10P13	11/6	20L1	11/-
EP41	10/-	KTZ41	6/9	U404	10/-	1A7	11/6	6AJ5	9/-	6J6GT	5/6	6V6GT	7/6	10P14	11/6	25W4	10/-
EP508yl	8/-	LP210	6/9	UB42	12/-	1C54T	8/-	6AK5	9/-	6J5M	6/6	6W2	15/-	12A6	6/9	25Z4GT	8/6
EP50	6/-	LP220	6/9	UB41	9/-	1L4	7/6	6AL5	7/-	6J6	8/-	6X4	8/-	12A8H	11/6	50L6GT	8/6
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 For conversion of Acoustic Gramophone to Electric reproduction. Fitted with Universal Adaptor for any type of tone arm. For use with Standard Size Needles. Highly polished plastic, brown finish. Types 112, 2,000-ohm resistance. Output 0.3 volts. Special Price 17/6 ea.

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SILVER MICA CONDENSERS
 Dozens of sizes available, including 50 pF, 50 pF, 15 pF, 100 pF, 200 pF, 500 pF, 500 pF, 1,000 pF, etc., etc. Price 3 1/2 ea.

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 All by well-known makers. T.C.C., Dubilier, Hints, etc. .001 (100 pF), .0002 (200 pF), .0003 (300 pF), .0005 (500 pF), .001 (1,000 pF), .01 (10,000 pF), etc. All 4 1/2 ea.

OSMOR COIL PACKS
 Type H.O., 48/-; L.M., 40/-; T.R., 50/-.

Type M.T.S., 50/-; T.R.F., 40/-; R., 50/-.

HEADPHONES
 Surplus C.R. phones, 120 Ω. 7/6 pair.
 .. CHR .. 4,000 Ω 11/6 pr.
 .. DHR .. B.A. ... 13/6 pr.

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 Two for 2/1 or 12/- doz.

American surplus Throat Microphones, type T30B, etc. ... 4/- set
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10H 200 Ω 90 mA, L.F. chokes ... 9/- ea.

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 Goldtone bakelite-cased Buzzer (loud tone) ... 2/6 ea.

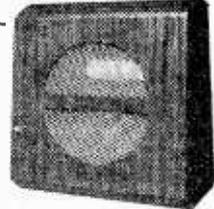


ALPHA invite you to build this 4 valve, 2 wave-band Superhet Portable for only £6. 16. 6.

Full details, circuit diagram note to point wiring instructions, and complete list of components. Available 2/8 ea. Case can be supplied separately. Available in the following attractive colours:
 ● Lizard Grey;
 ● Blue;
 ● Maroon.
 All components can be supplied separately.

TELEROD INDOOR AERIALS
 For Kirk O'Shott, frequency only. Complete with co-axial lead. Listed 2/6. - Our Price, 19/11, post and packing, 1/6.

STILL A FEW LEFT "THE COMPACT" TV AERIAL TYPE CD4 BY ANTIFERRENCE, LTD.
 Full instructions with each one. Listed 3/6. Our price, 14/6, plus 1/6 packing and post.



LOUDSPEAKER CABINETS
 This attractive walnut finished cabinet is available for 6 1/2 in. or 8 in. speaker units. Metal speaker fret, complete with back and rubber feet.
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TERMS:
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MAIL ORDER ONLY

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

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5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

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SPECIAL OFFER!
MULTI-TEST METERS
1,000 ohms per volt. Basic movement 400 micro-amp., 3 in. A.C./D.C. 0-5,000 v., 0-1 amp. 11 switched ranges: 100,000 ohms (using 3 v. battery supplied). Also decibel range. In polished wood carrying case (6 x 6 1/2 x 4 in. closed), with leather handle and space for test leads. Made in U.S.A. **LASKY'S PRICE** 95/- Post & Insur. 3/6. **TEST LEADS**, 3/6 extra.

GANGED TUNING CONDENSERS
.0005 Mfd. 1 in. spindle.
Standard 2-gang, 21 x 1 1/2 x 2 1/2 in., 5/-
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Special Offer!

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Chassis, 13 1/2 x 7 x 2 1/2 in., drilled for five latest type miniature valves, mains trans., I.F., etc. Dial, 13 x 4 in., for horizontal or vertical mounting. Spin wheel tuning. All pulleys and spindle supplied.

LASKY'S PRICE, 19/6
Post 3/-.

INEXPENSIVE RADIO YOU CAN EASILY BUILD

ALL COMPONENTS AND CABINETS AVAILABLE SEPARATELY



CAN BE
BUILT
FOR
£5.10.0

Carr. &
Pkg. 2/6

PARCEL No. 2. Contains everything to build this T.R.F. 3-valve Set for 200/250 A.C. mains, med. and long wave. Uses 6K7G, 6J7, 6V6, and metal rectifiers. Neat Plastic Cabinet, walnut or ivory finish, or Wood Cabinet as illus. on right, size 12 x 6 1/2 x 5 1/2 in. deep.

INSTRUCTION BOOK and shopping list, 1/- post free.

CABINET ONLY, Plastic or Wood, as illus., 17/6. Carr. 2/6.



CAN BE
BUILT
FOR
£7.19.6

Carr. &
Pkg. 2/6

PARCEL No. 1. Contains everything to build this 4-valve, 3-wave Superhet for 200/250 A.C. mains. Uses 6K8, 6K7, 6Q7, 6V6 valves. Attractive Wood Cabinet, walnut veneer, or Plastic Cabinet as illus. on left, size 12 x 6 1/2 x 5 1/2 in. deep.

INSTRUCTION BOOK and shopping list, 1/- post free.

LASKY'S 4-WATT A.C. AMPLIFIER KIT

Uses 1 each 6SL7, 6V6, 5Z4. All components, chassis, valves, output trans., mains trans. £4.5.0. Carriage and Packing, 2/6.

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P.M. LOUSPEAKERS

12 in. Plessey, 3 ohms, 37/6.
10 in. Heavy Duty, aluminium speech coil, 3 ohms, 26/6.
3 in., 12/6; 6 in., 17/6; 8 in., 19/6; 10 in., 19/-.

I.F. TRANSFORMERS
MINIATURE, 1 x 1 x 1 1/2 in. PRICE 9/6 pair.
WEARITE TYPE 550.
445-520 kc/s, 8/6 per pair.
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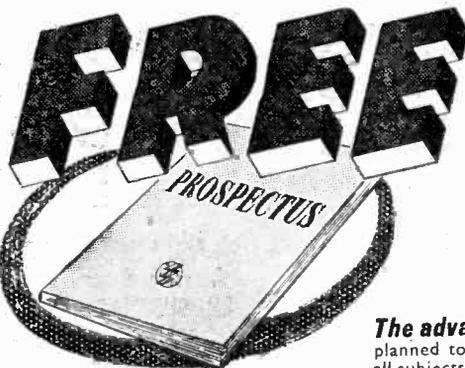
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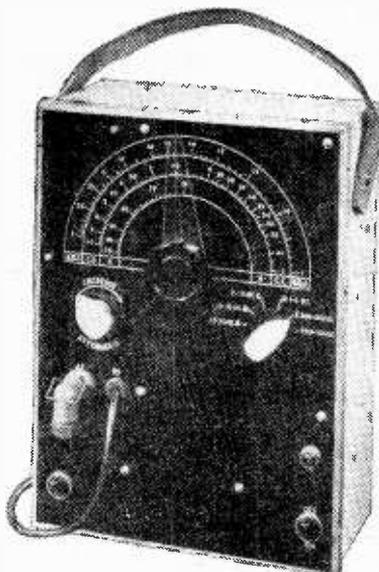
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		VR53/ EP3 9/6	SP2 5/6
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Continued here w. U.S.A. Types next month !!! Post 9d

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MIC 36



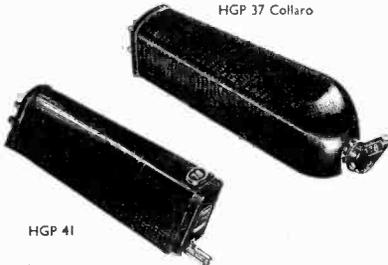
MIC 33-2



MIC 35

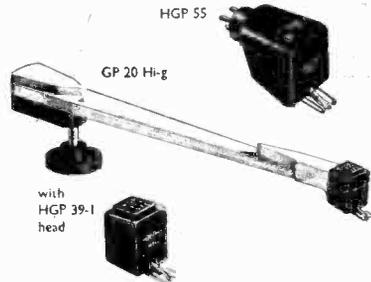


MIC 28



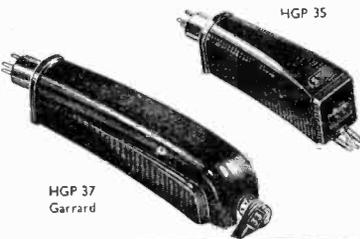
HGP 37 Collaro

HGP 55



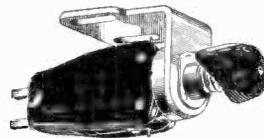
GP 20 Hi-g

with
HGP 39-1
head



HGP 35

HGP 37-1
Turnover
Cartridge



HGP 37
Garrard

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PRACTICAL WIRELESS

EVERY MONTH

VOL. XXXI, No. 584, JUNE, 1955

COMMENTS OF THE MONTH

EDITOR: F. J. GAMM

23rd YEAR
OF ISSUEBY THE EDITOR

An Interference Racket?

A MEMBER of Parliament, during the recent debate on interference suppression in the House of Commons, gave a warning of the possibility of exploitation of the regulations by spivs. He said that it would be comparatively easy for an unscrupulous person to knock at the door, say that there had been complaints of interference, and then proceed to sell some kind of phoney, and perhaps useless, piece of apparatus.

The reply was that the Regulations would be enforced only when the interference was unreasonable and when the owner would not take action of his own accord. It is probable that only in a small minority of cases would it be necessary to do this.

The G.P.O. analysis of interference complaints shows that the majority of complaints relate to interference with television. During the year ended January 20th, 1955, 55,566 complaints were received regarding interference with sound radio and 85,636 relating to interference with television. It is our view that interference with sound radio by television receivers is more widespread than these statistics would indicate, for the simple reason that most people now own a sound as well as a television receiver and may be reluctant to complain about interference in case one or other of their own receivers is also causing interference.

THE RADIO SHOW

THE Radio Show this year takes place at Earls Court from August 24th to September 3rd. This and our associated journals will, as hitherto, be represented on our stand. We shall as in past years produce a special design to signalise the occasion. We are at present experimenting with frequency-modulation circuits, and we mention this because of the large number of letters we have received on the subject of F.M. We hope this year that there will be a greater display of components for amateur set builders, and that some of the smaller suppliers of kits and parts will be represented at the Radio Show.

ABOUT CLUBS

AS a result of the remarks of a contributor on the subject of clubs, we have received a large amount of correspondence from members of similar organisations seeking our advice. Our

advice is brief and to the point. It is that no one should join a club unless it is run on constitutional lines, where the members themselves have a say in the conduct of the club's affairs and are able to elect their officers, and their club officials each year. In general, proprietor clubs, that is clubs founded by some individual or some group of individuals for the purpose of profit, should be avoided. They are not clubs properly so described but businesses. It is quite clear from the correspondence that some of these clubs are breaking the law, and that their sponsors are either unaware of or deliberately abrogating the provisions of the various Acts relating to clubs, particularly the Business Names Act.

Our contributor this month postulates a hypothetical case in which someone could start a club, install himself as the proprietor, attract a large membership, and therefore a large annual revenue, and give very little of it back in the form of service to the club. The members would have no redress, except to resign. Where a club claims national or international standing, it should undoubtedly be run on the lines we have already laid down in this journal.

We make these comments because some members of the club in question have stated that they are satisfied with the present order of things. But is the law being obeyed? We repeat what we have stated in other issues, that it is absolutely necessary for a balance-sheet to be published and that such balance-sheets should be independently audited.

This journal has always acted as a watchdog for its readers, and in the 22 years of its history has investigated a large number of clubs, some of whom were found to be specious and merely run for profit. It is because of complaints we receive that investigations are made, and we hope that readers who are members of any club will continue to keep us informed when matters arise which do not comply with club practice.

We do not intend to imply that all clubs are not properly run, but very few are. This may be due in the large majority of cases to incompetence or ignorance, and once the defects are pointed out matters are often remedied. Proprietary clubs are seldom satisfactory and accurate investigation impossible, because the books are not kept in accord with book-keeping practice.—F. J. C.

Round the World of Wireless



By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of broadcast receiving licences issued during the year ended February, 1955. The grand total of sound and television licences was 13,916,246.

Region	Number
London Postal ...	1,464,333
Home Counties ...	1,419,552
Midland ...	1,148,320
North Eastern ...	1,523,698
North Western ...	1,173,445
South Western ...	949,392
Wales and Border Counties ...	592,578
Total England and Wales ...	8,271,318
Scotland ...	1,019,013
Northern Ireland ...	218,522
Grand Totals ...	9,508,853

Head of Religious Broadcasting

THE BBC has announced that the Reverend Roy McKay has been appointed Head of Religious Broadcasting as from June 20th.

The present Head of Religious Broadcasting is the Reverend Francis House, O.B.E., who was appointed in 1947. His predecessors were the late Dr. F. A. Iremonger (1933-39) and Dr. J. W. Welch (1939-46).

BBC Concerts

DURING May the BBC will present a series of seven concerts, to be given on Wednesdays and Sundays by the BBC Symphony Orchestra and Chorus at the Royal Festival Hall. Doctor Bruno Walter will conduct four of the seven concerts, the dates of which are May 11, 15, 18, 22, 25, 29 and June 1.

Air Traffic Control

A NEW Air Traffic Control Centre for Southern England, which has been built at London Airport, recently began operations.

It replaces the Air Traffic Control Centre at Uxbridge, Middlesex, which was separated from the long-range radar unit at London Airport by five miles of telephone wires. The main feature of the new centre is that for the first time the air traffic controllers work alongside the radar unit. This represents a fundamental change. Radar is now accepted as an essential part of the control system, rather than an adjunct, and it is expected that the new integrated centre will handle the ever-increasing volume of air traffic over Southern England with greater speed and efficiency than was possible before.



A technician replaces an output unit into the radio distribution unit of a channel used by controllers speaking to aircraft. (See "Air Traffic Control".)

The heart of the new centre consists of a control room 60ft. by 50ft. with a "service space" of the same size immediately below it. Only those items of radio and radar equipment required by the controlling staff are located in the control room itself—the only radar equipments to be seen, for instance, are desk-mounted units of the shape and size of a table-model television set. Associated equipment has been placed immediately below or in nearby equipment rooms and is easily reached for maintenance purposes without disturbing the operating staff.

G.E.C. Atomic Energy Plans

THE General Electric Co. Ltd., announces that Mr. R. N. Millar, lately chief mechanical engineer to the British General Electric Co. (Pty.) Ltd., Australia, has been appointed to take charge of its newly formed Industrial Atomic Energy Section.

Cyprus Broadcasting Station

ON April 3rd came news that the Marconi 20 kW transmitter at the Cyprus Broadcasting Station at Nicosia had been damaged by saboteurs and was out of operation.

An emergency plan on an around-the-clock basis was rushed into action at Marconi's Chelmsford works. Forty-eight hours later a complete 2 kW broadcasting transmitter was in packing cases ready for shipment.

The transmitter was flown to Cyprus the next day, accompanied by Marconi engineers. Marconi's stated that, barring unforeseen contingencies, the equipment should be operational within a short time after arrival.

Marconi Mast Radiators for Corfu

IN the face of severe German competition, Marconi's Wireless Telegraph Co., Ltd., has secured an important order from the Greek Broadcasting authorities.

The order, which was obtained through the company's Greek agents, Messrs. P. C. Lycourezos, Ltd., is for two 148-metre (approx. 485ft.) mast radiators of galvanised lattice steel, complete with R.F. transmission line of the five-wire unbalanced type, aerial matching

equipment, an earth system, test apparatus and spares.

The masts are to be installed on the island of Corfu, at a coastal site about 3 kilometres south-west of the town of Corfu. The aerial matching equipment will be coupled to an existing 50 kW transmitter.

The installation work is to be carried out by Marconi engineers.

Invisible Hearing Aid

IT is reported from the U.S.A. that a new hearing aid has been developed which is entirely invisible. Made to resemble a pair of horn-rimmed eyeglasses it incorporates over 200 component parts in a standard width and weight spectacle frame, and a thin, colourless, flexible tube in length leads direct to the ear from the bow. The microphone is in the frame directly behind the ear. The miniature battery lasts 180 hours.

F.M. Litigation

THE long-standing action against R.C.A. has now been settled by the payment of 1,000,000 dollars by the R.C.A. to the estate of the late Major Armstrong. The action was commenced in 1948 by Armstrong, accusing the R.C.A. and N.B.C. of infringement of five of his basic patents on frequency modulation.

Hi-Fi Demonstration

A NEW idea in hi-fidelity sound demonstrations, named "Soundorama" took place in Washington. A 90-piece orchestra played a selection which was tape recorded and then played back through a most ingenious network. For this, ten 50-watt amplifiers were used, and ten three-way loud-speaker systems mounted on the stage with the orchestra. The audience were thus able to compare the original with the played back recording.

Inventor of Radar Caught

SIR ROBERT WATSON-WATT, the noted radar pioneer, was trapped in Kingston, Ontario, whilst speeding. He was fined \$12.50, and it was stated that the police checked his speed by means of a radar installation.

Ampliphase Transmitter

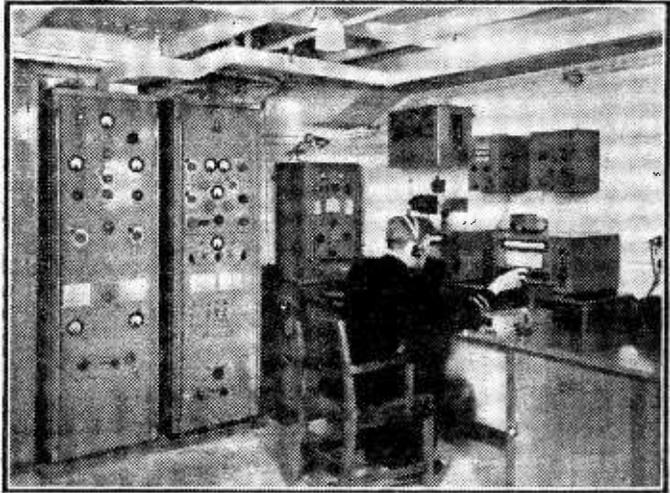
A NEW system being used by the R.C.A. enables a 50 kW modulated signal to be obtained

with only a few watts of audio power instead of the 35 kW normally required. The system uses phase modulation principles to produce standard amplitude modulation. Its circuitry permits two phase-modulated amplifiers to produce a combined power equal to the output of much larger AM

Sutton Coldfield Television Transmitting Station in which post he has remained until taking up his present appointment.

Radio and TV Sales

THE second of the interim statements of retail sales of radio and television receivers derived



One of the radio officers of the new 20,000-ton Shaw Savill passenger liner "Southern Cross" at work with the Marconi Marine equipment in the radio room. He is seen tuning the "Mercury" receiver, while other equipment shown comprises (l. to r.) the "Worldspan" main transmitter, "Reliance" emergency transmitter, "Electra" receiver "Alert" emergency receiver and "Autokey" automatic keying unit.

transmitters, resulting in a saving of operating costs of up to 50 per cent.

BBC Engineering Division Appointment

THE BBC announces the appointment of Mr. T. P. Douglas, M.B.E., as Engineer-in-Charge, Sutton Coldfield Television Transmitting Station.

Mr. Douglas joined the BBC in 1938 as a junior maintenance engineer at the Daventry Transmitting Station.

During the war he held a commission in the Royal Corps of Signals and was, for 3½ years, a prisoner of war in Siam. He was awarded the M.B.E. in 1948 in recognition of his services while in captivity when he was actively engaged in radio work.

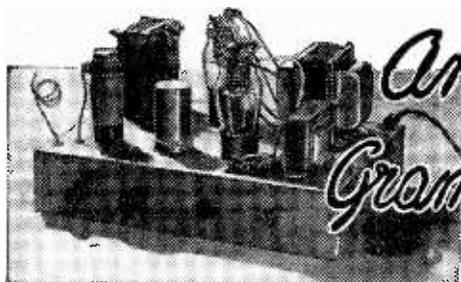
Mr. Douglas returned to the BBC at Daventry in 1946. He was transferred to Kirk o'Shotts Television Transmitting Station in 1951 and in 1953 became the Assistant Engineer-in-Charge of the

from the British Radio Equipment Manufacturers' Association monthly market surveys shows that, as compared with January, there was virtually no change in the sales during February of radio receivers and radiograms, but television sales fell in comparison with January by approximately 10,000.

Estimated National Retail Sales

Month	Radiograms	Receivers
January 1955	122,000	97,000
February 1955	122,400	87,200

An approach is being made to over 1,000 additional dealers requesting their co-operation in the extension of the B.R.E.M.A. sample. This extension has been designed to obtain returns for trade in March, and monthly thereafter, from a sufficiently large and representative cross-section of traders to enable reliable regional estimates to be made and for stocks and sales to be analysed, e.g., showing sales for cash and hire purchase or credit.



An *ECONOMICAL* Gramophone Amplifier

A GOOD AMPLIFIER FOR UNDER £5

By A. Selwood

THE amplifier featured in this article was designed with three limitations in view. Viz.:

- (1) It was to work from a crystal pick-up.
- (2) It was to give three or four watts of good sound.
- (3) It was to cost as little as possible.

The final circuit is quite simple, and as may be seen is derived directly from the "Economy Quality Amplifier" which was described in these pages during the winter 1953-54. Incidentally, it should be noted that most economy amplifiers work out at about 25s. a watt.

For example, the present one costs £4 for 3 watts;

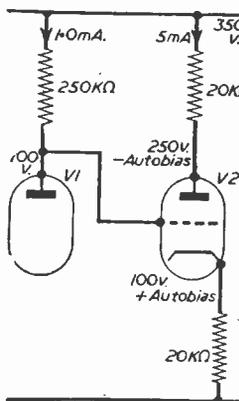


Fig. 1.—Circuit of a direct-coupled phase-splitter as used in this amplifier.

the Economy Quality Amplifier costs £10 for 8 watts, and the Williamson would cost about £30 for its 25 watts.

The Circuit

The heart of this amplifier is the semi-starvation operated pentode, and the direct coupling to the phase-splitter. The anode of the first valve works about a steady voltage of 100 volts; this state of affairs being brought about by appropriate choice of the anode load resistor and of the screen potential for V1. Now it so happens that a positive bias of 100 volts or so is required by the phase splitter, which then draws its four or five milliamps quite happily. The simple nature of the coupling and a typical set of operating conditions are shown above. The load resistors of the phase-splitter must be of exactly equal value. They may best be matched, if they are the large two-watt type, by filing a slot into the resistor of lower value, and deepening it until the resistors are the same value. A touch of hot shellac will keep moisture out of the cut.

As for valves, practically any good pentode and triode will do; in the circuit of Fig. 1 an SP61 amplifier and a triode-connected EF50 splits the signal.

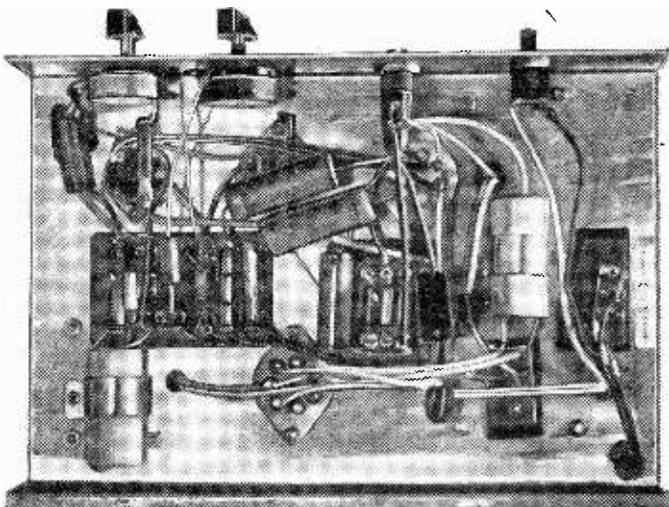
The only other feature of interest in the circuit is the use of the 6 volt RK34 as the double-triode output valve. The RK34 was chosen for no other reason than that it may be bought for just half a crown. Originally it was designed as an R.F. power output valve capable of handling 20 watts, so there is little likelihood of it overloading in the present circuit. Another RK34 with its grids tied to their separate anodes is used as the full-wave rectifier.

