

THE TV TUBE EXPLAINED - BY F.J.CAMM

Practical Television 13

AUGUST, 1958

AND TELEVISION TIMES

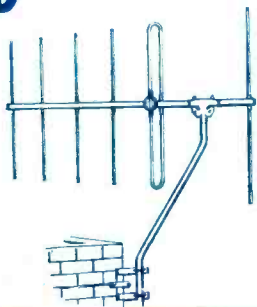
EDITOR: F.J.CAMM



CONTENTS

TELEVISION TROUBLES: SYMPTOMS AND CURES
TV PATTERN, PULSE AND SQUARE-WAVE GENERATOR
BIRTH OF TELEVISION
BUYERS' TV GUIDE
SERVICING TELEVISION RECEIVERS
READERS' PROBLEMS SOLVED, Etc., Etc., Etc.

Build your own Aerials...



AT HOME

AERIAL FITTINGS FOR BAND III, BAND I & RADIO F/M.
 Useful formulae and hints for constructing your own aerial quickly and cheaply. Catalogue illustrating our increased range of Diecast Alloy Fittings, including Band III to Band I Mast Couplers, Reflector and Director Rod Holders, Insulators (both "Inline" and "H" types), Masthead Fittings, Masts and Elements, Chimney Brackets, etc. Send 1/- in stamps for the above to:—

Fringelevision Ltd.

MARLBOROUGH, WILTS. Phone : 657/8

ADCOLA

PRODUCTS LIMITED
(Regd. Trade Mark)

SOLDERING EQUIPMENT

ILLUSTRATED

3/8" Detachable bit type (List No. 64)

Protective Shield (List No. 68)

Catalogues sent FREE

Telephones:
MACaulay 4272 & 3101



British and Foreign Pats.

Reg. Des'gns, etc.

Head Office, Sales:

ADCOLA PRODUCTS LTD.

Gauden Road, Clapham High St., London, S.W.4

TELEVISION TUBES

WE OFFER

MULLARD — COSSOR — EMITRON

Etc., From Stock

12" TUBES - - - £6

Re 12" tubes, please confirm before placing order.

14" MULLARD TUBES £6

(Or equivalent)

14" MAZDA TUBES £6 10.

17" TUBES - - £7 10.

Please add 12/6 Carriage and Insurance.
12" tubes guaranteed for 3 months;
14" & 17", 6 months

MARSHALLS for TELEVISION

131 St. Ann's Road, Tottenham, London, N.15.

Callers welcome. STAmford Hill 3267

EMI "HIS MASTER'S VOICE" MARCONIPHONE · COLUMBIA

Announce

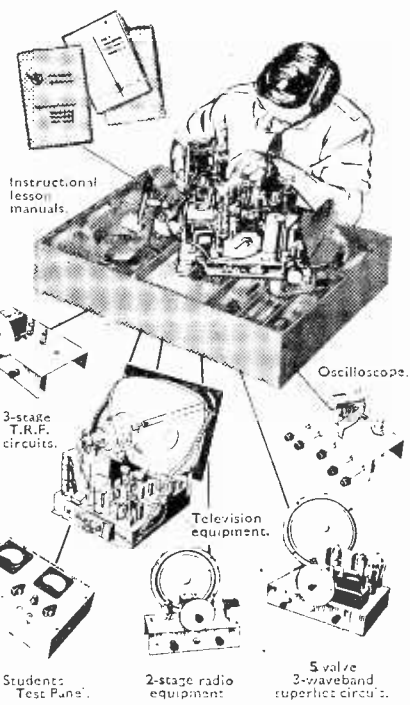
NEW PRACTICAL WAY OF LEARNING AT HOME

NEW — completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

NEW — experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

Radio and television courses, with which specially prepared components are supplied, teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern Radio and T/V equipments.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.



- Courses with Equipment**
- RADIO · SHORT WAVE RADIO**
 - TELEVISION · MECHANICS**
 - CHEMISTRY · PHOTOGRAPHY**
 - ELECTRICITY · CARPENTRY**
 - ELECTRICAL WIRING · 'HI-FI'**
 - DRAUGHTSMANSHIP · ART etc.**

E.M.I. Factories:
at Hayes
England.