The feedback loop and the scratch filter are elementary, and, some may say, rudimentary. Nevertheless they function quite well.

Most "shop" mains transformers will need an extra volt wound on to their rectifier windings, since the RK34 has a 6 volt heater. In most cases this is very easy because the rectifier windings are put on last, at the outside of the coil. But do make sure! Loose H.T. windings are an unpleasant sight, and 38 s.w.g. is tricky to handle.

Price List

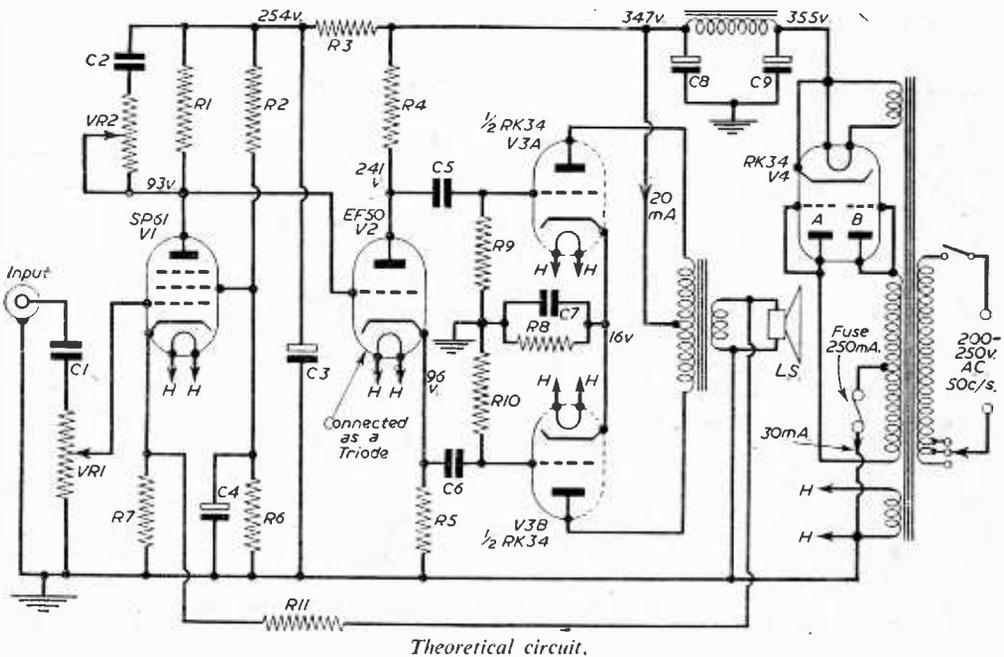
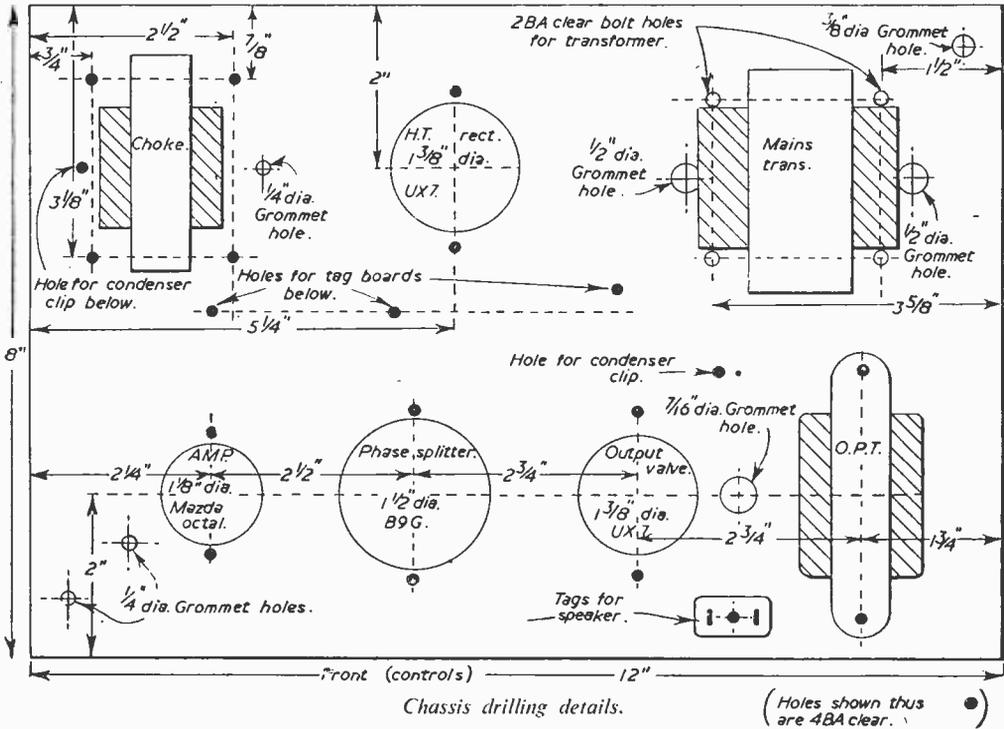
The price of parts list is complete, and compiled from the catalogue of Messrs. Radio Supply Co. Ltd., Leeds. The items marked with an asterisk

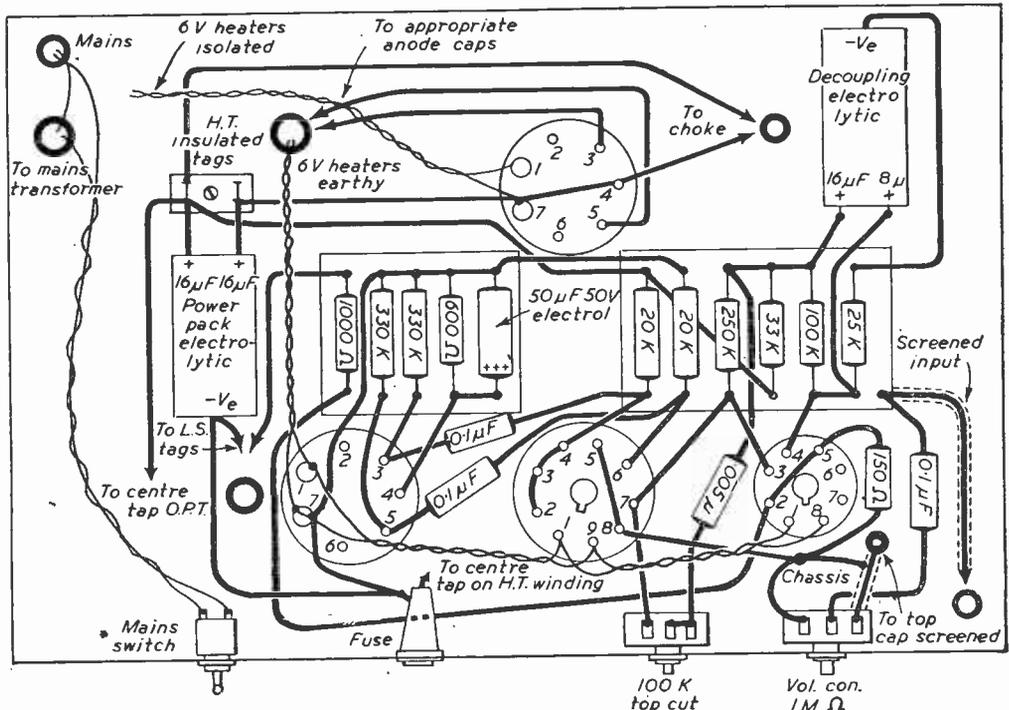
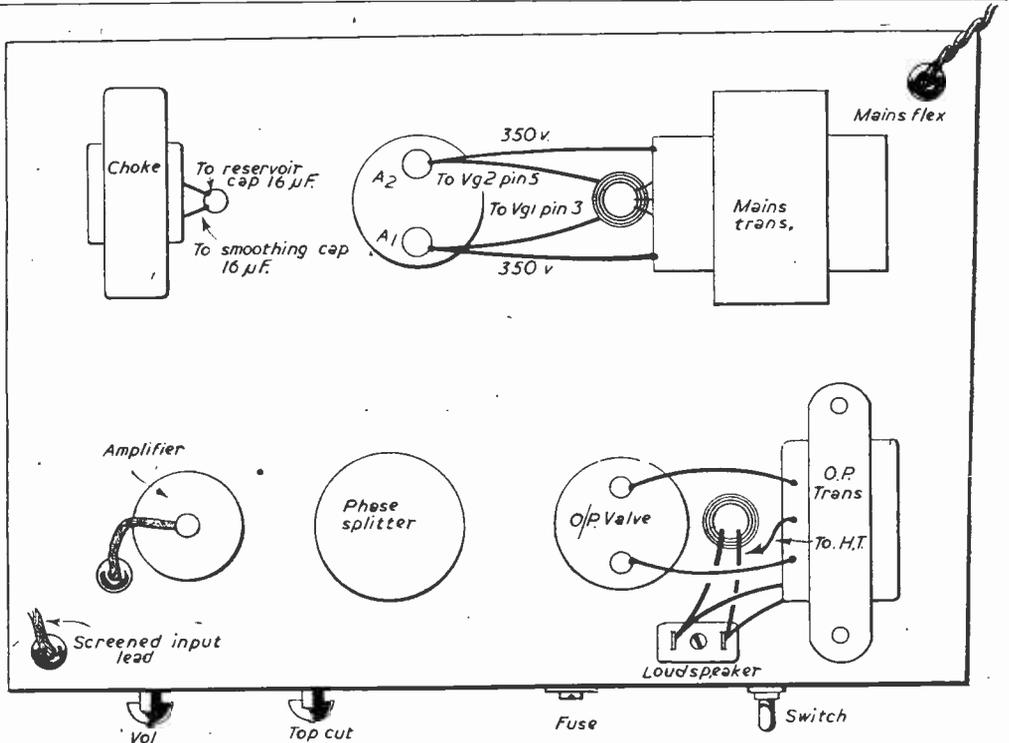


Under view of the complete amplifier.

do not appear to be readily obtained elsewhere. When the amplifier is complete, it is essential to check that the anode voltage of V1 is within 10 volts of 100 volts positive. If it is not, a slight amount of

juggling with the value of R6 will be necessary. Voltages and currents at other parts of the circuit are indicated below; they were measured with a 50 μ A meter.





Above and below chassis wiring details.

The sound output is more than sufficient for a room 20ft. square, and the gain is such that the amplifier overloads at maximum volume and 400 mV input. The quality is good to listen to; it cannot be

lished in these pages, whilst we are at all times willing to assist readers who find themselves in difficulty in getting satisfactory results from apparatus built from the descriptions in these pages, we are

PARTS PRICE LIST

	s.	d.
*Mains Trans.—350-0-350 v. 70 mA ; 6.3 v. 2 a. ; 5 v. 2 a. (needs slight modification)	18	9
Choke—50 h Ω 50 mA (or near)	9	9
*O/P Trans.—push-pull 8 watt 6v. 6 to 3 Ω	7	11
C8 + C9—16 μ F + 16 μ F Dubilier elec- trolytic 500 v.	5	9
C3 + C4—8 μ F + 8 μ F Dubilier electro- lytic 500 v.	3	9
*V3, V4—RK34 at 2/6	5	0
V1—SP61 at 2/9	2	9
V2—EF50	5	9
HARDWARE		
1—chassis 16 s.w.g. 12in. x 8in. x 2 $\frac{1}{2}$ in.	5	3
1—Switch Arrows T.S.P., 250 v. 1 a. ...	11	
1—British screened top cap	5	
1—Fuseholder and 250 mA fuse	1	1
*2—UX 7-pin ceramic bases RK34 at 10d.	1	8
1—I. O. valvholder	4	
1—B9C ceramic va'veholder	8	
4—plain top clips	3	
1—tag board	6	
Sundries	2	6

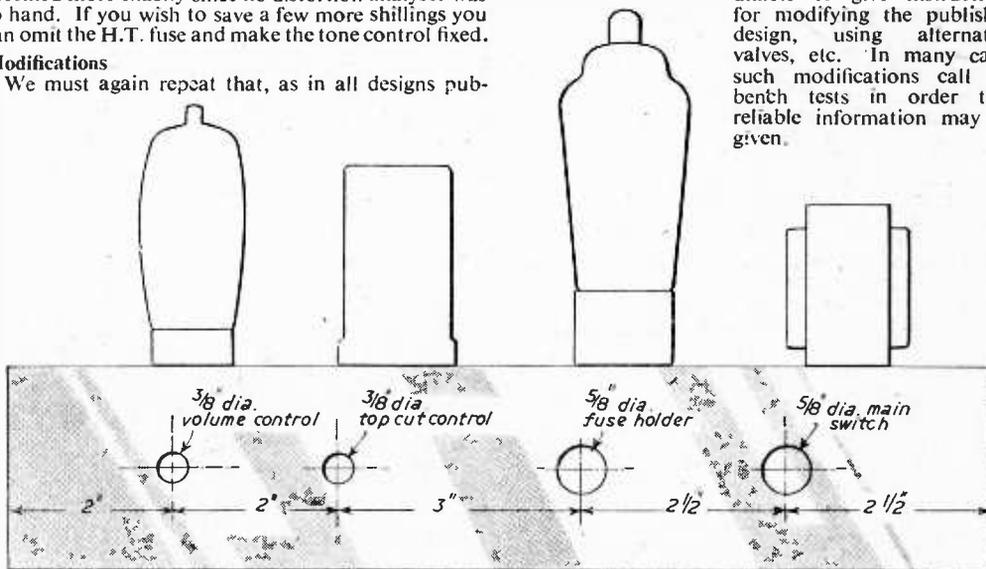
		CONDENSERS	
	s.	d.	
C1—0.1 μ F 350 v. paper	6
C2—0.005 μ F 350 v. paper	4
C5 } 0.1 μ F 1 Kv paper at 9d.	1 6
C6 }	
C7—50 μ F 50 v. electrolytic	2 3
RESISTORS			
VR1—1 m Ω Dubilier	2 9
VR2—100 K Ω Dubilier	2 3
R1—250 K Ω 1 w. \pm 10%	
R2—100 K Ω $\frac{1}{2}$ w.	
R3—30 K Ω $\frac{1}{2}$ w.	
R4 } matched to 1%, value 20 K \pm 10% 2w.	
R5 }	
R6—25 K Ω $\frac{1}{2}$ w. \pm 10%	
R7—150 Ω $\frac{1}{2}$ w.	
R8—600 Ω 1 w. \pm 10%	
R9 } 300 K $\frac{1}{2}$ w.	
R10 }	
R11—1 K $\frac{1}{2}$ w.	5 1
Total	£4 7 8

specified more exactly since no distortion analyser was to hand. If you wish to save a few more shillings you can omit the H.T. fuse and make the tone control fixed.

Modifications

We must again repeat that, as in all designs pub-

unable to give instructions for modifying the published design, using alternative valves, etc. In many cases such modifications call for bench tests in order that reliable information may be given.



Details of panel layout.

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The Radio Components Show

DETAILS OF SOME OF THE EXHIBITS AT THE R.E.C.M.F. EXHIBITION IN LONDON

THIS year's exhibition of component parts showed very little which was new in the radio line, although, as readers of our companion paper will see, several new television items were on show. In the main, however, the exhibition merely consisted of well-known lines plus one or two new versions of popular items. The greatest part of the new developments was concerned with the printed circuit technique, which no doubt in time will revolutionise the construction of all forms of electronic apparatus. T.C.C. had some interesting items in this connection, as they are now specialising in this particular branch. These included:



Front view of the new Plessey 5-channel pre-selector.

Several high quality amplifiers.
Radio receivers of the A.C./D.C. and battery types.
Portable with contained battery.
TV tuners for Band I and Band III.
Aerial filters for TV receivers.
Cross-over networks.
I.F. transformers for TV.
I.F. transformers and amplifiers for TV.
Transistor computer panels.
Telephone distribution panels.
Flexible circuits, etc., etc.

Other printed circuit developments were seen on the Belling Lee Stand, and one of these is here illustrated. It is a circuit connector. These are designed for easy installation, and can be mounted side-by-side in multiples of four connector strips to produce a practically unlimited number of contacts. They can be "stacked" with spacers between for component mounting. They can be mounted direct to plates, printed or otherwise, and are suitable for mounting on ceramic and laminated plastic printed circuits.

In connection with the development of these printed circuit applications the Multicore Company have developed the special solder which they showed at the last exhibition, and now the complete range at present offered for the soldering of printed circuits is as follows:

- P.C.1. Multicore Abrasive Degreaser.
- P.C.2. Multicore Dip Cleaner.

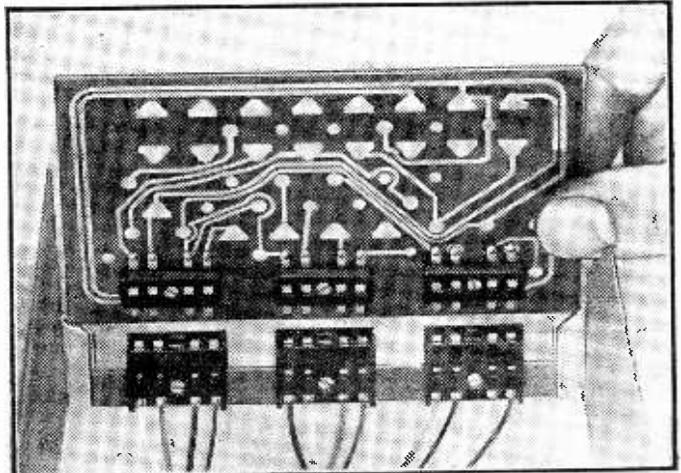
- P.C.10. Multicore Activated Surface Preservative.
- P.C.20. Multicore Special Non-corrosive Liquid Flux.
- P.C.21. Oil-free Special Non-corrosive Liquid Flux.
- P.C.31. Multicore Alloy for Printed Circuit Solder Baths.
- P.C.35. Ersin Multicore 5-core Solder for hand soldering the printed circuits.
- P.C.38. Special Multicore Alloy Service.
- P.C.40. Multicore Anti-oxidant Oil.
- P.C.50. Multicore Finishing Enamel.

Trade Items

As the largest manufacturer of components to the trade, the Plessey Company naturally had the widest range of separate items, and as many of these are used by other manufacturers in their products, an inspection of the stand gave a very good all-round idea as to what is available. Apart from the special television apparatus, two new pre-selectors, the PV98 and PV98A, were shown. These are designed for use in conjunction with a single-channel fixed frequency H.F. receiver, such as the Plessey PR53A, PR53C or PR51C, to provide switched selection of any one of five pre-set crystal-controlled channels in the frequency range 2.7-27 Mc/s.

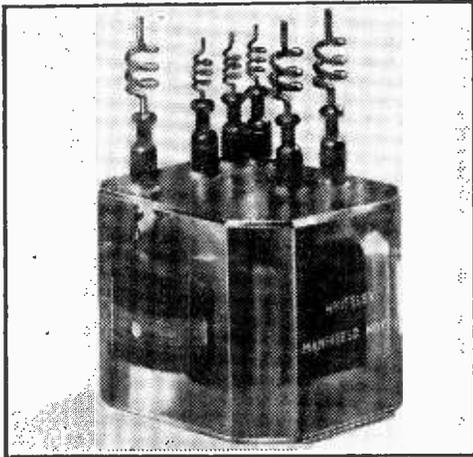
The PV98 is fitted with a crystal-controlled B.F.O. for use when receiving C.W. signals, while the PV98A is designed for M.C.W. and R/T working. Both are extremely versatile and may be used on conjunction with Plessey or other manufacturers' units in commercial communication networks. In an F.S.K. installation, for example, the use of a PV98 in conjunction with stable oscillators PG81 and PG82, provides five-channel reception with the same high stability as the standard PVR80 equipment, and is hence suitable for unattended operation.

When the stability requirements are less critical,



One of the many printed circuit adaptations—a Belling Lee plug and socket combination.

the PV98 may be used with its own internal oscillators, making an F.S.K. installation available at very moderate cost. Operational trials have shown that extremely good performance can be achieved if the vernier controls are periodically adjusted.

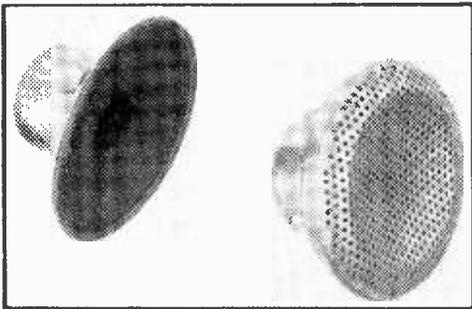


One of the new "C" core potted components—by Whiteley Electrical.

Both pre-selectors comprise an R.F. stage, a crystal-controlled H.F. oscillator and a mixer, giving a low impedance coaxial output at a fixed frequency of 2.1 Mc/s. The R.F. stage is tuned by pre-set circuits and the oscillator stage crystal controlled, the appropriate circuits being selected by a single five-position rotary switch manually operated from the front panel. Alternatively, the selector switch may be motor-driven from the rear, thus permitting remote control.

Additional facilities are available on the PV98 for operation from external oscillators. The tuned circuits are mounted as plug-in units, six ranges being provided to cover the frequency band.

Two pre-selectors and two receivers may be connected to form a dual-diversity combination, the receiver outputs feeding a conventional path selector or diversity switch unit. Under these conditions the channel frequency crystals need only be fitted in one of the pre-selectors, as the two may be operated with H.F. oscillator circuits cross-coupled, and similarly for diversity telegraphy two B.F.O. outputs are provided for the operation of both receivers



Plessey's new 3in. loudspeaker.

driven by a single crystal fitted in one only of the pre-selectors.

Switches

F.M. slider switches were seen, and are intended for a variety of purposes, including F.M. radio and TV band switching. They utilise H-type contacts in groups of three, and as many as six groups may be incorporated on one switch. Being flat, the switches may be mounted horizontally or vertically and thus occupy the minimum of space. They are slider-operated, either directly or by some external means such as a cam or a simple rotary switch. Both spring-loaded and non-spring-loaded types were shown.

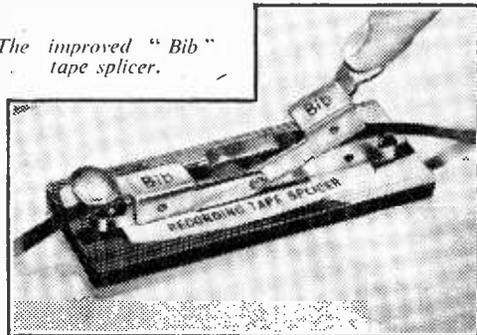
Condensers

Gear-driven and in-built ganged capacitors were also seen. The integral ball drive variable capacitors types "U" and "S" are fitted with integral reduction drives having ratios of approximately 6:1, thus simplifying the design of receivers, since additional cord or other slow-motion drives are unnecessary.

Control knobs shown are of various types, while the capacitors displayed included miniature plastic-cased electrolytics, NATO-type electrolytics and tubular paper capacitors.

New sealed lampholders, type X.L.I., designed primarily for use on radio and electronic equipment, and holding lamps with standard miniature Edison

The improved "Bib" tape splicer.



screw caps were shown. For these lampholders two interchangeable caps are available. One is a translucent moulding in a wide variety of colours to suit individual requirements. The second is a dimmer cap consisting of a light alloy die-cast fitting with a plastic filter coupled to a shutter.

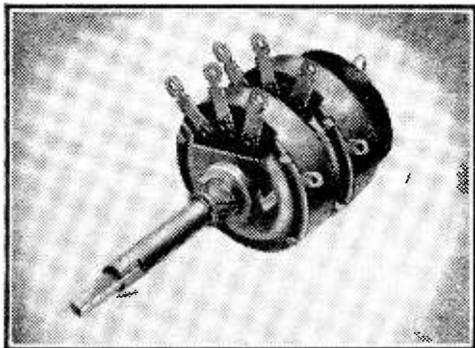
Plessey have recently designed additional types of output transformers. Among those displayed were a miniature transformer for use in "personal" sets, in conjunction with sub-miniature output valves and where the primary direct current is limited to 3 milliamperes maximum; size 10 for use in battery portable and "personal" sets in conjunction with sub-miniature valves operating above 4 milliamperes direct current in the primary; size 13a for use with 10in. speakers operating in the 4- to 5-watt range, and size 15 for use with high-fidelity equipment, with a power output rating of 6 watts maximum.

Loudspeaker

The 3in. inset loudspeaker, shown on the left, was specially developed in conjunction with S.R.D.E. for use in Services equipment and is suitable for

any application in which a small size, clear reproduction of speech and the ability to withstand extreme climatic conditions are essential requirements.

The inset loudspeaker is mounted in a sealed metal



One of the new dual controls with concentric spindles, by Egen Electric.

backing plate by means of vibration-proof rubber mouldings, the connections being brought out of the case through ceramic seals. The front is protected by a perforated steel cover. The magnet system is of the totally enclosed centre-pole type. The frequency response has been specially adjusted to give maximum intelligibility of speech under conditions of high ambient noise and has extreme sensitivity over the range 800 c/s to 5,000 c/s with a frequency response extending to 400 c/s. It will handle 1 watt and has a speech coil impedance of 10 ohms. The commercial versions are made with either round or square mounting flange.

Tape Recorders

Among the several tape recorders shown were the special Ferrograph instruments shown by Messrs.

Millimicro-second Photography

THE use of image converter tubes as the shutters of ultra high speed cameras is now well established. The image of the object to be photographed is focused on the sensitive photocathode of the tube. When operating voltages are applied a duplicate image appears at the opposite end of the tube. To photograph fast transient phenomena the tube is switched on by voltage pulses synchronised with the phenomena, the actual photographic record being made by an ordinary camera.

In the past circuit limitations have fixed the lower limit of exposure at about 30×10^{-9} seconds. In a new Mullard instrument the use of a coaxial pulsing system enables the exposure time to be reduced ten times, i.e., to 3×10^{-9} seconds.

In a demonstration at the Physical Society's Exhibition recently a voltage pulse produced by a very fast spark discharge travels down a coaxial line to trigger on the tube. At the same time the light generated by the spark is guided by mirrors to the photocathode of the image tube. When the light path is lengthened by moving the mirrors a point is reached where the image of the spark on the viewing screen disappears, because the light arrives at the photocathode after the voltage pulse which triggers the tube has died away.

Wright and Weaire. These included instruments having tape speeds from 11/16 c.p.s. up to 15 c.p.s. in a variety of portable and rack-mounted forms to meet the varying needs of industry, research, education and entertainment.

Auxiliary apparatus for use with Ferrograph recorders including:

Endless loop cassettes. Signal operation switch units. Pulse units.

Mention must also be made in this connection of the novel Bib-tape splicer shown by Multicore. This has previously been dealt with in these pages, but has now been redesigned and is now known as the Mark 2 and incorporates two tape retaining clamps which, in addition to having extensions on them providing an even easier releasing arrangement, are also fitted so that the clamp openings both operate identically towards the tape recorder. It is claimed that this makes tape splicing a quicker and simpler job without losing any of the virtually foolproof advantages of the original Bib product.

Multicore Solders, Ltd., state that if an earlier model has already been bought and the user requires this latest modification, the work will be undertaken on receipt of the Splicer, properly labelled with the owner's name and address, and a postal order for 2s.

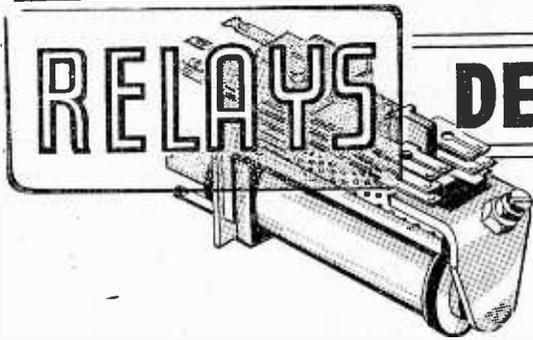
Potted Chokes

Another type of component which is coming into increasing use is the "C" core potted transformer and choke. Illustrative of these is the W/B component shown on page 335. This has a "C" core moulded in Aroldite, and is fitted with waterproof plugs and sockets. Other W/B exhibits included the complete range of Stentorian high fidelity loudspeakers, now incorporating the patented Cambric cone from 2½ in. to 18 in. in diameter, including 8 in., 9 in. and 10 in. models fitted with universal impedance speech coils, providing instant matching at 3, 7.5 and 15 ohms.

New Reflectometer System

ONE of the most important elements in the Hewlett-Packard reflectometer system for wide-range microwave impedance measurements is the new 'hp' 416A Ratio Meter. This instrument automatically combines forward and reverse signals and displays their ratio directly. Reflection coefficient is read directly on a front panel meter. A separate output terminal is provided to operate an oscilloscope or recorder. The Ratio Meter includes an R.F. power monitor indicating proper power level. Accuracy obtainable for swept frequency measurement is ± 0.015 reflection coefficient; for single frequency measurement, ± 0.005 reflection coefficient. Model 416A may also be used to measure S.W.R. in connection with slotted lines. A reference voltage from the system power source applied to the ratio meter eliminates error due to amplitude variation.

Another important instrument in the reflectometer system is the new 'hp' 670HM Swept Frequency Oscillator. This equipment operates over a frequency range from 7 to 10 KMC. It may be manually tuned or motor driven to sweep any portion of this frequency band automatically. Sweep is at a velocity which is constant and sufficient to ensure a clear trace on a long-persistence oscilloscope. The instrument has a direct-reading frequency dial.



DESIGN & USES

THE FOURTH ARTICLE IN A NEW SERIES DEALING WITH A MOST USEFUL TYPE OF RADIO ACCESSORY

By J. R. Davies

(Continued from page 305, May Issue.)

BI-METAL strips are fairly easy to obtain from surplus dealers, or they could possibly be made at home. Manufactured strips are capable of giving delays up to three or four minutes. When used in the circuit of Fig. 20, the double action ensures that the strip is always cold and ready for re-use as soon as it has completed its cycle.

It will be noticed also that, in the event of a mains failure, the energising voltage to relays $\frac{A}{3}$ and $\frac{B}{1}$ ceases. These relays would then de-energise and, on resumption of the mains supply, it would be necessary for the bi-metal strip to operate before H.T. could be obtained once more. The circuit, therefore, protects the equipment in which it is used against all foreseeable accidents. (The energising voltage for the relays should, of course, be derived "after" the on-off switch of the equipment.)

In last month's article we discussed a relay circuit by means of which it was possible to control three remote circuits over two lines (see Fig. 15 (b)). This month we shall examine a system which is capable of controlling many more operations whilst still requiring only the two interconnecting lines. As this system lends itself very easily to control by radio, this aspect will be given due prominence as well.

The Uniselector

One of the most practicable devices for enabling a large number of remote circuits to be operated over a single pair of lines is the uniselector. (The uniselector

is used in automatic telephone exchanges to interpret the impulses sent by dialling.)

A simplified diagram of a standard uniselector is shown in Fig. 22. Its operation is quite simple and is almost self-explanatory. When its coil is energised the armature is attracted to the core, causing the pawl to pull the ratchet wheel through the distance occupied by one tooth and thereby move the wipers (i.e., the moving contacts at the ends of the contact or "wiper arms") to the next contact in the bank. On de-energising the coil the armature restoring spring brings the armature and pawl back to their original positions. The pawl, on returning, engages with the next tooth of the ratchet wheel. The detent spring (a fixed spring which bears against the teeth of the ratchet wheel), prevents the wheel from rotating backwards as the pawl returns.

It will be readily seen that, by energising and de-energising the uniselector coil the requisite number of times, it is possible to set the uniselector wipers to any desired position. With a uniselector, therefore, a large number of different operations can be controlled over two interconnecting leads alone, simply by sending the requisite number of impulses.

Practical Details

The uniselector shown in Fig. 22 has 25 fixed contacts on the contact bank. This is a standard number (although not by any means necessarily the number used for all uniselectors), and corresponds to what is necessitated by a 10-number telephone dial.

In practical use the 25 contacts shown in the diagram resolve themselves down to 24, since, when one wiper is resting on the 25th fixed contact, the

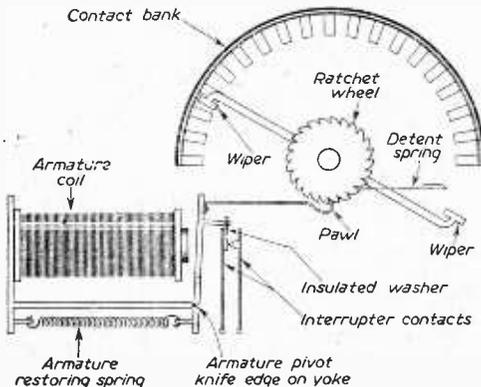


Fig. 22.—A simplified diagram illustrating the construction and operation of a forward-acting uniselector.

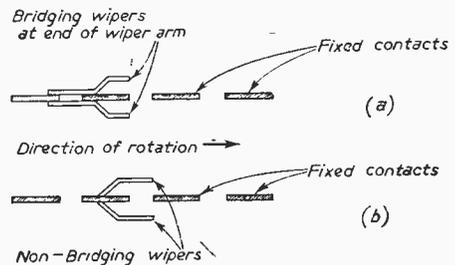


Fig. 23 (a).—A pair of bridging wipers. They are depicted here moving from one fixed contact to the next. (b) A pair of non-bridging wipers.

wiper on the opposite arm is resting on the first. The remaining 24 contacts then split into two halves of 12 contacts each, the first 12 contacts being paralleled with the remaining 12 contacts (i.e., contact 1 to contact 13, 2 to 14, 3 to 15, and so on). With this method of connection it is unimportant whether the rotating wipers start a dialling cycle at contact 1 or contact 13. The 12 contacts "remaining" are the number required for dialling purposes. Of these, one contact is used for "homing" or reference purposes, another is spare and the remaining 10 correspond to the 10 numbers on the telephone dial.

Although only one contact bank was shown in the simplified diagram in Fig. 22, uniselectors usually have at least two banks and often more.

Fig. 22 also showed two interruptor contacts; these being operated by the armature and breaking as the armature moved to the core. These contacts are used for "homing"—a process which will be explained later. It can be readily imagined that, if these contacts were connected between the coil and an energising voltage, they could cause the unselector armature to vibrate in the same manner as does that of a bell or buzzer. The pawl, being fixed to the armature, would move in a similar fashion and would cause the ratchet wheel to be turned through one tooth for each vibration of the armature; with the result that the wipers would rotate at a relatively high speed.

Another point of importance lies in the fact that two different types of wiper may be employed. These two types are known as bridging and non-bridging wipers, and are illustrated in Fig. 23. Bridging wipers are used when it is necessary to ensure that no break occurs between contacts.

Returning to Fig. 22 again, it may be remembered that the pawl of the unselector shown in this diagram moved the ratchet wheel when that armature was attracted to the core. The force driving the ratchet wheel was derived therefore from the movement of the armature. In a large number of uniselectors the ratchet wheel is moved when the armature releases, the force driving the wheel being derived this time from the armature restoring spring. When the armature of such a unselector moves to the energised position it causes the pawl to engage with the next ratchet wheel tooth. This latter type of relay is known as "reverse-acting." That of Fig. 22 is "forward-acting."

Having gone thus far into the theory and design of the unselector, it would now be of interest to show how we can use it in a practical circuit.

Circuit Design

Such a circuit is shown in Fig. 24. For this circuit we need a reverse-acting unselector with two contact banks; one having bridging wipers and one having non-bridging wipers. Twelve contacts are shown in the diagram for each bank, the remaining 13 (assuming a 25-contact unselector), being omitted for simplicity. The purpose of the circuit is to so control the unselector that it will automatically select one of 10 circuits; control being effected over two lines. (It could also be controlled by a radio link; S1 and S2 keying the transmitter carrier, and a relay in the receiver closing their circuit on reception of the carrier.)

Although the circuit of Fig. 24 may be, at first sight, a little complex, this is only because it takes advantage of the refinements offered by the unselector. The circuit could very conveniently be operated by a dial,

but, as such components are difficult for the experimenter to obtain, the switch and push-button are used instead.

Operating the Unselector

Let us now see how the circuit operates. We start off by closing S1. This energises relay $\frac{A}{3}$ and, after a second or two, relay $\frac{B}{2}$ as well (the latter being slow to operate and release). We then press the push-button, S2, a predetermined number of times corresponding to the number of impulses we wish to transmit to the unselector coil. Each time S2 is pressed, relay $\frac{A}{3}$ de-energises, causing its break contact A1 to close. Relay $\frac{B}{2}$ does not de-energise during this period because it is slow to operate and release. Thus, each time relay $\frac{A}{3}$ de-energises, a circuit is completed from the positive source of supply via contacts B1 (closed all the time) and A1 (closed when relay $\frac{A}{3}$ de-energises) to the unselector coil, and thence to earth. The unselector armature then energises and de-energises (once for each pressure on the push-button, and correspondingly causes the ratchet wheel to be turned through the requisite number of teeth. When S2 has been pressed and released for the last time it is left alone, whereupon relay $\frac{A}{3}$ stays energised and the unselector comes to rest, its wipers positioned at the contact selected.

During this time, another circuit has come into operation on Bank 1. As soon as we started to press the push-button, and the bridging wipers of Bank 1 left contact 1 of that bank, they commenced to complete (via contacts 2 to 12 inclusive), an energising circuit to relay $\frac{C}{1}$; this circuit being completed by the make contact A2. However, due to the fact that relay $\frac{A}{3}$ is continually energising and de-energising whilst the push-button impulses are being sent, this energising circuit is intermittent. Relay $\frac{C}{1}$ is slow to operate and release and this intermittent energising current is insufficient to cause it to energise. This condition would automatically be satisfied if a dial were used instead of S1 and S2. With the push-button it would probably be necessary to send the impulses fairly quickly, and to try to keep the time of each approximately equal to the time between impulses. When impulse sending has been completed, and S2 is left closed, relay $\frac{A}{3}$ remains energised; and the energising current to relay $\frac{C}{1}$ becomes constant.

Relay $\frac{C}{1}$ therefore energises.

As soon as it energises, a circuit is made, via contact C1, contact A3, and the wiper of Bank 2, to the appropriate external circuit selected. It will be seen that the purpose of relay $\frac{C}{1}$ is to prevent unwanted

(Continued on page 341)

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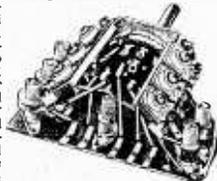
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I want to add a little negative feedback to my 5-valve superhet. Please give me a simple scheme.
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Dear Sirs,
I wish to insert a meter as an indicator when peaking your coilpack, and to determine the optimum signal. Please state a position which will not entail too much destruction of the wiring.

The meter may be placed across the bias resistor of the frequency changer. The meter must be a high-impedance RF meter.

Dear Sirs,
If I fit push-pull output shall I get more output from my existing single valve output?

If all the valve types were the same you would not obtain a greater output from push-pull, but quality should be considerably improved.

Dear Sirs,
I am experiencing instability in the I.F. stages of an FM receiver. Could you state a possible cause of this?

Two causes of instability which come to mind—insufficient decoupling of either cathode or anode circuits (possibly the use of an inductive type of condenser) or the failure to use a common earthing point for the I.F. decoupling, etc., and a different common point for the O.P. decoupling, etc.

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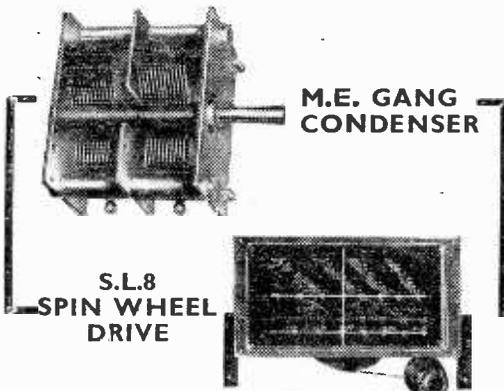
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Using TEST INSTRUMENTS



Part 6 of a New Series of Articles
Dealing with the Practical Application
of Standard Test Equipment



(Continued from page 282 May issue)

WITH the meter connected as in position (b) the result would not be quite so accurate as the reactance of C1, and C2 would be bound to have some effect on the voltmeter reading—probably causing it to read something less than 50 volts.

Now let us suppose that the meter is connected as in position (c), and that the loudspeaker loading at this point is, say, 4 ohms, then with the valve delivering 1 watt of A.F. we should get a reading of something like 2 volts, by altering the "watts formula" round like this: Volts equal the square-root of watts times the resistance in ohms.

When taking power output measurements it is desirable to disconnect the loudspeaker and connect in place an equivalent value resistor capable of dissipating the full A.F. power.

Receiver alignment and overall sensitivity tests usually call for some means of measuring A.F. power, and such tests will be dealt with in full later on in this series; at this point, however, it is as well to realise that the universal multimeter can be admirably employed for this function.

The Multimeter as an R.F. Indicator (18)

As is very well known, the detector circuit of a broadcast or television receiver is essentially an R.F. rectifier. The modulated R.F. signal is usually applied direct to the anode of a diode valve, or to the equivalent terminal on a crystal diode, and the modulated signal, together with a D.C. potential corresponding to the amplitude of the R.F., is developed across the associated load resistor.

Within certain limits, and excluding the stabilising action of the A.V.C. system, any variation of direct-current in the load resistor will be governed by the amplitude of the R.F. voltage applied to the receiver. Advantage is sometimes taken of this factor as a broadcast receiver alignment aid, and is nearly always used to assist in the alignment of television receivers.

A typical vision detector circuit is depicted at Fig 21, in which the 5,600 ohm resistor R1 constitutes the detector load. To achieve signal indication in the vision channel, therefore, it is necessary simply to unsolder R1 from the chassis (earth line), and connect in series a D.C. milliammeter having a f.s.d. of not more than 1 milliampere. As is shown in the circuit, it is desirable to decouple the meter with a capacitor C1 to avoid any possibility of instability—C1 should have a value in the region of 0.05 μ F.

It is readily possible by this means to observe with a high degree of accuracy any alteration in sensitivity of the vision channel at a spot frequency selected on the signal generator—which, incidentally, should be unmodulated—as the result of adjustments to the tuned circuits. Normally a current in the region of

250 microamps should be expected to correspond to a peak-white picture signal.

As an alternative method—but one which is liable to induce instability under certain critical conditions—the actual voltage appearing across the diode load can be measured and used as a signal indication by connecting a multimeter set on the 0-1 volt range across the resistor—connecting the positive lead to the cathode side of the resistor.

If a multimeter of mediocre sensitivity only is available, such as one possessing, say, 500 ohms per volt, this can be used on the 0-20 milliampere range and inserted in series with the anode load resistor of the video amplifier valve, being suitably by-passed by a capacitor—see Fig. 22.

The sync pulses in certain receivers are extracted from the cathode circuit of the video amplifier valve. The Murphy V114 series receivers use this arrangement, which is illustrated in Fig. 23. A stable and reliable method for signal indication in the vision channel on such a circuit is by measuring the volts drop across the cathode load resistor. A multimeter adjusted to the 100 volts range is suitable for this purpose.

If a very sensitive multimeter or valve-voltmeter is available it can be connected between the cathode of the picture-tube (assuming cathode modulation)

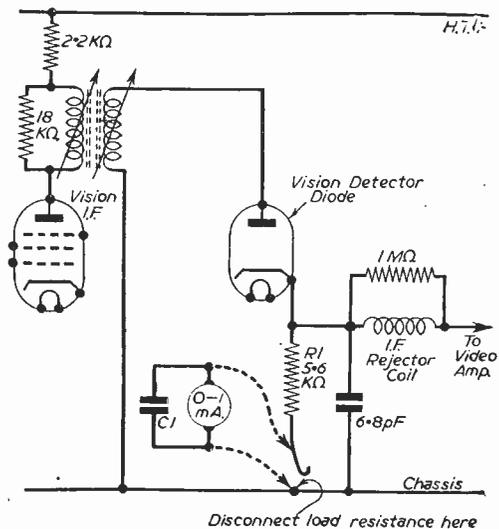


Fig. 21.—Showing how the current in the detector load resistor can be used to provide an indication of R.F.

and receiver chassis. The meter should be adjusted approximately for f.s.d. on a volts range under conditions of no signal. Since the tube is cathode modulated, the presence of a signal will cause a fall in potential at the anode of the video amplifier valve (relative to chassis), being the reverse of the previously described methods, where a RISE in voltage or current indicates the presence of signal in the vision channel.

It must be stressed that in all these tests it is most important to keep the meter connecting leads as short as possible, and this applies especially where the meter lead is connected to the picture-tube cathode direct. As previously intimated it is not necessary to modulate the R.F. signal applied to the receiver under test, for we are not bothered about extracting the modulation content as a means of R.F. signal indication, we are simply measuring the rectified R.F. voltage to determine the magnitude of signal—and thus the relative sensitivity of the R.F./I.F. circuits—arriving at the detector valve.

We are readily able to follow the rectified R.F. in D.C. form past the detector load resistor, and right up to the picture-tube, so far as television receiver is concerned. Because, as we are well aware, the post detector circuits are all coupled to retain the D.C. component of the vision signal.

With an ordinary broadcast receiver this does not apply, of course. Here we can measure the D.C. potential corresponding to the R.F. only at the detector load resistor—past this point the D.C. content of the signal is lost owing to the isolating feature of the A.F. coupling capacitor.

General Testing (19)

There is little doubt that a good multimeter represents the most essential tool of the experimenter and practical radio man. It should be the aim of all experimenters and home-constructors either to make or purchase an instrument having a sensitivity of, at least, 10,000 ohms per volt on the D.C. ranges. Although instruments of lower sensitivity possess a wide range of application, something just that little bit better is usually demanded for TV work where extremely high resistance networks are often encountered—indeed, it is when working on such circuits that one realises the limitations imposed by instruments of low and mediocre sensitivity.

The writer ventures to suggest that practically any fault in a broadcast or television receiver can be brought to light by knowledgeable application of a high sensitivity multimeter. This is not to suggest that other test instruments are superfluous to the general cause, indeed, this is far from true as we shall later realise in subsequent articles in this series. Certain critical adjustments demand the employment of instruments of an entirely different kind, and in the service department, where time is at a premium, a host of instruments is often desirable to reduce the time spent on a repair, and consequently keep its cost down to a respectable level!

Now to get back to the multimeter, we have so far covered its general applications—other tests will, of course, suggest themselves to the experimenter from what has already been described.

Seemingly, voltage tests would appear to represent the main mode of analysing a faulty receiver. In the writer's opinion, this is not true, for it would be suggested that the whole of a receiver can be readily and conclusively analysed by current measurements.

The function of each valve stage can be individually analysed in this way without seriously disturbing the voltage distribution of the circuit. Defects ranging from the local oscillator to the output section can be pin-pointed simply by breaking the appropriate circuit and introducing a milliammeter.

As an illustration in this respect, it may or may not be realised that a milliammeter inserted in series with the grid resistor of the local oscillator valve will immediately indicate whether or not the valve is doing its job. The 0-1 milliampere range should be used for this test, and one can rest assured that the valve is oscillating if the grid current reading can be reduced to zero by shunting the tuned circuit with an 0.1 μ F capacitor.

A less sensitive milliammeter can be inserted in series with the anode of the oscillator valve if more convenient, when an appreciable alteration in valve current by by-passing the tuned circuit with a capacitor will indicate oscillation. Any valve stage can be checked for spurious oscillation by adopting this mode of current analysing.

Excessive cathode current in the sound output valve accompanied by distortion of reproduction represents an example of current analysing that would almost certainly lead the operator to suspect trouble in the valve biasing network. A fault of this nature is frequently caused by a coupling capacitor developing a slight leak, thereby permitting the grid to go positive and as a consequence outweighing its normal negative potential. This would be quickly proved as fact if, on disconnecting the capacitor from the valve grid, the cathode current reduced to normal.

As will have been noticed, this individual current test proved not only that the excessive current was in some way tied up with the accompanying distortion, but it also proved that the coupling capacitor was faulty without the necessity of testing it subjectively.

A short-circuit occurring in the cathode by-pass capacitor would undoubtedly provoke a similar set

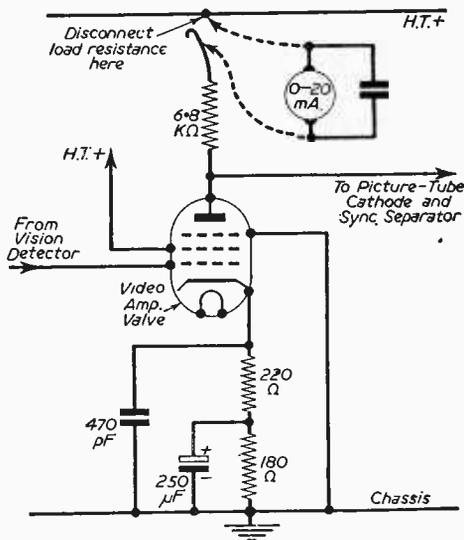


Fig. 22.—With a less sensitive instrument R.F. is best detected by connecting an 0-20 mA meter in series with the video load resistor.

of symptoms, but here, again, removal of the suspect from the circuit would soon reveal its defect.

There is, of course, always the possibility of a faulty valve upsetting one's initial suspicions, although even a valve fault could more or less be eventually proved by performing a simple current test.

This same mode of testing can be readily adopted in any other stage. Erratic and intermittent faults may be found to require a lengthy current test, but there is no doubt about it, that somewhere in the circuit the current is going to alter as the result of the fault.

Faults in the A.V.C. system can be brought to light by introducing a milliammeter in series with the anode of each controlled variable-mu valve in turn. A substantial reduction in anode current is sufficient proof that A.V.C. bias is reaching the valves and reducing their gain in the proper manner when the receiver is tuned to a powerful station.

Estimating Capacitance (20)

Some multimeters are separately scaled in capacitance values and embody features for connecting an add-on capacitance measuring unit. If one is not lucky enough to possess an instrument of this kind, however, a method of determining the approximate value of a capacitor is available.

The test boils down simply to that of measuring the alternating current passed by a capacitor of unknown value as the result of a known voltage. The capacitor and meter are connected in series across the A.C. mains—the mains voltage will be known from accurate measurement beforehand—the current in the capacitor may be read from the A.C. milliammeter, and the capacitance can be resolved with the aid of the following formula :

Capacitance in $\mu F = 1 \times 3184 / E$,
 where I = the current in amperes, and E = the applied 50 cps. voltage.

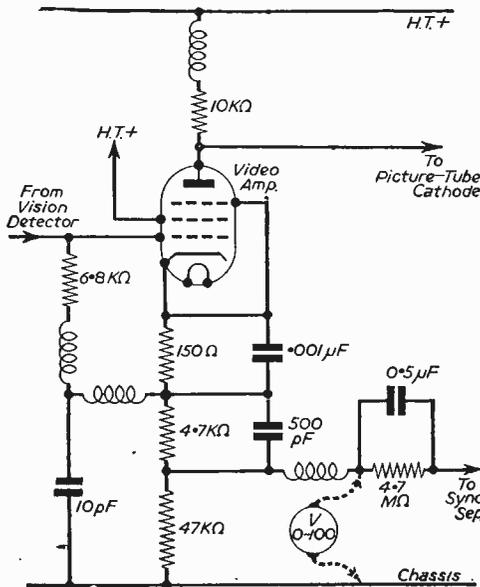


Fig. 23.—In certain video circuits the voltage variation across the cathode resistor provides a suitable R.F. indication.

Owing to the resistance of the meter being in series with the capacitor; a certain calculation error is inevitable ; nevertheless, this will usually be so small as to be insignificant for normal purposes.

The main problem of a test of this kind is that of protecting the meter should the capacitor develop a short-circuit while being measured. Such a possibility can be completely avoided by introducing a resistor, as a current-limiting device, in series with the capacitor as shown in Fig. 24. The presence of this resistor will, unfortunately, provoke considerable error in capacitance calculation if the above formula is used, though as a compromise the resistor could be included initially and then short-circuited during the shortest possible time that an accurate current reading can be taken.

Even so, this still leaves the meter as the target should anything happen to the capacitor, and since meters are expensive items and not readily replaceable, it is best always to leave a resistor in circuit to limit the current to a safe value, and introduce a factor

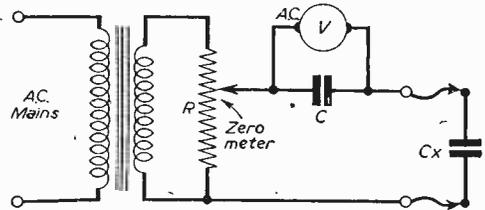
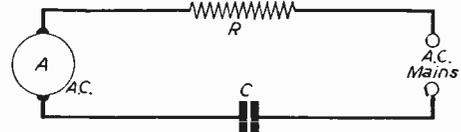


Fig. 24.—A method of determining the value of a paper capacitor—not suitable for electrolytic types. Fig. 25.—A method of determining the value of an unknown capacitor by comparing it against one of known value.

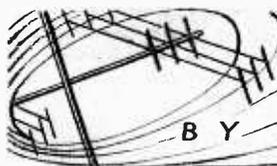
to the above formula to correct it for resistance. The following formula is quite suitable and should always be used when a resistance follows the capacitor :

Capacitance in $\mu F = 3184 / \sqrt{(E/I)^2 \text{ minus } R^2}$,
 where E = the applied 50 cps. voltage, I = the alternating current in amperes, and R = the resistance in ohms.

There is another interesting and fairly accurate method of measuring capacitance, whereby the reactance of a known capacitor can be compared against that of an unknown capacitance. A circuit set-up of such an arrangement is shown in Fig. 25, from which will be seen that the known and unknown capacitors are connected in series across an A.C. supply, and the voltage developed across the known one measured on a high-resistance A.C. voltmeter.

It will also be seen that if the leads connecting the unknown capacitor (Cx) to the circuit are shorted, the full A.C. supply voltage will be developed across the known capacitor (C), and the meter will read accordingly. It is often desirable to get this circuit working after the style of an ohmmeter, and for this purpose the variable resistor R permits the meter to be set to zero at full scale when the tests leads are shorted.

(To be continued.)



On Your Wavelength

BY THERMION

The Business Names Act

A PROPOS my recent remarks regarding radio clubs, it is not generally known that in certain circumstances it is necessary for clubs to register under the Business Names Act, particularly where such clubs are run for profit. The provisions of that Act to some extent safeguard the members, for it is necessary to issue an annual balance sheet. The Act was designed to protect the public from exploitation by any person or persons who start a club with the idea of collecting annual subscriptions in return for some nebulous service which only absorbs a very small part of the annual sum received. Suppose, to take as an example a hypothetical case, someone started a club such as the International Radio Guild, appointed himself as the proprietor, without providing anything in the rules for annual meetings or elections, membership being obtained merely by filling in a form and paying, say, 10s. a year subscription. Further suppose that the club caught on and obtained a membership of, say, half a million. The annual revenue from subscriptions would therefore be £250,000. That is a considerable sum of money, and the members have every right to know what is happening to it and whether it is being spent in promoting the interests of the club. Clubs are of two types—proprietary clubs and members' clubs. The members of the latter are co-owners therein in law, but not so the members of a proprietary club who are merely the paying-guests of the proprietors. Nearly every properly run club is constituted, regulated and governed by rules which provide for the admission of members, the subscriptions payable, the conduct of the club, and for the retirement of the officers and expulsion of members.

In my view the I.S.W.L. is a proprietary club, and as it does not publish a balance sheet to each member they have no means of knowing how the money is spent or how much is being received. No doubt the intention was that it should be a members' club. In view of the large amount of correspondence I have received, it seems desirable, if the League is to continue, that it should be reformed, remodelled and run on proper and democratic lines.

I referred last month to a letter sent out by the I.S.W.L. to all members. At least, I was informed that it had been sent to all members, but one member, who resides in Barrow on Humber, tells me that he did not receive it and the first he knew of it was when he read my notes. I gather that at one time the books of the league were in a bad state, and it took months to square them up. Many letters requesting subscription renewal were sent to members, and many sarcastic replies were received, with statements that they had paid up their subs. but had not received a receipt. Is it not true that most of the members approached did not renew their subscription the following year? It seems obvious that an audit back to the days of the league's formation would now be impossible. Indeed, no audit could be possible, without a list of members.

I feel that the only satisfactory solution is for a Special General Meeting to be called with the object of appointing a sub-committee to investigate the club's affairs and issue a report thereon. This investigating committee should be given the widest possible powers of investigation.

Commercial Radio ?

IF the I.T.A. commercial television programme proves successful will the advice given in the Beveridge Report be ignored and commercial radio programmes introduced? If such programmes are right for television they must be equally right for radio. The price of one minute of TV programme time is, I understand, just short of £1,000. I do not foresee that many advertisers are going to get their money back from such a transitory form of publicity, bearing in mind the many restrictions which are to be placed on the amount of advertising plugging which will be permitted. A cheaper form of visual advertisement would be through the cinema screens of this country, the coverage of which must be at least equal to the TV viewing audience. In any case, it is obvious that commercial TV is designed to appeal only to very large and prosperous companies, for very few of the smaller ones could afford £1,000 for a minute of programme time.

The Newspaper Strike

ONE effect of the protracted newspaper strike was to force many more millions of listeners to switch on to the news programmes which they often ignored because they had already received the news from their morning or evening newspaper. It is a pity in some ways that the BBC did not more extensively enlarge its news features during the run of the strike, although I understand that a general agreement was reached amongst the publishers and the BBC not to do anything which would savour of an attempt to cash in on the absence of newspapers. But then the public was entirely cut off from the world during the newspaper strike and had to rely upon the BBC news bulletins. There were some millions who could not listen in and had to rely upon gossip for their news. The results of the municipal elections were a matter of national importance and so was the resignation of Sir Winston Churchill. Large numbers of the public were unaware of the results of the elections.

As news dissemination is a matter of national interest the Government itself should have produced a daily national news sheet as it did during the General Strike, if it was impracticable for the BBC temporarily to fill the breach. It is true that the BBC did add a few minutes to the news bulletin, but the extra time was totally inadequate. It is on such occasions that a very small pocket portable with single earphone would be of great advantage, especially if it were designed to run on very low H.T. voltage in order to keep the weight down. The quality of reproduction would be secondary in importance. If any readers have built such receivers I should like to have details of them.

More About BBC Frequency Modulation

LATEST NEWS CONCERNING THE V.H.F. STATIONS

THE BBC has placed an order with Marconi's Wireless Telegraph Co., Ltd., for the construction of 26 V.H.F. frequency modulated (F.M.) transmitters for sound broadcasting. Delivery will commence within 14 months.

These transmitters, of Marconi design, comprising 24 of $4\frac{1}{2}$ kilowatts power and two of 10 kilowatts, will form part of the BBC's plan to provide a powerful reinforcement to the coverage of its present medium- and long-wave stations, by the use of V.H.F. F.M. stations.

As envisaged, the $4\frac{1}{2}$ kilowatt transmitters will operate in parallel pairs, each pair handling one programme. Thus, six of these transmitters will be used on each three-programme station. The two 10 kilowatt transmitters will be used in parallel at the BBC's existing V.H.F. station at Wrotham, where there are already two 25-kilowatt Marconi transmitters.

Nine Marconi station monitors have also been ordered by the BBC for use on this project.

Technical Details

Many new features are incorporated in the transmitters and the performance of each is outstanding in its own particular output-category.

These transmitters, comprising units of basically similar design, but suitably arranged to provide the various output ratings, operate on the frequency band 87.5-108 Mc/s.

Air-cooled valves are used throughout, leading to a simplification of equipment, with reduced installation and maintenance costs.

The F.M.Q. drive unit used on these transmitters, employs a frequency-modulated quartz crystal and supplies an output at the carrier-frequency. This signal is then amplified to raise it to the required output level, the number of amplification stages used depending on the rated power-output of that particular type of transmitter.

The initial R.F. amplification stages consist of a double tetrode stage, capacity coupled to a pair of tetrode valves, the anode circuits of which take the form of quarter-wave balanced lines magnetically coupled to a 50-ohms line, from which the output is taken at 250 W.

A third amplifier stage is added (in this case a triode), for the 1 kW equipment. The input is fed via the 50-ohms line to the cathode, the two cathode leads being at the same R.F. potential and forming the inner member of a tuned unbalanced line. The grid is grounded and the anode circuit takes the form of a concentric line whose electrical length is variable by moving an R.F. short-circuit along the line. A tuned inductive coupling takes power from the anode line and feeds to the aerial termination.

For the $4\frac{1}{2}$ kW transmitter a further identical triode amplifier stage is added, while for the 10 kW case yet another amplifier stage is used, employing two such arrangements in parallel.

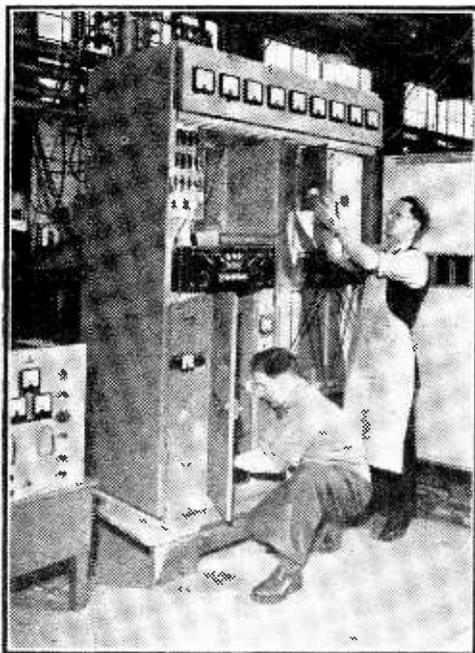
Northern Transmitter

A further contract for the supply, installation and setting to work of six 10 kW V.H.F. frequency-modulated transmitters to serve the North of England

area has also been placed. The order also calls for the provision of the necessary drive, phasing and monitoring equipment, and four combining units.

The six transmitters for the North of England are to be sited at Holme Moss, and will feed into the slotted aerial array which forms an integral part of the existing 750ft. television mast, in accordance with the BBC's plan for shared TV/FM sites. The transmitters will operate in parallel pairs, one pair handling the Home programme, another the Light, and the remaining pair the Third programme. Each unit will therefore have an output power of 20 kW, which, in conjunction with the high-gain aerial, is estimated to produce an effective radiated power of 120 kW. It is anticipated that the new station may become operational in the latter half of 1956.

The range cannot as yet be stated with certainty, but the BBC estimate the coverage to be roughly over an area bounded on the north by a line running from Barrow to Bridlington and on the south by a line from Rhyl to Cleethorpes. There will, however, be local variations in the fringe areas because of the screening effect of hills and large buildings.



Assembly work in progress on a Marconi $4\frac{1}{2}$ kW F.M. transmitter for the BBC.

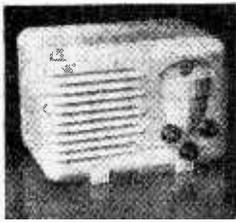
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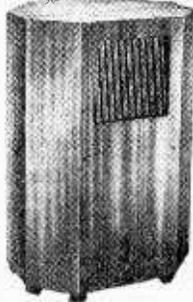
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3-speed record player with



pick-up using the famous Accos "Hi G" turnover crystal—motor also by very famous maker—speed selection is by Bakelite knob. All on unit board ready for installation. A wonderful bargain at £8/10/- plus 5/- carriage. Hire Purchase 15/- deposit.

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ALL DRY BATTERY SET VALVES IT4, IR5, IS5, 3A4, offered as a set, 30/- the four.

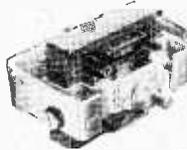
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Band 1	.15 to .315 mc/s	} i.e., 20 to 200 metres
Band 2	.315 to .680 mc/s	
Band 3	.680 to 1.5 mc/s	
Band 4	1.8 to 3.7 mc/s	
Band 5	3.7 to 7.5 mc/s	
Band 6	7.5 to 15.0 mc/s	

The Sensitivity is 4 micro valves for full output. It uses 8 valves and operates from batteries (12 or 24 volt) or from the mains through a power pack. It has built in output stage with a jack socket for Controls, all of which are brought to the front panel, include aerial switch comparative condenser, main tuning condenser, band selector, C.W. switch, power on/off switch, and volume control.

Very compactly built in crackle finished case, these sets are brand new, having never been used and guaranteed in perfect working order—special price this month is £14/10/- each, or 45/- deposit, balance by 12 monthly payments of £1/3/6, carriage and insurance 10/-. Order now to avoid disappointment. Circuit diagram and component data given free with sets, or available separately price 2/6, post free.



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COMMUNICATIONS RECEIVER R155 YOURS FOR 30/-



The R155 is considered to be one of the finest communication receivers available to-day. Its frequency range is 75 kc/s to 18 Mc/s. It is complete with 10 valves and is

fitted in a black metal case. Made for the R.A.F. so obviously a robust receiver which will give years of service. Completely overhauled and guaranteed in perfect working order. Price £29/19/6, or will be sent on receipt of deposit of 30/-. Balance by 12 monthly payments of 16/3. Carriage and Transit Case 15/- extra. Mains Power Pack, £5/10/-.

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We undoubtedly hold the largest stock of cabinets in the country. All are made of the finest plywood, veneered and polished and all radio and motor boards are left uncut to suit your own equipment. The top one



is The Bureau, walnut finished and highly polished, size approximately 30in. high, 32in. wide, and 16in. deep. Price 16 guineas or 39/- deposit, carriage 12/6. The centre one is The Em-



press, our most popular cabinet, size 32in. high, 36in. wide, and 16in. deep, walnut finished, lined sycamore. Price 15 guineas, or H.P. deposit 32/-, carriage 12/6. The lower one is The Contemporary, size 29in. high, 30in. wide and 15in. deep. Oak finished with contrasting moldings. Price £8/15/-, H.P. deposit 19/-, carriage 12/6.



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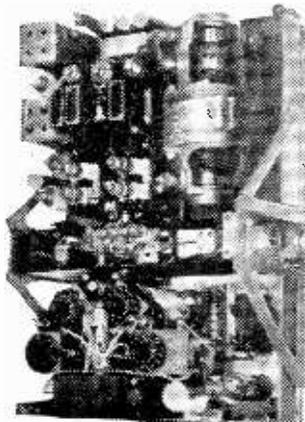


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The saving of space resulting from the use of these condensers is one of the chief reasons for their popularity. Type 928 is of particular interest to designers of rectifier units as a small and efficient substitute for a large 800 v. paper condenser.

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

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

Capacity in μF.	Peak Working Volts	Surge Volts	Dimensions in Inches			T.C.C. Type No.	List Price Each
			H.	D.	Screwed Boss		
*32	350	400	2 7/8	1	1/2	312	9/-
4	500	600	2 1/2	1	1/2	512	7/-
8	500	600	4 1/2	1	1/2	512	8/-
16	500	600	4 1/2	1 1/2	1/2	512	11/6
32	500	600	4 1/2	1 1/2	1/2	512	17/6
*8	800	900	4 1/2	1 1/2	1/2	928	18/-

*Etched Foil.

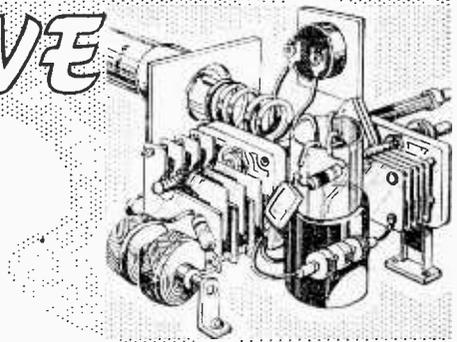


THE TELEGRAPH CONDENSER CO. LTD

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SHORT-WAVE SECTION

SHORT-WAVE NOTES—THE RIVER HEAD RECEIVING STATION OF R.C.A. COMMUNICATIONS INC., NEW YORK



THE east coast receiving station of R.C.A. Communications Inc. is located at River Head Long Island, a few miles east of Rocky Point, and approximately 70 miles from the centre of New York City.

This site, which when purchased 30 years ago was barren land with sandy soil, is flat for many miles around. Four miles north is Long Island Sound, with the Atlantic Ocean eight miles to the south.

The original receiving station dates before the short-wave era when long waves were used exclusively.

River Head To-day

The River Head site is divided into two areas, the east being 600 acres and the west 1,264 acres. The receivers as used at River Head are gigantic affairs when compared with short-wave receivers as we know them. Built-in shielded sections and rack mounted, a complete receiver takes up a considerable amount of space.

The Receivers

The total number of short-wave receivers available is 69 diversity groups divided into three sets. It is interesting to know that the number of valves used and in operation total 10,000.

When one considers the number of spare radio valves which must of necessity be kept for replacement purposes the grand total will be rather staggering.

The M1005 Receiver

This is the type of receiver used at the station, and here are brief details concerning it. Taking all types of valves as listed, these total 78. This receiver has three R.F. amplifiers, 3-6 Mc/s, 6-12 Mc/s, 12-24 Mc/s respectively, followed by three further R.F. amplifiers and three third R.F. amplifiers. All stages at stated Mc/s, excepting the following:

Then follow three detectors and three oscillators, a first I.F. amp. First Stage at 450 kc/s and a first I.F. Second Stage. Next comes converters Z, Y and X, a 400 kc/s oscillator, isolation amps. Z, Y and X, followed by three 50 kc/s second I.F. amplifier stages, two diode detectors, monitor oscillator, monitor detector, monitor

output and diode driver.

Tone Keyer

This section of the receiver includes Limiter, Threshold Control, Audio Amp. oscillator.

Audio Frequency Amplifier

First audio amplifier, threshold control, second audio amplifier.

Frequency Shift Adaptor Unit

Amplifier Limiter, Amplifier Detector, Trigger Restorer D.C. insertion valve. Two-valve double trigger gate control. Bias clamp. Two-valve voltage regulators, morse printer, followed by two more voltage regulators, tuning indicator rectifier. Trigger driver and coupling threshold indicator, plate, bias and power supply rectifiers.

To quote the valve types used in the various stages would be rather confusing, and they are therefore omitted.

Transmission Lines

The total length of the longest short-wave trans-



A corner of the main operating room at Broad Street, New York.

mission line used at River Head is 4,000ft. This is a four-wire, and not a transposed line.

Aerials

All aerials are directive; 24 Rhombic and 50 fishbone types. These are spaced in groups of three and arranged for space directivity reception 800ft. apart. That this is an extensive aerial system will be appreciated, for there are 600 aerial poles which are 60ft. to 150ft. high. There are also eight steel towers 160ft. to 200ft. high, together with 6,000 transmission line poles 16ft. to 35ft. high.

H.F. Traffic

The H.F. reception section averages a daily peak of 52 signals. Leased land lines are used between River Head and New York, as follows:

Sixteen lines 50 to 8,000 cycles transmission bands to New York, and two lines via Rocky Point to New York. There are also six lines from New York to Rocky Point. For multi-channel transmissions 18 filter groups are available.

Radio Programmes

Another section deals with radio programme material, and Radiophoto transmissions. On this service, six diversity groups of three sets and one single-sideband receiver are used; three fishbone and 13 Rhombic aerials. All the aerials are directive.

Frequency Checking

There are three measuring positions. They cover the following ranges: 10 kc/s to 500 kc/s.

In conjunction with this department three M.F. aerials, seven H.F. aerials of the fishbone type and V.H.F./U.H.F. doublet aerials are used. Primary crystal standards are accurate to 1.5 parts in 10,000,000.

Comment

Readers of this article will appreciate that Trans-Atlantic and world-wide radiophone communication is radio in a very big way, far beyond what we early listeners used to imagine in the days when we were, as it were, in on the early tests of commercial point-to-point and ship-to-shore telephony.

During the years the author has contributed to this journal he has from time to time stressed the importance of an efficient aerial system, however simple its form may be, in order to assure the maximum signal voltage transfer. That this is essential is proved when one realises that professional radio engineers like those of R.C.A. go to great expense in order to assure reliable communication day by day.

Diversity Reception

This is carried out with a view to receiving the required transmission at a constant and satisfactory signal level. To this end three separate aerials are coupled to three separate receivers tuned to the one frequency. By this means fading effects are compensated for. As is well known when using aerials located some distance apart, fading at any one time is not equally pronounced in all. Thus if the combined inputs are fed into a common output a constant signal or nearly so will be obtained.

New "Stereosonic" Tape Records

THE disclosure on April 4th of the new "His Master's Voice" "Stereosonic" (two channel) tape records marks the culmination of some 25 years of experimental and development work behind the scenes of E.M.I.

The H.M.V. "Stereosonic" System

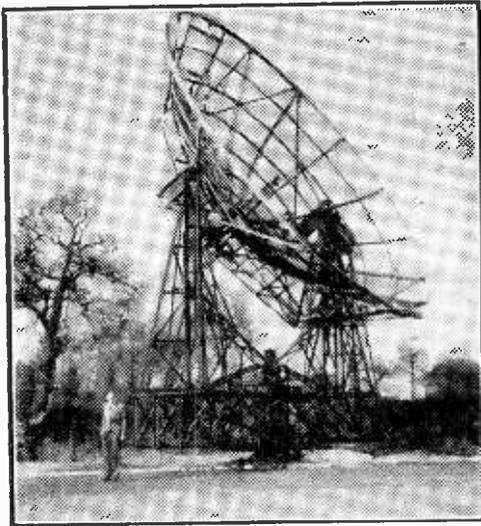
The H.M.V. "Stereosonic" system differs from most other systems that have been tried by the fact that the stereophonic effect is operative over the whole frequency range. Other systems have been demonstrated for which it has been quite erroneously claimed that it is not necessary to reproduce the stereophonic effect below about 500 cycles. It has, however, been found by H.M.V. engineers that boominess is one of the greatest difficulties in sound recording and reproduction, and that this boominess is due to lack of stereophonic definition in the low frequencies. This definition is fully restored in the new "Stereosonic" system so that a bass drum sounds like a bass drum and not like a door banging, and one can discriminate between the original sound of the double bass, for instance, and the reverberation of this sound in the studio.

The system requires two independent channels from the recording studio to the listener. — In practice the two channels are put on to two tracks on a $\frac{1}{2}$ in. magnetic tape and replayed through two identical sets of amplifiers feeding two loudspeakers. The spacing of these two loudspeakers will vary according to the size of the room, and they will generally be heard to best advantage when placed in the corners

at each end of one wall of the room, so that the subtended angle to the listener is approximately between 60 deg. and 90 deg. The new H.M.V. "Stereosonic" reproducer will give good results using any form of stereophonic tape, including those made by using spaced microphones, but the best results will be obtained with the new H.M.V. "Stereosonic" tapes made on the principles described above.

Using such tapes, a full field of sound is obtained, stretching across the space between the two loudspeakers. When the sound comes from a solo instrument intended to be in a central position, then a single apparent source of sound is heard from a position half-way between the two loudspeakers. The general enhancement of the realism of the reproduced sound is apparent at any position in the room, although the exact position of the sound source is reproduced with complete accuracy only over a listening area near the centre line between the two speakers.

An important feature of the "Stereosonic" records is that the listener can obtain an apparent increase of dynamic range. The reasons for this are not yet fully understood. The fortissimos for a given sound level (as measured by a sound level meter) appear to have a greater volume of sound compared to the normal single sound source, while the pianissimos can be reduced to a lower level with reasonable discrimination and clarity. A further feature is that a greater degree of reverberation is permissible on the recording than would be permissible with single-channel recording.



A completely steerable 30ft. parabolic reflector used as a radio telescope at the Jodrell Bank experimental station.

Making a Radio Telescope

A SIMPLE HOME-MADE BUT EFFICIENT INSTRUMENT FOR THE EXPERIMENTER

PART 2.—AERIAL SYSTEMS

By W. Schroeder

of aerials, but not nearly sufficiently for the purposes of radio astronomy.

Best known among the directional aerials, of course, is the usual television aerial, normally consisting of a half-wave dipole with a reflector placed behind it.

A simple dipole has a power gain of 1.64 over an aerial which receives at equal strength from any direction. Such a purely theoretical aerial is called an isotropic aerial and cannot be realised in practice. It is conceived merely as a standard for comparison.

For use in radio astronomy, however, aerials of considerably higher gain and directivity must be used. This can easily be achieved by using an array of several half-wave aerials and feeding them in phase (Fig. 1). Highest sensitivity is in the direction Z. The polar diagram of this four-element system is shown in Fig. 2. Sensitivity is zero at an angle of 30 degrees from the direction of the highest sensitivity (Z), and by increasing the angle a smaller maximum of sensitivity is found. These "side lobes" are present with all multi-element arrays.

The beam width of this aerial, which is reckoned to the angle at which half maximum sensitivity is measured (-6 db), is about 35 degrees. An eight-element system would have a beam width of 25 degrees, and by further increases the directivity can be made greater still.

If several such "stacks" are placed side by side, the directivity in the horizontal plane can be increased too. Such broadside arrays (Fig. 3) are used quite frequently in radio astronomy, and they are especially effective if a conducting screen, usually

AN input which is only a minute fraction of the noise power generated in the receiver still gives a clear indication, and with this improvement it may be well worth while to connect an automatic recording instrument instead of the meter to the output. This can even be calibrated directly in units of field strength.

An aerial—in order to be usefully employed in a radio telescope—must be highly directional. To a certain extent this property is inherent with all types

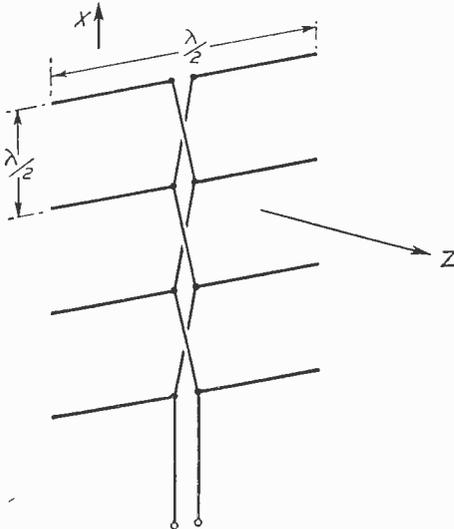


Fig. 1.—4-element stack of half-wave dipoles. In-phase feeding is achieved by crossing the feeders between elements.

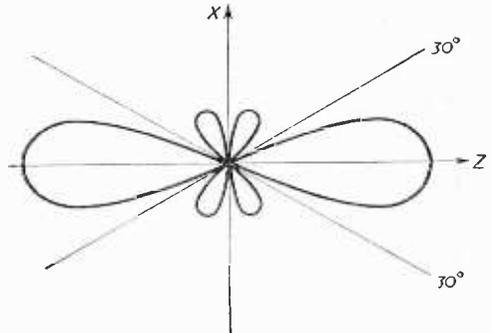


Fig. 2.—Polar diagram of a system of four half-wave dipoles. Highest sensitivity in direction Z, zero sensitivity in directions 30 deg. and 90 deg. (X).

consisting of wire netting, is placed one eighth of a wavelength behind the elements. This doubles the gain of each half-wave aerial, and the combined gain of the system in Fig. 3 would be $2 \times 1.64 \times 20 = 65.6$.

The screen at the back should overlap the aerials by at least half a wavelength. The beam width of the array shown is about 30 degrees in any plane.

A more economical method, though a little more

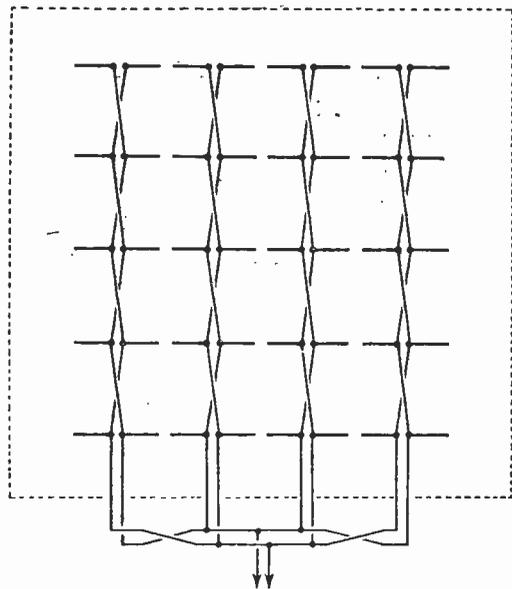


Fig. 3.—Graphical representation of a 20-element broadside array, with screen behind. Power gain about 66, beam width 30 deg.

difficult to construct, is the erection of an array of Yagi aerials. A single unit of this type, consisting of a folded dipole, a reflector 0.15 wavelength behind the dipole, and five directors, 0.434 wavelength long, and spaced at half-wavelength intervals in front of the dipole, has a gain of about 20 and a beam width of 35 degrees. The measurements given represent the optimum values found experimentally.

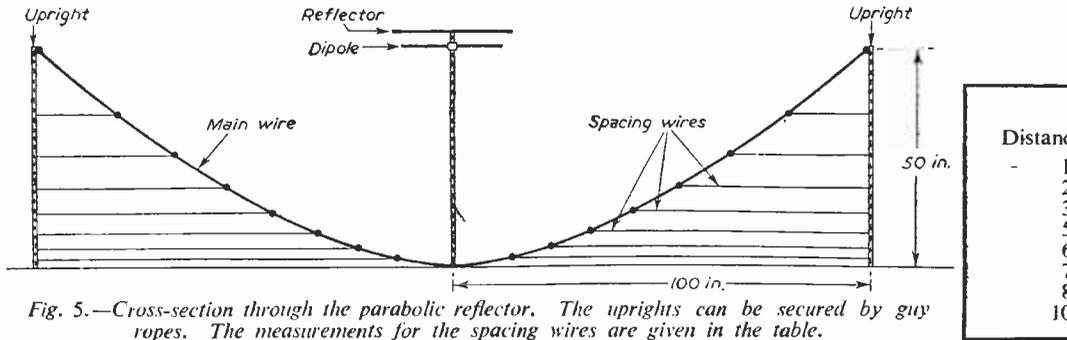


Fig. 5.—Cross-section through the parabolic reflector. The uprights can be secured by guy ropes. The measurements for the spacing wires are given in the table.

Five such systems can conveniently be mounted on a frame which should be as large as possible to keep the beam width small (Fig. 4). Working on a wavelength of about 1 metre, and the Yagi elements at the corners of a square with sides 20ft. long, the arrangement will provide a gain of 100 and a beam width as small as 10 degrees. (Beam width is approximately 60 wavelengths divided by length of the sides of the square. This formula also applies to broadside arrays).

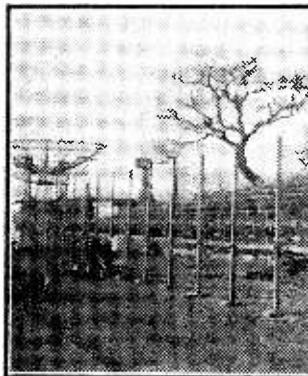
Both broadside arrays and Yagi aerials, although extensively used in radio astronomy, have one great disadvantage: they have to be constructed for a specific wavelength, and any desired change of this requires a complete rebuilding of the aerial system.

Overcoming a Disadvantage

This disadvantage can be overcome by the use of a parabolic reflector. This usually consists of a circular frame over which a wire mesh is stretched in such a manner that a cross-section through the centre is a true parabola, and the dipole is situated at the focus.

Theoretically such an aerial has a power gain of $\frac{4\pi A}{\lambda^2}$ where A = area of the aperture, and λ = wavelength. The spacing of the wire mesh introduces some losses, however. These amount to 20 per cent. if the wires are spaced $\lambda/10$ apart, and 35 per cent. if spaced $\lambda/8$. The latter is the widest practicable spacing.

An aerial system of 20ft. diameter, working on a wavelength of 1 metre, and with wires spaced 5in., would have a power gain of about 220, quite enough to feed our receiver and give useful indications of the radiations which reach us from the Milky Way. The beam width of the system would be in the region



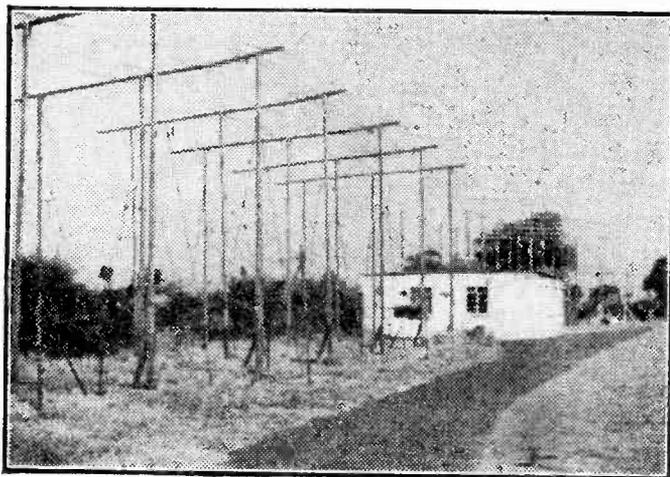
A partly adjustable broadside

of 10 degrees, quite a useful value for its intended application.

The construction of such an aerial is comparatively simple, especially if it is not required to be steerable. This need be no great disadvantage, as a certain amount of steering is possible by tilting the arm which carries the dipole at the focus. Without much deterioration of gain or beam width a deflection of up to 15 degrees can be achieved.

Aerial Construction

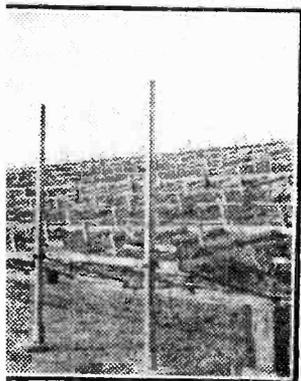
The framework can be constructed of metal or timber, the simplest method being a number of poles stuck in the ground. The height of the uprights must be one quarter of the diameter of the framework, and



A fixed array of Yagi aerials for the reception of extra-terrestrial radiations.

the dipole at the centre is fitted at the same height. To make the shape of the reflector

the uprights which are opposite one another with the arm carrying the dipole in the middle, which it should be possible to tilt in a north-south direction. In the centre, a wire ring is fitted, which should



of several hundred half-wave

as near parabolical as possible, 12 uprights at least are necessary, but for larger systems working on shorter wavelengths, this number must be increased. At no point must the shape of the finished wire mesh depart more than $\lambda/8$ from the true shape of a paraboloid.

In Fig. 5 are shown the suggested measurements for such an aerial, showing two of

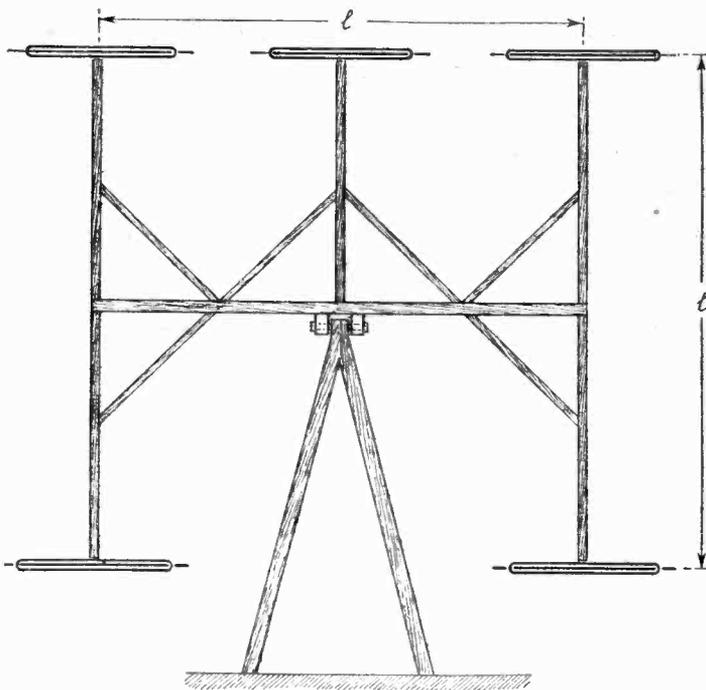


Fig. 4.—End-on view of an array of five Yagi-aerials. For $l=20$ ft., and on a wavelength of 1 metre, the beam width is 10 deg., and the power gain 100.

Table 1

centre.	Height from ground.
	1in.
	3in.
	7in.
	12.5in.
	19.5in.
	28in.
	38in.
	50in.

have a diameter of 25in., and is fixed in. from the ground. Twelve wires are soldered to this ring, and their other ends are laid over the tops of the uprights, and weighted down to keep them taut. At a distance of 25in. from the centre, spacing wires are soldered to the twelve wires in such a manner as to keep the solder joints 3in. from the ground. Further spacing wires are then added according to the measurements given in the table.

For smaller or larger aeriels these measurements must be decreased or increased in proportion.

When all spacing wires are in place, the ends of the twelve main wires are fixed to the tops of the uprights, and they should then all be in the shape of parabolas.

Starting from the innermost ring, further rings are soldered to the main wires at intervals of 4in. Finally, another number of wires are soldered between the main ones, starting from that ring where the distance between the main wires just exceeds 4in., and carrying on to the rim of the "bowl," so that at no point of the completed mesh there is a space of more than 4in. between any two wires. A reflector built to these measurements can be used at wavelengths down to 70 cm. (420 Mc/s) and at that frequency would have a power gain of about 300. If the spacing of the mesh is reduced to 2in., the gain reaches nearly 500.

The dipole at the focus is best fitted with a reflector behind it, on the side away from the "bowl." Although this has little effect on the gain, it considerably reduces the side lobes of the system.

It is necessary to match the aerial fairly accurately to the receiver input, as any mismatch not only results in a loss of power, but also introduces additional noise in the aerial, as the lost power is used to produce a thermal noise, and as the strength of this would not be constant it would lead to inaccurate indications.

If the aerial is built on level ground the beam is directed towards the zenith, and the measurements of the receiver therefore relate to that part of the sky which is right overhead at the time of observation.

As the Milky Way at certain times during the day reaches this position, fairly strong signals will be recorded. The radio telescope can be kept running all day long, and if it is made self-recording, a graph will be obtained showing the strength of radiations reaching us from different parts of the sky. These measurements can be compared with those taken on other days, but on the whole it will be found that the field strength recorded will be the same for any particular part of the sky.

By tilting the supporting arm of the dipole, the beam is displaced, and another part of the sky can be investigated. In each position, the beam sweeps out another circular strip of the sky, about 10 degrees wide, as the earth makes one revolution with regard to the fixed stars. When the possibilities of the aerial have been exhausted, the change to another wavelength offers new scope.

Hydrogen gas, which is fairly common in outer space, emits under certain conditions a strong radiation on a wavelength of 21 cm. The recording of this radiation and of the Doppler-shift associated with it has led to the most important results achieved by radio astronomy. So far, no other such "spectrum lines" have been discovered, but they should, theoretically, be present on some longer wavelengths. Here is a field of research for the keen amateur.

As "new stars" and other surprises in astronomy are almost always discovered by amateurs working with quite small telescopes, it is not impossible that in radio astronomy unexpected changes or developments are to be also first noticed by an amateur, in spite of the watching eyes of the scientists of Manchester University, who, at the end of this year, will take into use a new radio telescope of 250ft. diameter.

Correction

In the first column on page 290 of last month's issue it was stated that the receiver would give certain results with an input of only 10-14 watts. This figure should, of course, have been 10^{-14} watts.

News from the Clubs

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec. : C. H. Bullivant, G3DIC, 25, St. Fillans Road, Caiford, S.E.6.

THE first D.F. contest in the 1955 series takes place on Sunday, May 8, in the vicinity of Farnborough, Kent. The club station, G3GHN/A, will be operating portable between 11.00 hrs. and 16.00 hrs. on a frequency of 3504 Kc/s and as only low power will be used reports and QSOs will be welcomed.

Tape recording will be covered by Mr. L. Barnes on May 20 and the evening will comprise a demonstration and talk on the equipment being used.

Meetings are held every Friday at the clubrooms, 225, New Cross Road, London, S.E.14, at 7.30 p.m. Details of membership may be obtained from the Hon. Secretary.

SOUTHEND & DISTRICT RADIO SOCIETY

Hon. Sec. : J. H. Barrance, M.B.E. (G3BUJ), 49, Swanage Road, Southend-on-Sea, Essex.

ON April 1 the judging of exhibits of home-built equipment for the Hudson and Pocock Cups took place. There were a good number of entries, and the judges spent some time in determining the winners. Mr. J. L. Goss won the Pocock Cup, and Mr. A. D. Asher the Hudson Cup. These, together with a runner-up prize, won by Mr. C. W. Cragg, A.M.I.E.E., were presented by Mrs. Goss, wife of the society's chairman, at the Hamfest, held at the Royal Stores Restaurant, the following day. Another Cup, the Pocock Cup, was also presented to Mr. R. K. Seabrook for the best performance during 1954, in "direction finding" (finding a hidden transmitter).

COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec. : J. H. Whitby, G3HDB, 24, Thornby Avenue, Kenilworth, Warwickshire.

FORTHCOMING Programme. At 9, Queens Road (7.30 p.m.) May 9, "Receiver Servicing," G3HDP. May 23, "Frequency Modulation," G6WH. June 2, Night on the Air. June 4-5, National Field Day. June 6, Junk Sale. June 20, "V.H.F.," G3BAK. July 2-3, Field Day. July 4, Lecture. July 7, Night on the Air. July 18, Lecture. August 1, No meeting. August 4, Night on the Air. August 7, Field Day. September 1, Night on the Air. September 4, Field Day.

EAST KENT RADIO SOCIETY

Hon. Sec. : D. Williams, "Llandogo," Bridge, Canterbury, Kent.

THE society meets fortnightly on Tuesdays at "The Two Brothers," Northgate Street, Canterbury. Nearly all radio and electronic subjects are covered. Raffles are held regularly and lectures and demonstrations also. New members are joining nearly every meeting.

New members are welcome and visitors in the district.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec. : L. H. Webber, G3GDW, 43, Lime Tree Walk, Newton Abbot.

STEPS are being taken to assist our new blind member, Geo. Western, BR5.20605, to get his gear together, and to arrange additional help in technical and Morse instruction for him.

COMMUNICATIONS RECEIVER K.1155. Another purchase from the Air Ministry enables us to once again offer this superlative Communications Receiver at prices to suit every pocket. A World Station Getter, this covers 5 wave ranges: 18.5-7.5 mc/s., 7.5-3.0 mc/s., 1,500-600 kc/s., 600-200 kc/s., 200-75 kc/s., and is easily and simply adapted for mains use, full details with circuits of receiver being supplied. New in Maker's Cases and aerial tested. **£11.19.6.**

Dicto but slightly used for demonstration purposes. **£9.19.6.**

A.C. MAINS POWER PACK OUTPUT STAGE.—In black metal case enabling the receiver to be operated immediately without any modification. can be supplied as follows:—Less Speaker, **£4/10/-**; with 6in. P.M. Speaker, **£5/5/-**. DEDUCT 10/- IF PURCHASING RECEIVER & POWER PACK TOGETHER.

Please add carriage costs of 10/6 for Receiver and 3/6 for Power Pack.

COMMUNICATIONS RECEIVER RA-1B.—Just released by the Air Ministry, this is a superb 6 waveband American Receiver covering 150-315 kc/s., 315-680 kc/s., 680-1,500 kc/s., 1.80-3.70 mc/s., 3.70-7.50 mc/s., 7.50-15.0 mc/s. Takes in all important bands including Trawlers. Illuminated vernier scale is most accurately calibrated, and slow-motion tuning is completely free from backlash. Incorporates AVC, CW, and Sensitivity controls. Valves are 5 of 6X7G, 1 of 6L7G, 1 of 6R7G, and 1 of 6CG (output). Case size 10in. x 7in. finished in black crackle. Power requirements 6.3 v. and 250 v. All receivers aerial tested before despatch. ONLY **£11.19.6** (carriage, etc., 10/6).

CHASSIS OF INDICATOR #23.—Contains VCR97 C.R.T. holder, 11 valveholders, resistors, condensers, etc., etc. BRAND NEW. ONLY **10/-** (carr., etc., 5/-).

E.H.T. TRANSFORMER.—Normal 230 v. Primary, with Secondary of 2,000 v. r.m.s. (approx. 2,800 v. D.C.). A special offer of interest to all using the VCR97 or similar tube. Size 2 1/2 in. W. x 2 1/2 in. D. x 3 in. H. 1 in. for tag panel. AN UNREPEATABLE SNIP, and well worth buying as an insurance against failure of existing E.H.T. supplies. ONLY **15/-** (postage, etc., 2/-).

POCKET VOLTMETERS. not ex-Govt.—Read 0-15 v. and 0-300 v. A.C. or D.C. BRAND NEW & UNUSED. ONLY **18/6.**

HEAVY DUTY TRANSFORMER.—Normal primary. Has 3 separate windings of 5 v., 0-5 v. at 5 amps., and by using combinations will give various voltages at high current. Ex-Admiralty and extremely robust. BRAND NEW. ONLY **39/6** (postage, etc., 2/6).

CRYSTALS.—British Standard 2-pin 500 kc/s. 15/-; Miniature 200 kc/s and 485 kc/s. 10/- each.

SPRAGUE.—1 mfd. 600 v. metal tubulars. 10d. ea., 9/6 dozen (add post).

H.F. UNIT TYPE 26 & 27.—For use with the R1355 or any receiver with a 6.3 v. supply. These are the variable tuning units which use 2 valves EF54, and 1 of EC52. Type 26 covers 65-60 mc/s. (6-5 metres) and Type 27 covers 85-85 mc/s. (3.5-5.0 metres). Complete with valves and BRAND NEW IN MAKER'S CARTONS. ONLY **29/6** each. **CHOKES.**—10H 60 mA., 4/-; 5H 200 mA., 7/6; 10H 120 mA., 10/6 (post. 1/- ea.). **SPEAKERS.**—P.M. 6in. less trans., 19/6; 6in. less trans., 18/6; 10in. with trans., 27/6 (postage 2/- ea.).

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100	D.C. 2 1/2 in. Flush circular	12/6
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500	thermo 2 in. Flush square	5/-
500	thermo 2 in. Proj. circular	5/-
30 amps	D.C. 2 in. Proj. circular	7/6
40 amps	D.C. 2 in. Proj. circular	7/6
30-40 amp.	D.C. Car type moving iron	5/6
15 volts	A.C. 2 in. Flush circ., mov. iron	8/6

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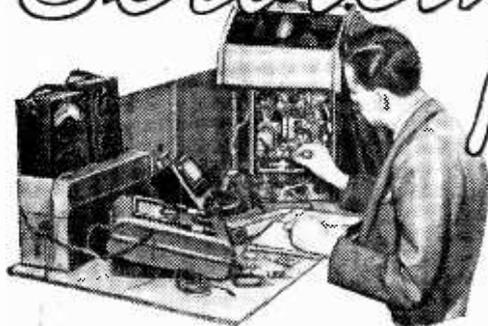
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Servicing Radio Receivers



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

No. 1.—PYE 18A AND G18K SERIES

THE secret of successful radio receiver servicing, as with television, lies in knowing the circuit of the receiver, or parts of it that are less readily traced, the general lay-out of the valves, coils and components of direct service interest, having knowledge of the intermediate frequency and general alignment procedure, and, without doubt, having an idea of how to fix an awkward tuning drive cord or tuning mechanism. On top of this a number of commercial receivers become endowed with somewhat elusive "stock" faults characteristic of their kind. A knowledge of such faults which are liable to develop as the receiver gets older might well save hours of fruitless testing and substituting.

It is the purpose of this series of articles to bring these points to light; it is not intended that the articles should be representative of "service sheets," although it is hoped to cover the main features needed for the successful servicing of commercial sets. For the apprentice engineer—who these days has to cope with most of the problems associated with broadcast receivers, while his chief solves the TV problems—and for the experimenter—who is endeavouring to keep his own and friends' receivers up to standard—this series should prove of great value.

It is hoped to cover the commercial receivers of more popular standing.

The Pye 18A and G18K Series

This is one of the very popular 1947-1948 vintage receivers. It was produced in two models; the G18K as an auto-radiogram and the 18A as a table model. One of its main features is the six-position tone control which is ganged to the main on/off switch and thus gives seven positions in all.

As will be seen from the circuit diagram at Fig. 1, the receiver takes the form of a three-valve—plus H.T. rectifier—superhet. The long, medium and short wavebands are covered and are selected by means of a three-position rotary switch. The receiver also embodies a frame aerial (L1 on the circuit), which avoids the necessity of having to install an external aerial for local reception.

When an external aerial is used, the insertion of the aerial plug into the appropriate socket actuates switch S1, and removes the 220 pF loading capacitor across the aerial coil L3. For this reason, therefore, it is essential to use a proper aerial plug of sufficient length to engage with the switch. Failure of the

switch to be brought into operation will impair the receiver's apparent sensitivity, and may lead one to suspect a fault somewhere in the aerial coupling circuits.

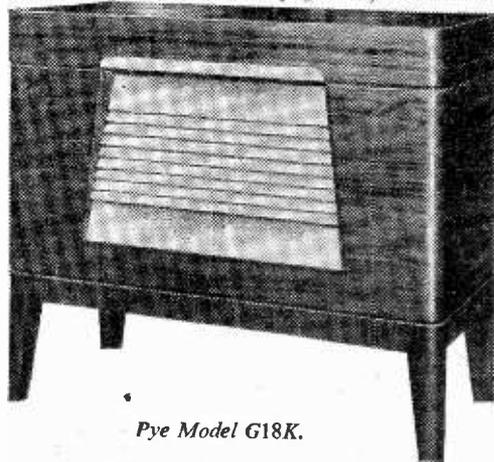
A triode-hexode frequency changer valve (ECH35) produces local oscillations in the triode section, and receives the aerial signals on the first grid of the hexode section. The appropriate aerial and oscillator coils are brought into circuit by the waveband rotary switch, each contact on which is shown on the circuit, for simplicity, as a straightforward make-break switch.

L4 is the short-wave coil and T1 the short-wave trimmer; L2 is the short-wave aerial coupling coil. L5 is the medium-wave coil and L6 the long-wave coil. When an external or plate aerial is used, L3 acts as medium and long-wave aerial coupling coil. T2 is the medium-wave aerial trimmer. The selected coils being tuned by C3.

The oscillator grid and anode coils are selected in a similar manner; L7/10, L8/11 and L9/12 being the short, medium and long-wave coils respectively. These are trimmed in the same order by means of T3, T4 and T5, and oscillator tuning is performed by C4 which is ganged to C3. A degree of fixed padding is achieved by the 570 pF capacitor C5.

Mixing takes place within the valve V1, and a 465 kc/s intermediate-frequency signal occurs across L13. This is conveyed, via the first I.F. transformer (I.F.T.1), to the signal grid of the I.F. amplifier valve

(Continued on page 361)



Pye Model G18K.

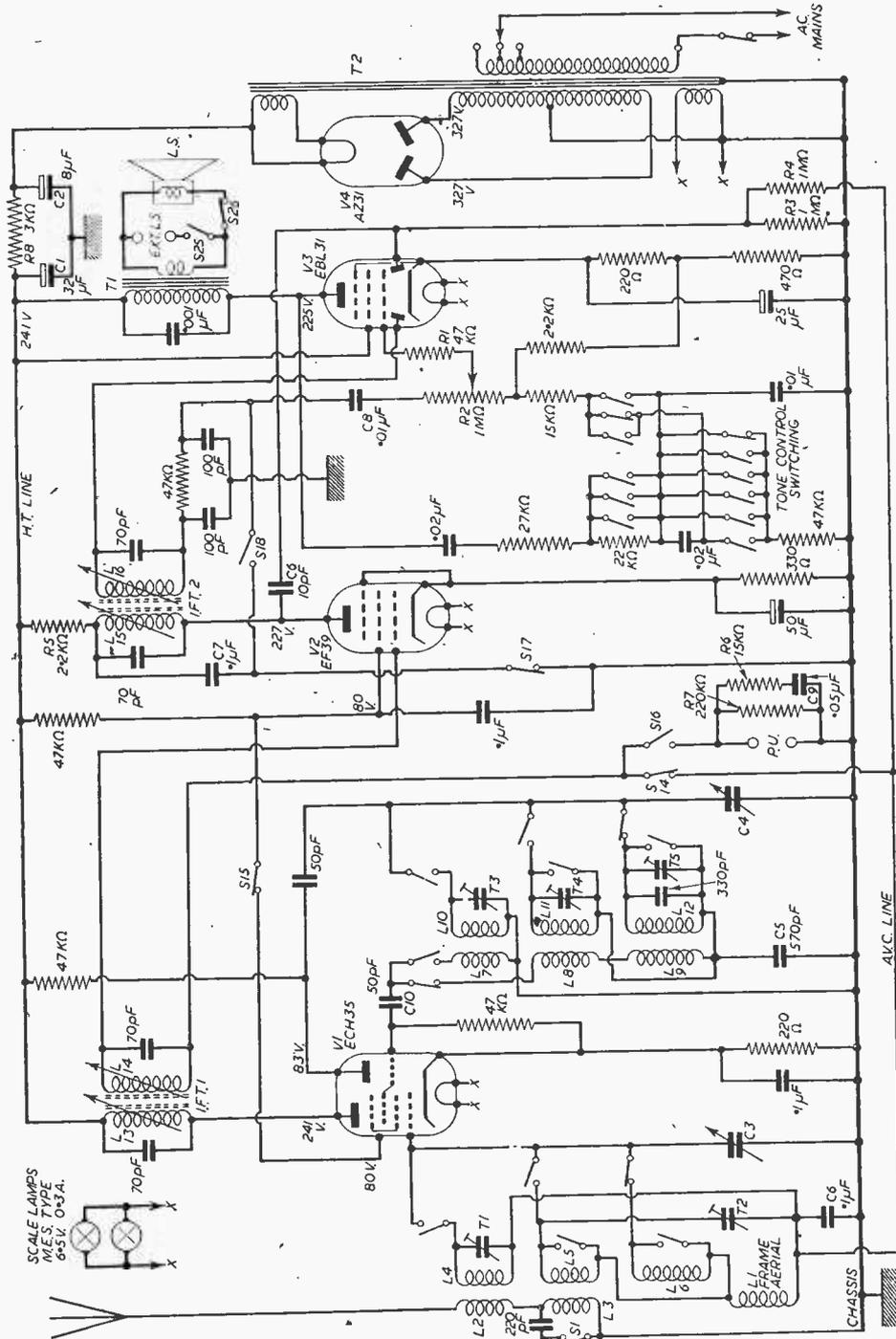
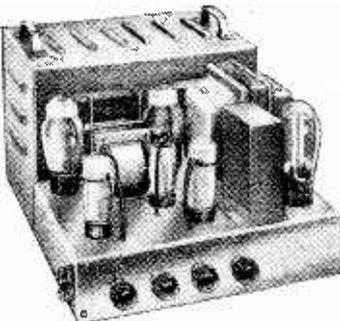


Fig. 1.—Circuit diagram of Pye 18A, etc. The circuit is drawn with the waveband switch in the long wave position, and the tone control switch in the "fidelity" radio position. Switch S1 is shown in the open position as with an external aerial connected. *Voltage readings relative to chassis, using a No. 7 Avo. Resistor values in ohms and capacitor values in microfarads, unless otherwise stated.

R.S.C. A4 HI-FIDELITY 25 WATT AMPLIFIER

A new design for 1955. "Push-Pull" output. "Built-in" Tone Control Pre-amp. stages. Increased sensitivity. Even further improved performance figures. Includes 7 valves. Specially designed sectionally wound output transformer, block paper reservoir condenser and reliable small condensers of current manufacture. TWO SEPARATE INPUTS CONTROLLED BY SEPARATE VOLUME CONTROLS allow simultaneous use of "Mike" and Gram., or Tape and Radio, etc., etc. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response ± 3 db. 30-30,000 c/c. Six negative feedback loops. Hum level 66 db. down. ONLY 20 millivolts INPUT required for FULL OUTPUT. Certified harmonic distortion only 0.35% measured at 10 watts. Comparable with the very best designs.

ENTIRELY SUITABLE FOR SMALL HOMES OR CLUB HALLS, CLUBS, GARDEN PARTIES, DANCE HALLS, etc. etc. FOR ELECTRONIC ORGAN or GUITAR. FOR STANDARD or LONG-PLAYING RECORDS. FOR ANY "MIKE" or PICK-UP. H.P. TERMS ON ASSEMBLED UNITS. DEPOSIT £2 and ten monthly payments 22/6.



Size approx. 12-9-7in. For A.C. mains 200-230-250v. 50 c/c.s. Outputs for 3- and 15-ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at 9 Gns. or ready for use, 50/- extra. Carriage 10/-. If required, cover as illustrated can be supplied for 17/6.

9 GNS.

A PUSH-PULL 3-4 watt HIGH-GAIN AMPLIFIER FOR £3/7/6. For mains input 200-250 v. 50 c/s. Complete kit of parts including circuit, point to point wiring diagrams and instructions. Amplifier can be used with any type of Feeder Unit or Pick-up. This is not A.C./D.C. with "live" chassis, but A.C. only with 400-0-400 v. trans. (Output is for 2-3 ohm speaker.) Supplied ready for use for 25/- extra. Carr. 2/6. Descriptive leaflet, 7d.

PLESSEY 3-SPEED MINOR AUTO CHANGER. Takes 7in., 10in. and 12in. records, standard or long playing. Crystal Pick-up with Duo-point sapphire stylus changed from standard to long playing position by simple switch movement. For A.C. mains 200-250 v. 50 c/s. Limited number. Brand New, cartoned, at only 10 Gns., carr. 5/-.

BATTERY SET CONVERTER KIT. All parts for converting any type of Battery receiver to All Mains. A.C. 200-250 v. 50 c/s. Kit will supply fully smoothed H.T. or 120 v. 50v. or 50 v. at up to 40 mA. and fully smoothed L.T. or 2 v. at 0.4 to 1 a. Price, complete with circuit, wiring diagrams and instructions, only 45/9. Or ready to use, 8/9 extra.

PERSONAL SET BATTERY SUPERSEDER KIT. A complete set of parts for construction of a Unit (housed in metal case) to replace Batteries where A.C. Mains supply is available. Input 200-250 v. 50 c/s. For 4 valve receivers requiring 90 v. 10/20 mA. and 1.4 v. 250 mA., fully smoothed. Price complete with circuit. Only 35/9. Or ready for use, 42/6. Size of unit, 5 1/4 x 4 1/4 in.

BATTERY CHARGER KITS For mains 200-250 v. 50 c/s. To charge 6 v. acc. at 2 a., 25/6. To charge 6 or 12 v. acc. at 2 a., 31/6. Above consist of transformer, full wave rectifier, fuses, fusible wire and steel case. Any type assembled and tested, 8/9 extra.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve 200-250 v. A.C. Mains receiver with selenium rectifier. It consists of a variable Mu high gain H.F. stage followed by a low distortion anode bend detector. Power pentode output is used. Valve line up being 6KT7, SP61, 6BF6. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point to point wiring diagrams, instructions, and parts list, 2/6. This receiver can be built for a maximum of 42/19/6 including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

Terms: C.W.O. or C.O.D. NO C.O.D. under £1. Post 1/- extra under 10/-; 1/6 extra under £1; 2/6 extra under £3. Open 9 to 5.30; Sat. until 1 p.m. Catalogue 6d., Trade List 5d. S.A.E. with all enquiries.

R.S.C. 10 WATT "PUSH-PULL" HIGH-FIDELITY AMPLIFIER A3

Ideal for the quality enthusiast in the home or small hall. Two different inputs can be simultaneously applied and controlled by separate volume controls. Any kind of Pick-up is suitable and most microphones. Tone controls give full Long Playing record equalisation for uncorrected Pick-ups. Sensitivity is very high. Only 130 millivolts required for full output. H.T. and L.T. available for Radio Feeder unit.

Complete with integral Pre-amp. Tone control stage (as A4 amplifier), using negative feedback, giving humproof individual bass and treble lift and cut tone control. Six Negative Feedback Loops. Completely negligible hum and distortion. Frequency response ± 3 db. 30-20,000 c.p.s. Six valves. A.C. mains 200-230-250 v. input only. Outputs for 3 and 15 ohm speakers. Kit complete of parts complete in every detail, plus 7/6 carriage. 7 GNS. Or ready for use, 45/- extra.

Illustrated leaflet 6d. Cover as for A4 is suitable. H.P. TERMS ON ASSEMBLED UNITS. DEPOSIT £1/13/4, plus 7/6 carriage, and nine monthly payments £1.

P.M. SPEAKERS. All 2-3 ohms, 61in. Plessey 16/9. 8in. Plessey, 10/9. 10in. Plessey, 19/6. 10in. R.A., 28/9. 10in. 30in. with trans. 29/6. 10in. W.B. "Stentorian" 3 or 15 ohm type HF1012 10 watts, high-fidelity type. Highly recommended for use with any of our amplifiers, 23/17/6.

MICROPHONES. Crystal high fidelity types. Recommended for use with our amplifiers. Accs. Hand or Desk type, 50/-; Stand type, with heavy floor base and adjustable stem, 82/10/6. H.P. TERMS ON "MIKES," SPEAKERS, etc., when supplied with our amplifiers.

COAXIAL CABLE. 75 ohms, 1 in., 7d. Yard. Twin Screened Feeder, 9d. yard.

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L.T. Types	H.T. Types H.W.
6/12 v. 1 a. H.W.	150 v. 40 mA 3/9
	250 v. 50 mA 6/9
F.W. Bridge Type	250 v. 80 mA 7/9
6/12 v. 1 a.	RM4 250 v. 250 mA 11/9
6/12 v. 2 a.	

H.M.V. LONG PLAYING RECORD TURNTABLE WITH CRYSTAL PICK-UP (Sapphire Stylus). Speed 33 1/3 r.p.m. For A.C. mains 200-250 v. Limited supply. Brand New Cartoned. Perfect. Only 53/19/6. Plus carr. 5/- (Normal price £5 approx.).

COLLARO HIGH-FIDELITY MAGNETIC PICK-UPS. High impedance magnetic type. Limited stocks at fraction of normal price. Only 35/-, Brand New.

FOUR STAGE RADIO FEEDER UNIT. Design of a High Fidelity Tuner Unit T.R.F. L. & M. Wave. Full decoupling. Self-contained heater supply. Only 250-400 v. 10-15 mA. H.T. required from main amplifier. Three valves and low distortion Germanium diode detector. Flat-topped response characteristic. Loaded H.F. coils. Two variable-Mu controlled H.F. stages. 3-Gang condenser tuning. Detailed wiring diagrams, parts list, and illustration, 2/6. Total building cost, 23/15/-.

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250-0-250 v. 70 mA, 6.3 v. 2.5 a.	13/9
250-0-250 v. 70 mA, 6.3 v. 2 a. 5 v. 2 a.	16/9
350-0-350 v. 80 mA, 6.3 v. 2 a. 5 v. 2 a.	18/9
200-0-250 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a.	22/9
300-0-300 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a.	22/9
350-0-350 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a.	22/9
350-0-350 v. 100 mA, 6.3 v. 4 a. C.T.	23/9
0-4-5 v. 3 a.	23/9
350-0-350 v. 150 mA, 6.3 v. 4 a. 5 v. 3 a.	23/9
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C.T. 0-4-5 v. 3a	27/9
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350-0-350 v. 100 mA, 6.3 v. 4 a. 5 v. 3 a.	27/9
C.T. 0-4-5 v. 3 a.	27/9
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21	1/7	2/8	1/8	2/8
22	1/8	2/9	1/8	2/9
23	1/9	2/10	1/9	2/10
24	1/9	2/11	1/9	2/11
25	1/10	3/-	1/10	3/-
26	1/10	3/1	1/10	3/1
27	1/11	3/2	1/11	3/2
28	1/11	3/3	1/11	3/3
29	2/-	3/4	2/-	3/4
30	2/-	3/5	2/1	3/8
31	2/-	3/6	2/2	3/9
32	2/1	3/7	2/3	3/11
33	2/2	3/8	2/4	4/1
34	2/2	3/9	2/5	4/3
35	2/3	3/10	2/6	4/5
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V2 (EF39). On the radio position the function of this valve is quite conventional, the amplified I.F. signal being developed in the second I.F. transformer (I.F.T.2), and passed on for demodulation to the signal diode in V3 (EBL31). The filtered A.F. signal thus appears across the 1 megohm volume control R2, and is taken through the grid-stopper R1 to the signal grid of the pentode section of V3.

This performs as the sound output valve and converts the signal into power, in conjunction with the output transformer T1, to drive the loudspeaker (L.S.)

Some of the I.F. signal voltage is taken by way of C6 to the A.V.C. diode in V3. This signal is thus rectified, loaded by R3 and filtered by R4 and C6, and used as A.V.C. bias for V1 and V2. A delay voltage and bias for V3 pentode section is given by the two resistors in the cathode circuit of V3.

The network comprising switches, resistors and capacitors between the anode and the control grid circuit of V3, constitutes a voltage negative feedback tone control arrangement, and is brought into modified action by means of the tone control switch previously mentioned. Four positions—"Fidelity," "Brilliant," "Mellow 1," and "Mellow 2"—are available on radio, and two positions—"Fidelity"

and "Mellow"—are available on gram., the seventh position actuates the receiver's main on/off switch.

These facilities enable the A.F. response of the receiver to be modified, and in practice the results achieved are quite effective. On the "gram" positions, however, a change takes place in the I.F. amplifier stage V2.

A Reflex Arrangement

Switches S14, S15 and S17 open, and S16 and S18 close. This produces an A.F. coupling from V2, in virtue of the resistive load R5 in its anode, through C7 and C8 and the volume control, to the grid of V3. The pick-up signal, being applied across the correcting network R6, R7 and C9 between chassis and the lower end of L14, thus finds its way to the signal grid of V2. This valve, therefore, acts as a voltage amplifier and raises the pick-up signal to a level suitable for fully driving V3.

Other Features

Facilities are provided for using an extension loudspeaker. Switch S25 brings the extension speaker into circuit, and switch S26 mutes the internal speaker.

A double-wound transformer is employed in the power circuit, and thus the receiver can only be used on A.C. mains supplies.

Mains smoothing is catered for by the filter resistor R8 and the electrolytic capacitors C1 and C2 (a single-unit capacitor). In the radiogram version, R8 is replaced by a conventional smoothing choke; this is to minimise the residual hum which may otherwise become disturbing owing to the larger speaker baffle area of the radiogram cabinet.

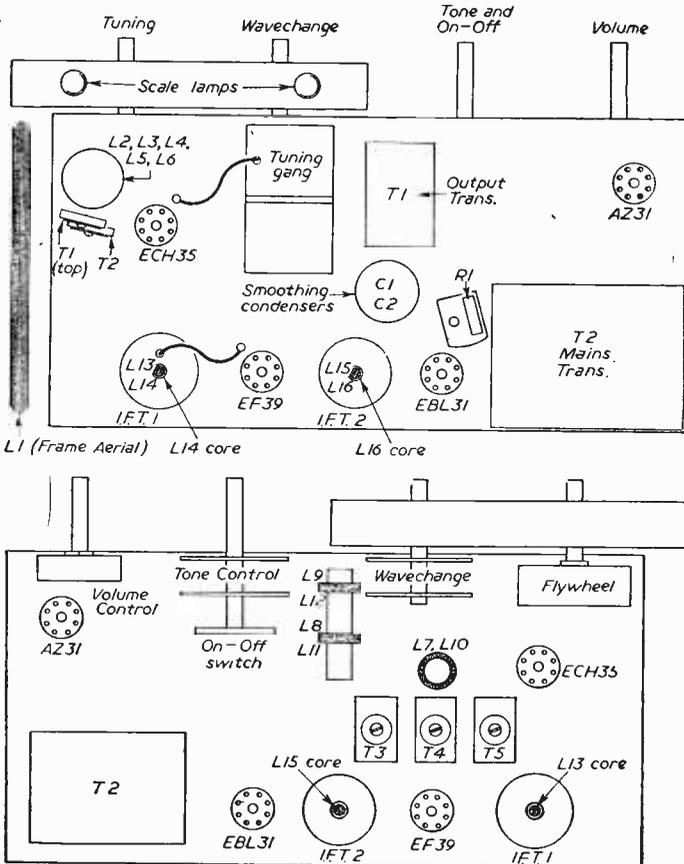
Owing to the resulting rise in H.T. line potential, an additional resistive capacitive filter section is also included in the radiogram chassis.

The difference between the tuning drive cord arrangements of the radio and radiogram versions is illustrated in Fig. 4.

General Faults

If excessive hum is experienced when the receiver is switched to the gram position, a 4.7 KΩ 1-watt resistor should be added between the H.T. line and the top of R5, and a 2 μF 350-volt electrolytic capacitor connected from the chassis to the junction of the resistors. Later model receivers in this series embody this modification.

Insufficient volume when using a high-impedance mag-



Figs. 2 (above) and 3 (below)—Top and bottom views of chassis, showing positions of various parts.

netic pick-up on the radio version may be due to excessive damping as the result of the correcting network, R6 and C9. Enhanced performance may sometimes be achieved by removing these components from across the pick-up terminals.

A general lack of sensitivity has frequently been proved, the result of an alteration in the value of one

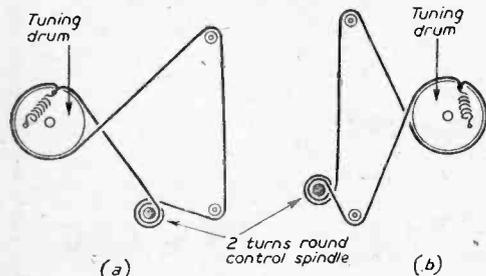


Fig. 4.—Method of fitting tuning drive cord. (a) on table models; (b) on the radiogram chassis.

or more of the 70 pF fixed tuning capacitors across the I.F. transformer windings. These capacitors are contained within the I.F. screening cans, and if poor sensitivity seems to be an elusive feature of the receiver, one is nearly always rewarded by replacing these parts. We would mention, of course, that the faulty capacitor can be located by adjusting the I.F. transformer cores in turn. If it is noticed that a considerable rise in sensitivity occurs when one particular core is adjusted, and that the peaking point is outside the range of the adjustment, then the associated capacitor should be replaced.

Weak signals, both on radio and gram, should lead one to check the condition of the 47 K Ω resistor which is situated in the top-cap connector of the EBL31 valve. Since this resistor is subjected to considerable heat from the valve, it has a habit of either going very high in value or completely open-circuit.

If an intermittent "rumbling" noise becomes superimposed on the reproduction, the top-cap of the EBL31 valve should be scrutinised, preferably through a magnifying glass, for it often happens that oxidation occurs between the grid wire leading out of the valve and the solder blob on the top-cap. This condition is frequently visible as a small black dot in the centre of the solder. It is easily cleared by quickly melting the solder on the cap, and while it is still liquid giving the valve a vigorous shake. This will remove the solder and permit the wire to be thoroughly cleaned, tinned and re-soldered—and in nearly all cases, save the expense of a new valve.

Apart from the 25 μ F electrolytic capacitor in the cathode circuit of the EBL31 valve becoming short-circuited, distortion on gram, rarely occurs. If it happens on radio, however, it is generally caused by C6 becoming leaky.

If the radio section fails, but the gram section remains live (on the radio version this can be proved by switching to gram, and touching the live pick-up terminal with a finger; if a fairly loud hum is produced, then it can be presumed that the gram section is operational), V1 should, of course, be tested first, but if the valve and its associated electrode voltages check normal, and a click from the loudspeaker can be obtained by touching the grid top-cap of V1 with

a screwdriver, then in nearly all cases it will be discovered that the oscillator grid-coupling capacitor C10 is open-circuited.

Apart from becoming completely open-circuited, this capacitor sometimes increases in value. This has the effect of preventing oscillation on the long waveband, the medium and short waves working normally, though probably slightly off tune on the scale.

An intermittent crackling or "rustling" noise should lead one to suspect V1 or V2 for loose electrodes. These can be tested for this fault *in situ* by removing the aerial, tuning to a quiet part of the long or medium waveband, and then gently but sharply tapping the valves in turn with the end of a screwdriver handle. If the valve has a loose electrode fault it will be revealed by a crackling or rustling from the loudspeaker as it is tapped.

When making a test of this kind, care should be taken to ensure that the noise is not being caused by poor contacts between the valve pins and the valve-holder sockets; as opposed to tapping the valve, this can generally be proved by wriggling the valve in its holder.

Another source of valve noise is a poor connection between the metallised red coating on the ECH35 and the EF39 and the wire which connects this coating to the cathode pin. This generally results if the envelope of the valve is loose in its base. Noise from this source can be cleared up by binding about six turns of tinned 20 s.w.g. wire around the valve between the envelope and the base. This will improve the electrical connection between the metallising and the metallising connecting wire. The wire can be held firmly in position either by soldering it at the ends, or by tightly binding over the top of it with insulating tape.

Alignment Procedure

The I.F. stages must be aligned first. To do this the receiver should be switched to the medium-wave position and the tuning set to the low-frequency end of the band (with the gang fully enmeshed). The A.V.C. should be made inactive by shorting C6, and the oscillator should be muted by shorting C4.

The volume control should be set at maximum, and a 465 kc/s signal applied to the top-cap of V1 (the top-cap connector should be removed and in its place a $\frac{1}{2}$ megohm resistor should be connected between the top-cap and chassis—this is necessary to maintain bias on the valve). It is best to apply the signal through an 0.1 μ F isolating capacitor, though the "earth" side of the signal generator can be connected direct to chassis (see "Using Test Instruments"—which will appear later in the series). The signal generator should be modulated, and an output meter connected across the secondary of T1.

The cores of L13, L14, L15 and L16 should be adjusted for maximum output (see Figs. 2 and 3). This concludes the I.F. alignment, and now the short circuit should be removed from C4, the resistor removed from V1 grid, and the top-cap replaced.

The medium-wave section should next come under attention by applying a 1,500 kc/s signal, through a dummy aerial, between the aerial and earth sockets, and setting the tuning to correspond to this frequency (200 metres on the receiver scale). Before commencing operations, it is as well to ensure that the scale pointer is traversing the scale correctly, and that this

(Concluded on page 366.)

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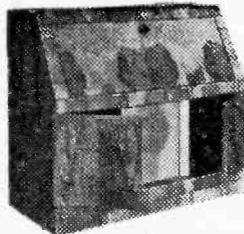
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1 gross Solder Tags.

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New Valve Construction

DETAILS OF SOME NEW MULLARD VALVES

THE well-known advantages of screen-grid valves for high-frequency amplification has led to the widespread use of tetrode valves in radio transmitters. In order to preserve the good performance of tetrodes at very high and ultra high frequencies, special types of construction are necessary. Some recent Mullard double tetrodes, incorporating such features as internal neutralising, operate efficiently at frequencies as high as 600 Mc/s.

The design of transmitting valves for use at frequencies above 150 Mc/s presents a number of problems. Stray capacitances and inductances inside the valve envelope affect operation more and more as the working frequency is raised. Despite these difficulties, a special construction now used in Mullard double beam tetrodes makes possible efficient operation at frequencies up to 600 Mc/s.

For high-frequency operation, the screen grid valve has the very important advantage over the triode that its anode-grid capacitance can be made very small. In high-frequency transmitters, tetrodes and pentodes may, therefore, be operated in conventional circuits without neutralisation. As the working frequency is increased, however, the effect of stray inductance in the screen and cathode circuits becomes marked. Inductance in series with the cathode gives rise to degenerative feedback which results in a lowering of the valve input impedance. This causes a waste of drive power. Inductance in series with the screen grid can give rise to positive feedback which may result in instability.

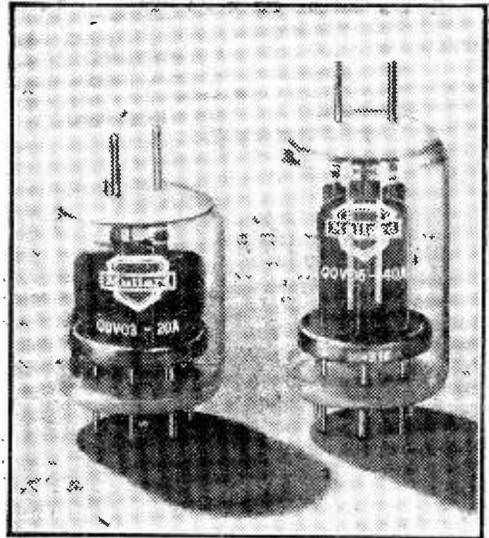


Fig. 6.—Two of the new valves.

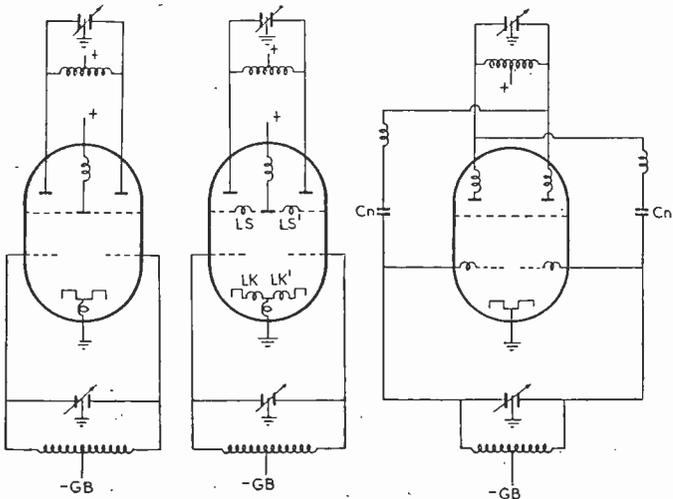
An Early Solution

The earliest remedy to this problem was to incorporate two screen-grid valves in one envelope, with the screens and cathodes connected together by low-inductance straps, the centre point of a strap being brought out as a pin connection. A typical circuit arrangement, showing stray inductance is illustrated in Fig. 1.

The existence of two separate electrode structures side-by-side in the envelope necessitated rather long grid and cathode straps, however, and these possessed sufficient self-inductance to cause undesirable feedback at still higher frequencies. At these higher frequencies, Fig. 1 ceases to be an adequate

representation of the circuit, which becomes more like Fig. 2. The effects of $L_k, L_k^1,$ and L_s, L_s^1 are not cancelled by the push-pull connection.

In the current range of Mullard V.H.F. double tetrodes an improved method of construction is used to reduce lead inductance to the absolute minimum, and thus permit operation at frequencies as high as 600 Mc/s. This construction is illustrated in Figs. 3 and 4. It will be seen from Fig. 3 that a single indirectly-heated cathode is employed. This is of roughly rectangular shape, and only the long sides which face the grids are coated with emissive material. In effect, there are two separate cathodes, interconnected by the short sides of the rectangle, which act as very low inductance straps. A single screen grid is placed round both grid-cathode systems, completely eliminating the effects of screen-lead



Figs. 1, 2 and 5.— C_n and C_n^1 in Fig. 5 are neutralising capacitors.

self-inductance. In practice no screen decoupling capacitor is needed and the screen may be connected to its high-tension supply via a choke or resistor.

Since this type of construction virtually eliminates the effects of screen and cathode lead inductance, the only remaining cause of instability at V.H.F. is the small residual grid-anode capacitance. It is possible for an amplifier to become unstable at certain high frequencies as a result of feedback through this capacitance. The effect is easily eliminated in a push-pull stage by connecting neutralising capacitors from the anode of each valve to the grid of the other. If, however, these capacitors are connected externally, the presence of stray inductance in anode and grid leads and the leads of the capacitors themselves, has the effect of upsetting neutralisation at high frequencies. This is illustrated in Fig. 5, in which the stray inductances are indicated.

Internal Condensers

In Mullard V.H.F. double tetrodes, the effect of the grid and anode lead inductances in respect of neutralisation has been eliminated by incorporating neutralising capacitors inside the valve. These take the form of small pieces of wire, indicated in Fig. 4 as C and C', connected to each grid support, each extending to a position near the anode of the other

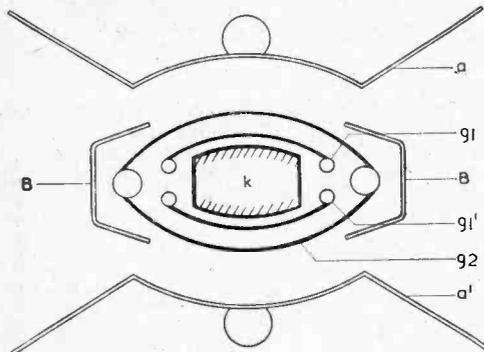


Fig. 3.—Sectional view of the electrode assembly.

tetrode. The result is a true direct electrical connection of electrode to capacitor without intervening stray inductance, and neutralising is effective at all frequencies.

The QQVO6-40A (CV2797) is a larger valve, with

SERVICING RADIO RECEIVERS

(Continued from page 362)

is properly synchronised to the movement of the vanes of the tuning gang: the tuning mechanism should be adjusted if necessary.

The medium-wave oscillator trimmer T4 (Fig. 3) and the medium-wave aerial trimmer T2 (Fig. 2) should be adjusted for maximum output. The calibration should be checked at 600 kc/s (500 metres), which, provided C5 is up to standard, should be found to be within a reasonable tolerance.

The long-wave oscillator trimmer T5 should next be brought into adjustment by applying a 250 kc/s (1,200 metres) signal, and setting the receiver accordingly. The trimmer should be adjusted for maximum output. Correct tracking should be

maintained over the entire band, provided the fixed padder C5 is of correct value.

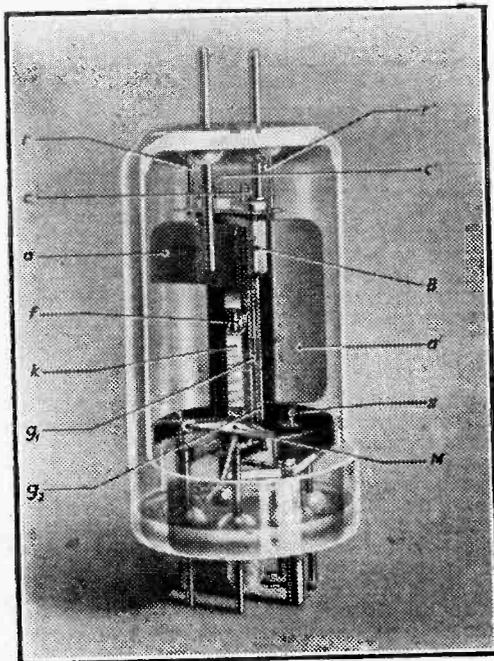


Fig. 4.—The actual valve which is shown in sectional form in fig. 3.

These valves have certain interesting constructional features apart from the special electrode configuration described above.

The anodes are of molybdenum coated with powdered zirconium, which reduces secondary emission, improves radiation of heat, and acts as a getter, with the important advantage that its ability to absorb gases increases as the temperature is raised. The anode lead-out wires are made thick in order to reduce the adverse effects of self-inductance mentioned above.

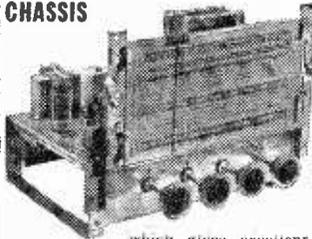
maintained over the entire band, provided the fixed padder C5 is of correct value.

The short-wave band should next be aligned by adjusting the short-wave oscillator trimmer T3 (Fig. 3), and the aerial trimmer T1 (Fig. 2) for maximum output at 17.14 Mc/s (17.5 metres).

Tracking should be checked at 6.98 Mc/s (43 metres), and if a considerable error exists the turns spacing of the short-wave oscillator coil L10 should be altered slightly as a method of compensation. In order to achieve optimum sensitivity over the whole of the short-wave band, the turns spacing of L4 should also be adjusted. After making coil adjustments of this kind, it will be necessary to repeat the short-wave alignment process until no further improvement is registered.

Finally, the short-circuit should be removed from the A.V.C. line.

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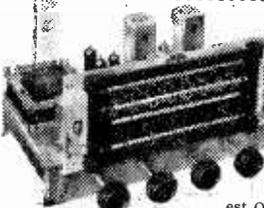
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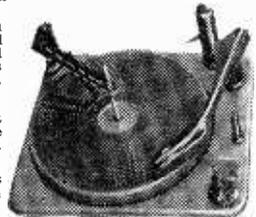
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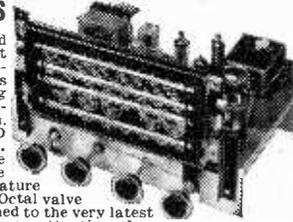


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Surplus Vibrator Power Units

DETAILS OF SURPLUS UNITS WHICH ARE AVAILABLE

By E. G. Bulley

THERE are available upon the surplus market various types of these units, some of which have been removed from other equipment, such as mobile transmitters and receivers, whilst others are new and unused and, in fact, still in sealed cartons.

Such units are extremely useful for supplying the power necessary for car radios or other similar mobile electrical equipment. The input power source for these units is mainly 6 and 12 volts. One will, therefore, appreciate that such voltages can be furnished by a car battery.

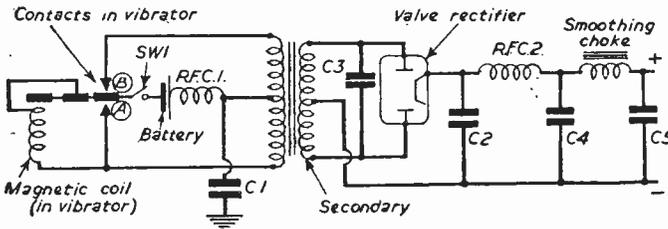


Fig. 1. — Circuit of a non-synchronous vibrator unit.

There are, however, two types of these units available, one incorporating what is known as a synchronous vibrator, and the other using a non-synchronous unit. Typical units of the former consist of a vibrator, specially designed transformer, various capacitors and R.F. chokes: and this type of unit is self-rectifying. The other type of unit, namely the non-synchronous, employs a valve or metal rectifier in addition to the components already mentioned for the synchronous unit. The additional parts are required as being that the vibrator is of the non-rectifying type, as will be explained in the following paragraphs.

Non-synchronous

The non-synchronous vibrator consists of a single reed set equidistant between two contacts. The arm upon which this reed is assembled is secured at one end in a metal frame, and the other end is in the vicinity of a magnetic coil. To assist the reader to understand how a vibrator operates, reference should now be made to Fig. 1.

When the switch (SW1) is made, a specified voltage is applied to the coil of the vibrator, the coil becomes energised and a magnetic field is created. Under the influence of this the arm on which the reed is assembled is attracted. The reed thus makes contact with contact-point "A," and by so doing the current flows through half the primary transformer winding.

Now, at the same time one will appreciate that as the reed has made electrical contact with point "A" it has also short-circuited the energising coil, and thus the coil loses its magnetic property. The sprung reed is now released and carried by its own inertia to make contact with point "B." With the reed in contact with "B," the current now flows through the other half of the transformer primary. This cycle continually repeats itself, the reason being that as contact is broken at point "A" the short-circuiting effect of the coil is cut out and results in the coil once again becoming energised.

This interrupting phenomena created in the primary winding of the transformer induces an alternating voltage in the secondary winding, as is common in standard transformer practice. The outputs from such units have to be rectified by means of a valve or metal rectifier.

Rectifiers

The rectifying units available employ rectifiers such as the OZ4, 84 or 6X5, the foremost being a full-wave gas-filled rectifier having what is termed an ionic heated cathode, and does not therefore require a heater voltage. Such units are extremely useful for car radios. The other types are conventional vacuum rectifiers and need no further comment.

Synchronous

In the synchronous units similar components are used, with the exception that a synchronous vibrator is employed. This eliminates the necessity for a separate rectifier. A typical circuit of such a unit is shown in Fig. 2. The reader will, therefore, by making reference to it, appreciate the fact that the vibrator here has an extra pair of contacts. These contacts are connected to the secondary winding of the transformer so that when the voltage is induced into this winding it is likewise fed back and rectified by the vibrator, the positive D.C. output being taken

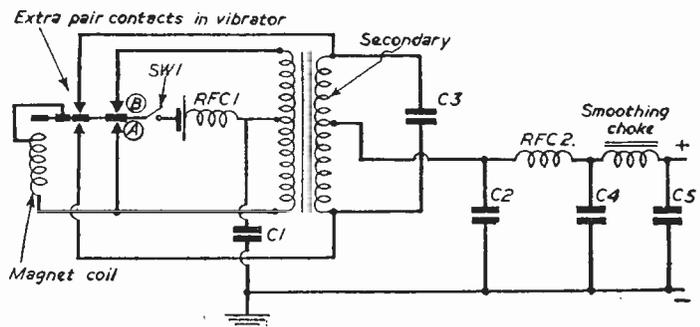


Fig. 2. — Circuit of a synchronous vibrator.

from the centre tap of the secondary winding. Such units, however, in common with the non-synchronous types, use R.F. chokes and capacitors. RFC1 and C1, RFC2 and C2 are filters, their presence being to prevent R.F. being passed to the circuit in which the unit is eventually connected. C3 is, however,

It may be found, however, that the rating and value has been obliterated, and in that case the correct value of the condenser can be determined by trial and error with an oscilloscope.

This is done by connecting the vertical plates of the oscilloscope across the primary winding and making a study of the waveforms. Typical waveforms are shown in Fig. 3. The reader must bear in mind that too large a buffer condenser will result in excessive wear on the vibrator contacts, whereas too low a value will cause arcing to occur at the faces of the contacts and thus reduce the life of the vibrator. As a matter of interest some units available

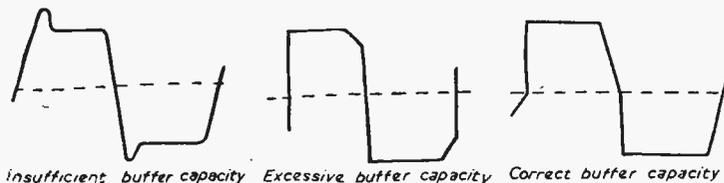


Fig. 3.—Waveform variations caused by condenser variation.

an important component in the unit and is essential to the correct operation of the unit. This condenser is termed the "buffer," its purpose being to provide the correct time constant for the circuit, and absorb any surges that may occur when the vibrator contacts make and break.

The value of this condenser is very critical and one should, therefore, bear in mind that if it is intended to replace this condenser, should it be faulty, only one of the correct value and rating should be employed.

upon the surplus market have the buffer condenser connected across the primary winding; this, however, is usually only found in those utilising 32-volt vibrators.

Condensers C4 and C5 form part of the smoothing filter which is conventional, but it is as well to mention that a great number of the units available do not have their own smoothing: one must, therefore, add these to such units before incorporating them in any receiver, etc.

A Simple Neon Tuning Indicator

THOUGH magic eye and meter-tuning indicators are excellent and largely used, the cost of the "eye" or meter may prevent some constructors using these devices. Where a simple tuning indicator is required, at very low cost indeed, a neon bulb may be used in the circuit shown in Fig. 1. These neon bulbs may be obtained new from Osram and other makers, or purchased at extremely low cost from some ex-Service stockists. In the latter case, the ex-Service 10E/327 is suitable.

The component values shown were most suitable for a receiver with 250 volt H.T. line and 6K7 intermediate-frequency stage. Best results of all will be obtained by using two pre-set potentiometers or resistors of about 15 K and 500 K maximum value, so that circuit constants can be adjusted for the desired effect. The 5 K resistor (or 15 K pre-set resistance) is wired in the H.T. line to the I.F. stage, the .01 to .1 μ F condenser being for by-pass purposes.

The type of neon shown would not operate if connections to it were reversed. As it requires a large Edison screwholder, difficult to obtain, the glass bulb was made a push-fit in the panel, and leads soldered directly to the bulb as indicated.

As a station is tuned in, the voltage drop across the 5 K resistor falls, due to decreased valve anode current. The voltage applied to the neon thus increases. The receiver is therefore tuned for maximum glow. If pre-set resistances are used, the neon can be set so that it just fails to strike when tuned between stations. It will then begin to glow when a station is approached, and be brightest at the point of correct tuning. It will not operate with weak stations. A correct tuning indication can, however, be obtained on all the most powerful stations.

The circuit cannot be used with small sets having a low H.T. voltage. For receivers with higher H.T. voltages, or using different valves, the adjustable circuit in Fig. 2 may be employed. The .5 megohm potentiometer slider should be turned towards H.T. negative until the neon strikes. The degree of brightness change on tuning can then be adjusted by the 15 K resistor.

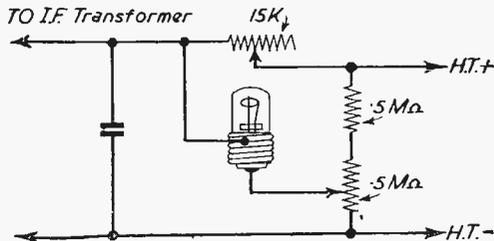
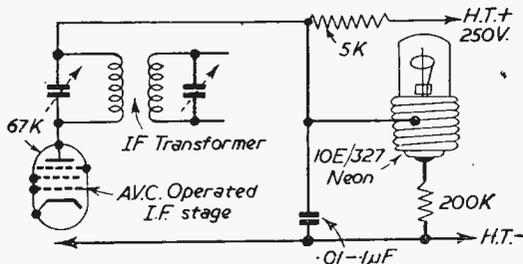
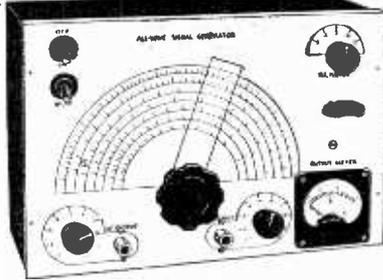


Fig 1 (left) —Showing the neon tuning indicator unit. Fig. 2 (right).—An adjustable circuit.



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

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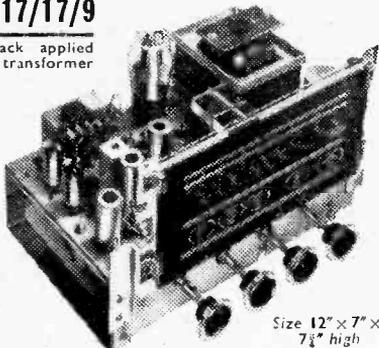
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TRANSMITTING TOPICS



A DX AID

DETAILS OF A SIMPLE AUDIO FREQUENCY LIMITER AND FILTER WHICH CAN BE ADDED TO AN EXISTING RECEIVER TO IMPROVE R.T. RECEPTION, PARTICULARLY ON HEADPHONES

As the reader will probably wish to incorporate this circuit in existing apparatus rather than build a separate unit, no constructional details are shown. There are, however, no snags in the wiring, though the A.F. choke should be positioned to avoid any possible hum induction.

MOST amateurs will agree that headphones are essential to pick out those elusive DX signals which even the "family QRM" would drown if received on a loudspeaker.

For the purpose intended—for use with headphones—the type to be described was found to be really efficient, simple and inexpensive to build, and having the advantage that it can be fitted to any type of receiver.

Basically it consists of a high-pass filter, followed by a full-wave clipper (set manually), and finally a low-pass filter.

The purist will probably argue that this circuit will introduce considerable distortion, but in practice even with maximum clipping (about 20 db)—when the output monitored on an oscilloscope would consist of square waves!—speech remains crisp and intelligible.

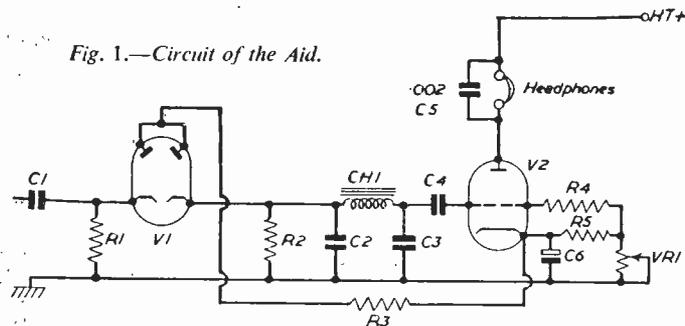
Bass response is attenuated (by choice of coupling components) but maintained afterwards in order to preserve gain and reasonable quality. The low-pass filter used after the clipper is necessary to remove objectionable harmonics, but is also useful to restrict the audio frequency range to that required for speech.

In practice the "clipper level control" is set so that audio distortion is just noticeable with normal volume setting.

Another useful feature of this circuit, which will be more than appreciated by users of straight sets without AVC, is that the audio output cannot exceed the

pre-set level; so when tuning through the band from a weak station to a powerful one, the agonising moments before the volume control is re-adjusted are spared.

Fig. 1.—Circuit of the Aid.



LIST OF PARTS

- | | | |
|-------------------------------------|--|---|
| C1—.001 μ F paper Tub. | CH1—3 Henries (with zero current). | VR1—5K Wirewound Pot. |
| C2—.002 μ F paper Tub. | R1—100K Ω $\frac{1}{2}$ watt carbon. | V1—6H6, EB91, etc. |
| C3—.002 μ F paper Tub. | R2—100K Ω $\frac{1}{2}$ watt carbon. | Any D. Diode valve will suit. |
| C4—.05 μ F paper Tub. | R3—1 meg Ω $\frac{1}{2}$ watt carbon. | Xtal diodes not recommended. |
| C5—.002 μ F paper Tub. | R4—1 meg Ω $\frac{1}{2}$ watt carbon. | V2—6J5—or output valve already in use. R5 to suit |
| C6—50 μ F 12 volt Electrolytic. | R5—1K Ω $\frac{1}{2}$ watt carbon. | |

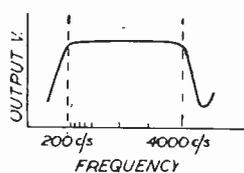
To others, headphones are essential for a different reason—the music of an occasional "VK" at "R9+" is classified by the rest of the family under the general heading of "noise."

What all headphone listeners share in common, however, are repeated attacks of "tortured eardrums." When straining to hear a weak signal with the controls "all out" even a light switch operated in the vicinity can cause a click sufficient to give actual pain.

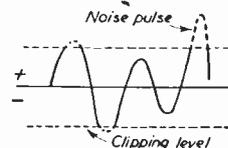
An efficient "noise or crash limiter" is clearly the answer and a filter to remove what is not wanted from the received signal.

The Circuit

Several types of noise limiter were tested, from a simple "saturated pentode" to a "compound full-wave" type operating automatically on the carrier-wave level.



Graph showing response to be aimed at per R/T reception.



Graph showing how audio waveform is clipped on high-amplitude signal or noise pulse.

Programme Pointers



Moderate Askey

THE Arthur Askey show, "Hello Playmates," struck me as very moderate. Composed to precisely the same formula as all the others of its kind, "Big Hearted Arthur" did not seem half as funny as when he has seven or eight minutes all to himself, or very nearly so. The supporting cast of David Nixon, Diana Decker, Irene Handl and Pat Coombs, with Bob Sharples and his music, were about the same—fair to average. This type of show must have played itself out more or less; that is, pending the arrival of another *Itma* and all who contributed to it. All we can expect is current events and personalities gagged with a bit of music thrown in to make two breaks. At least, that is all we get. Two of the "jokes" in "Hello Playmates" the last time I listened to it will serve to show the general level of its humour. "The only dog food that tastes like a postman's leg," and "When she sings 'I love Paris,' you can see the postcards in her eyes." Hardly another *Itma*!

Saturday Jazz

The Saturday afternoon jazz programmes at 5 o'clock make quite a remarkable series.

Goodness knows how long they have been going on now. I know of no other branch of music which has been treated over such a length of time so exhaustively or, if I may so, with such skill. They are very interesting and serve to show up one remarkable fact very plainly. The old records of dance bands of, say twenty years ago, are much more playable and "easy on the ear" than are records of "classical" music played on orthodox instruments and by orthodox combinations. Some of these latter sound frightfully primitive these days and that is, presumably, a sufficiently good reason for not playing them to any extent. Dance band recording seems to have been very superior to straight music in pre-electric days.

Of the many brilliant personalities whose work is featured in BBC programmes from time to time, few can rival Peter Scott for erudition, entertainment and microphonic efficiency. Son of the immortal Antarctic explorer, Mr. Scott is a naturalist of eminence and wide experience, and whether telling the children in *Children's Hour* about a bird's nest in Lapland, or their elders of his work in the bird sanctuary on, I think, the Severn, he is always one of the most welcome of broadcasters. He is that rare person, an expert at his job—and what a fascinating one—and a charming man.

Plays

One of the most rubbishy and unworthy plays ever offered on a Monday evening was sandwiched between two masterpieces. This was unfortunate in itself as it only served to show up its many weaknesses even more than if broadcast on its own.

I refer to "Christopher's Day," an adaptation by James McFarlan of Edwin O'Connor's story "The Oracle." The story, of a vanity-stuffed news commentator, who scales tawdry heights and ends in

Our Critic, Maurice
Reeve, Reviews Some
Recent Programmes

murky depths, was of the feeblest description. Throughout the 90 minutes of its wearisome journey, we were plagued with the "Chris baby" of the floozie he was foolish enough to take up with. Any man with brains would never have looked in such a creature's direction. Or, having regrettably done so, would have been forced to shoot either her, or himself, or both. The piece was set in America though the assumed accents were far from convincing. James McKechnie, Tucker McGuire, Aletha Orr and many others learnt themselves to it all.

The two masterpieces were, of course, Shaw's "Major Barbara" and Ibsen's "The Master Builder." Would anyone have much chance with two such escorts? Irene Worth, Barbara Couper, Anthony Jacobs, Frank Pettingell, Hugh Manning and others gave themselves to Shaw, and Malcolm Keen, Gladys Young, Cyril Chaps, Preston Lockwood, George Merritt and Ursula Howells to Ibsen.

"Major Barbara" was in *The Stars in Their Choices* series. Good drama merits, and usually receives, a worthy performance as I have often pointed out in this column. There was some excellent acting in both these productions, notably by Mr. Pettingell in Shaw and Mr. Keen in Ibsen.

"Caroline" was another Maugham tribute. It is surprising how many of the master's early works date, unlike Wilde, who has become a period classic along with Sheridan and Goldsmith. Perhaps we are still too near the times and the fashions. But the epigrams roll out and never fail to amuse and the theatrical craftsmanship is always fascinating. Roger Livesey and Ursula Jeans played it with unflinching charm and finesse. Richard Hurdnall, Noel Hood, Leslie Phillips, Avice Landone and Mairhi Russell adorned the cast. How like Jimmy Edwards Mr. Livesey frequently sounded.

"The Dover Road," by A. A. Milne, was another delightful play in *The Stars in Their Choices* series. Telling of an eccentric and wealthy bachelor living in great comfort hard by the road, who stops eloping couples and, on one pretext and another, invites them in to play host until he has convinced them of the "error" of their intentions. Many will remember Henry Ainley in the part at the Haymarket. It was extremely well acted by Laidman Browne, assisted by Brian Haines, Joy Rogers, John Gabriel, Lucille Lisle and Richard Bebb.

American Pianist

Julius Katchin is a brilliant young pianist from the United States who is deservedly making a name for himself. He did full justice to the fabulously difficult Brahms in D minor.

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6AB8	10/6 10D9	11/- DA91	7/-	11/6
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6AC5	6/6 10P13	10/- DP92	6/- PY80	9/6
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6AM5	6/6 12AT7	7/- DH150	10/- Q955/10	10/6
6AM6	6/6 12AU7	9/- DK92	7/-	10/6
6AQ5	8/6 12AX7	7/- DK96	8/6 Q875/20	10/6
6AT6	8/- 12BA6	8/6 DL72	9/- Q8150/15	10/6
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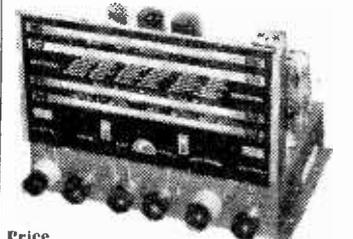
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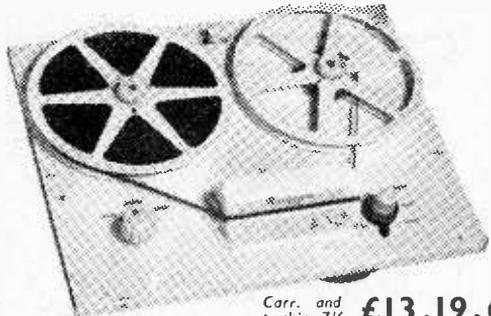
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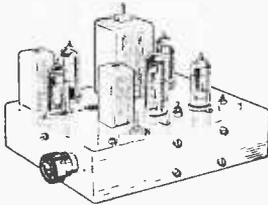
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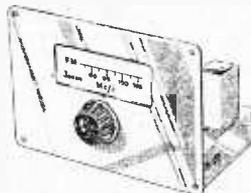
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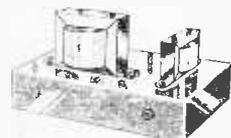
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Open to Discussion



R1155

SIR,—Until recently I have been very pleased with the performance of my R1155. Then one day I noticed that there was considerable distortion on deeply modulated signals. Once noticed, this has become a source of continual annoyance. I wonder if any other readers have noticed this on their 1155? I have tried all the usual remedies for possible causes: careful check of all valve voltages—within the scope of my home-made voltmeter, 2,000 ohms per volt—and check of the filtering on the A.V.C. lines and of the alignment. But nothing seems to make any difference. The symptoms could be A.V.C. distortion or intermodulation; but like Jerome K. Jerome, each time I read of an ailment new to me, I feel sure that is what I have got.

I feed a tape recorder from the top end of the A.F. volume control through a 0.1 condenser and 1 meg. resistor in series, and with a 100K resistor in parallel with the output socket to H.T. negative. The output socket to the recorder is fitted in a spare hole in the top left hand corner of the receiver panel, vacated by the meter balance control of the 1155. This arrangement works very well and gives an output independent of the receiver volume control when using A.V.C. though not on "manual" when R.F. volume control is used.—J. P. MARCHANT (Bedford).

Amplifier Design

SIR,—I read with much interest and more than a little surprise Mr. Kerslake's excursions in the field of audio-engineering, and in view of the—to say the least—astounding "practical" results he has achieved, I am surprised that he should wish Mr. Hindle to "evolve" a circuit.

I myself have been trying for years to achieve such realism, with theorists like Messrs. Williamson, Baxandall, etc., for guidance, but I see now that my efforts should have been empirical, and that theory must always take second place to good aural results.

In conclusion, therefore, I would like to invite Mr. Kerslake to present to an excited and expectant audio-world the *exact* circuitry, operating voltages and apparatus necessary for us to achieve all these "brilliances" and "realism in music."

Since Mr. Hindle has been invited to "deal" with the cathode-follower output stage, perhaps he also would care to comment on the above, possibly including what Mr. Kerslake calls the Horse and Pony output.—W. A. CORNISH (Leicester).

Unpopular Valves

SIR,—With reference to your "economical quality receiver," the saving in components, space and cost in using the double-diode-pentode valve 6B8 as

I.F. amp./detector-avc/1st L.F. amp. is very worthwhile. Quite apart from doing away with two sets of bias resistors and condensers (one an electrolytic), the lowering of H.T. and L.T. current consumed, makes the use of physically smaller mains transformers possible, so that chassis and cabinet sizes can be reduced.

Consider the saving in cost: a 6K7 I.F. amp. stage plus 6Q7 needs:

2 valves	say 15/-
2 v/holders	say 1/-
7 resistors	say 2/4
2 x .1 μ F condensers	say 1/-
1 x 25 μ F condensers	say 2/6

21/10

A count of the cost in the third stage of the circuit referred to is most revealing, especially as two advertisers offer 6B8, in the April issue, at 4/- each!

This valve can also be used as a direct substitute for 6Q7 or EBC33, provided that the anode and screen are strapped together.

Another cheap space saver is the little 9003, which I always now use instead of 6K7, wherever its .15 amp. heater consumption permits.—RICHARD PAGE (B.A.O.R.S.).

A Peculiar Fault

SIR,—I recently had an experience I feel would be of interest to participators of PRACTICAL WIRELESS especially. The experience was concerned with the Ferguson model 208V. After the set had been switched on for about half a minute, and as the valve-heaters were warming up, the pilot lamp, which is in series with the valve-heaters, would gradually light up and then would "blow." This state of affairs pointed to a heater-to-cathode leakage in the rectifier valve being great enough to step up the heater-pilot-lamp voltage, and thus cause the pilot lamp to "blow." The valve in question was the UY41 Mullard half-wave rectifier. A new UY41 Mullard valve was substituted and all was well. The original UY41 valve was subsequently tested and found that a cathode-to-heater "short" developed as the valve was in the state of conducting.—J. H. ROBINSON (Thornton, Fife).

A.C./D.C. Apparatus

SIR,—Quite often you publish some excellent "live chassis" circuits in your magazine. There are many newcomers to the fascinating hobby of radio construction quite unaware of the dangers involved when using A.C./D.C. receivers, etc.

Perhaps you could publish some basic rules regarding these sets, i.e., no metal parts to be accessible to the user, knob screw holes to be plugged. Chassis securing bolts beneath the cabinet are often overlooked and very few circuits include fuses in the

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 surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

mains input. Mains droppers in confined spaces when using a wooden cabinet are a fire risk, too.

As a service engineer I often meet frightening "hook-ups," such as extension speaker connections to A.C./D.C. sets, no back panels, poor flex on 15 amp. plugs and stone floors to "earth" oneself.—A. E. J. SIMONS (York).

An Obscure Fault

SIR,—I have a receiver built from the Osmor "Q" coil pack type H.O. diagram, the valve line up being 6K8, 6K7, 6Q7, 6V6, 5Z4G.

The set suddenly stopped working, and as I had a complete change of working valves from another set I replaced valve for valve.

Fault (or, rather, unpardonable error) No. 1 was that one set of valves included a metalised 6K7 and the other did not. Somehow I managed to replace the 6K7 with a 6Q7 and vice versa.

Having corrected that fault I discovered that the heater of the 6K7 (from the original set of valves) had burned out, but its replacement only gave me a slow pop-pop noise which I believe is called motor-boating.

Touching the grid of the 6K7 stopped the noise and brought in the station, though somewhat weakly.

It was some time before it dawned on me just why the signal was not getting through.

The new 6K7 was of the metal can variety, and the earth pin had not been connected whilst originally wiring for such a replacement. The fault was immediately cured by earthing the pin which connects the casing to the valve holder, thereby removing the stray capacity.

As I said before, this is not an obscure fault, but it might be of use to Mr. Apps when he writes another of his interesting articles.—J. CRICHTON BELL (Southsea).

A Satisfied Reader

SIR,—I have for some time intended writing this letter, and the current issue (May) of PRACTICAL WIRELESS has finally prompted me to do so.

The very wide range of subjects covered in your publication, from radio-control for models to the construction of a gram, is an endless source of pleasure. One can pick up any issue of PRACTICAL WIRELESS and be pretty certain that it will contain an article on at least one radio subject in which one is particularly interested.

The articles are always well written in a style which permits of easy assimilation by the non-technical, at the same time containing sufficient facts and information to satisfy the more advanced reader.

I particularly like the way in which circuit diagrams are laid out and drawn; your artist in this respect is, in my opinion, streets ahead of those of your contemporaries.

There is one small detail I should like to bring to your attention.

In a recent issue of PRACTICAL WIRELESS there appeared an article on Pi-Network TX output

circuits by O. J. Russell, B.Sc. The same article appeared in at least two other radio periodicals though in a slightly altered form, of course.—J. D. PEARSON (Barrow-on-Humber).

Modifying the R1132A

SIR,—May I reply to the letter of Mr. David W. Button, of Bedford, in the May issue of PRACTICAL WIRELESS.

Mr. Button suggests that interfering with the coils of the R1132A is a very tricky job. I do not agree with this statement at all. I merely removed the existing coils, and wound new ones and soldered these in position. True, there was the usual trial and error of squeezing up, and opening up of the turns to get the best results, and trimming to put the required frequencies on the dial where I wanted them.

A tiered circuit does not work as efficiently at either minimum or maximum, as it does in the centre of its range; therefore the most used frequencies should be trimmed to the centre or near the centre for best results. A 1132A Rx can be modified to an 1481 or 1526 by merely altering the coils. Providing the Rx is working before the modifications are undertaken, there is no trouble at all.

I have seen 1132A converted to 1481 and 1526 with coils wound with 22 s.w.g. copper to 18 s.w.g. iron wire and work all right. I am using one at the moment with 13 s.w.g. phosphor bronze wire, which is very hard and difficult to use for winding coils of $\frac{3}{8}$ in. I. diameter, nevertheless it is working perfectly.

I see no reason why the trimmers should be changed at all unless they have been damaged. I have modified six of these Rx which are all working correctly as far as I know. Two people I know of have modified these sets with no trouble.

May I also add a few lines to J. F. B. Elder (Smalley) re time and frequency checks. Why not tune to MSF 2.5, 5, 10 Mc/s, which gives vocal time checks every 14 minutes, also 1,000 c/s tone and one-second pulses? Clocks can be set at any five-minute period throughout the 24 hours. Frequencies are accurate to within ± 2 parts in 10^8 of the nominal values.—L. H. COX (S.W.18).

American Test Equipment

SIR,—Your correspondent signing "Grayshaw Instruments" (Harpenden) (page 282, May, 1955, issue) entirely misses the point, which is that imported kits of parts are available to purchasers.

I have personally tried to buy test equipment bearing the trade name used by your correspondent, at a dealer who claimed to be the agent for the apparatus. This dealer had no stock to dispose of but did exhibit what purported to be a signal generator and which may or may not have contained innards.

A colleague of mine forwarded cash with an order for another widely advertised piece of test equipment which he received after seven months, having repeatedly written without reply in the interim and eventually being obliged to resort to legal advice.—M. L. ELLIOTT (Fareham).

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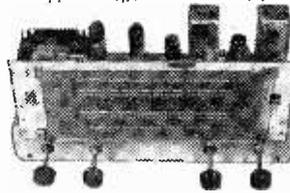
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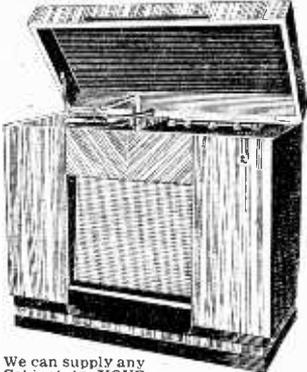
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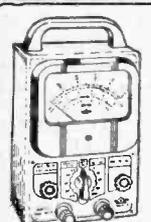
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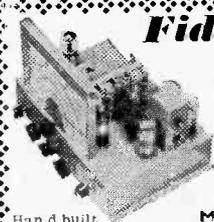
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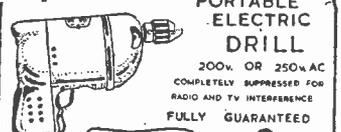
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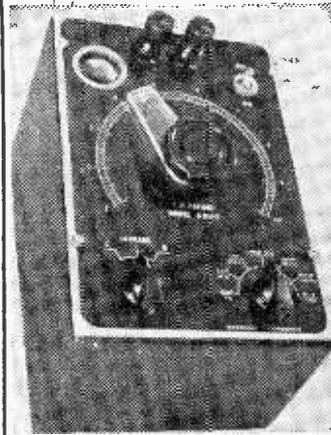
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*No. of
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PRACTICAL WIRELESS, June, 1955.



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0-25 " "
0-100 " "
0-250 " "
0-500 " "

D.C. Current
0-2.5 milliamps
0-5 " "
0-25 " "
0-100 " "
0-500 " "

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0-100,000 " "
0-500,000 " "
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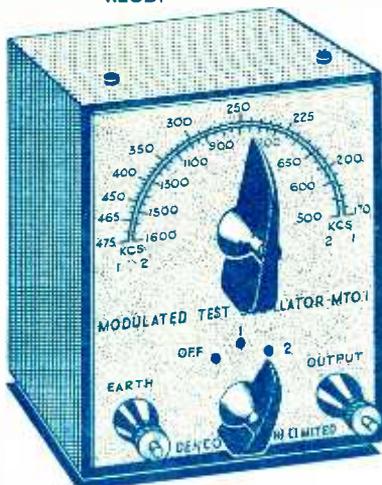
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