EMI INSTITUTES

Fill in for FREE BROCHURE
E.M.I. INSTITUTES, Dept. 138X, London, W.1.

Name Age
(If under 21)

Address

I am interested in the following subject(s) with
without equipment

(We shall not worry you with personal visits)

1C197

FREE

BLOCK CAPS PLEASE

AUG./58

The only Home Study College run by a World-wide industrial organisation

BENTLEY ACOUSTIC CORPORATION LTD.

THE VALVE SPECIALISTS

38 CHALCOT ROAD, LONDON, N.W.1

Primrose 9090

EXPRESS SERVICE!!!
C.O.D. ORDERS RECEIVED BY 3.30 P.M., EITHER BY LETTER, PHONE OR WIRE, DESPATCHED THE SAME AFTERNOON, ALL ORDERS RECEIVED BY FIRST POST DESPATCHED SAME DAY, HOLIDAY PERIODS EXCEPTED.

ANY ORDER UP TO £10 INSURED AGAINST DAMAGE IN TRANSIT FOR ONLY 6d. EXTRA. ORDERS OVER £10 INSURED FREE.

IA3	3/-	6AT6	8/6	6L6G	9/6	12AH7	8/-	35/51	12/6	D63	5/-	ECC91	5/6	GZ30	10/6	PCL83	14/-	UBF80	9/6
IA5	6/-	6AU6	10/6	6L18	13/-	12AH8	10/6	35A5	11/-	D77	6/6	ECCF80	13/6	GZ32	12/6	PEN40DD		UBF89	10/6
IC5	12/6	6B4G	6/6	6N7	8/-	12AT6	10/6	35L6GT	9/6	DAC32	11/-	ECCF82	13/6	GZ34	14/-		25/-	UCH85	10/6
ID6	10/6	6B7	10/6	6Q7G	10/-	12AT7	8/-	35W4	8/6	DAF91	8/-	ECH35	9/6	H30	5/-	PEN45	19/6	UCH42	11/-
IH5GT	11/-	6B8G	4/6	6Q7GT	11/-	12AU7	7/6	35Z3	10/6	DAF96	10/6	ECH42	11/-	H63	12/6	PEN46	7/6	UCH81	11/6
IL4	6/6	6B8GTM	5/-	6R7G	10/-	12AX7	9/-	35Z4	7/6	DF33	11/-	ECH81	9/-	HABC80				UCL82	15/6
ILD5	5/-	6BA6	7/6	6SA7GT	8/6	12BA6	9/-	35Z5GT	9/-	DF91	6/6	ECL80	14/-		13/6	PL83	11/6	UF41	9/6
ILN5	5/-	6BE6	7/6	6SC7	10/6	12BE6	10/-	41MTL	8/-	DF96	10/-	ECL82	12/6	HK90	10/-	PM23	12/6	UF80	10/6
IN5GT	11/-	6BJ6	7/6	6S7GT	8/-	12E1	30/-	50C5	12/6	DH63	10/-	EF36	6/-	HL23	10/6	PM12	6/6	UF85	10/6
IR5	8/-	6BR7	11/6	6SH7	8/-	12J5GT	4/6	50L6GT	9/6	DH76	7/6	EF37A	8/-	HL41	12/6	PM12M	6/6	UF89	10/6
IS5	8/-	6BV6	9/6	6S17	8/-	12J7GT	10/6	72	4/6	DH77	8/6	EF39	6/-	HL133DD		PY80	9/-	UL41	10/6
IT4	6/6	6BW7	8/-	6SK7GT	8/-	12K7GT	7/6	77	8/6	DK91	8/-	EF40	15/-		12/6	PY81	9/-	UL46	15/6
IU5	10/-	6BX6	8/-	6SL7GT	8/-	12K8GT	14/-	78	8/6	DK92	10/6	EF41	9/6	HVR2	20/-	PY82	9/6	UL84	11/6
2A7	10/6	6C4	7/-	6SN7GT	7/6	12Q7GT	7/6	80	9/-	DK96	13/-	EF42	12/6	HVR2A	6/-	PY83	9/6	UY41	0/6
2C26	4/-	6C5	6/6	6S57	8/-	12SA7	8/6	83V	12/6	DL2	15/-	EF50(A)	7/-	KF35	8/6	QP21	7/-	UY85	10/6
2D13C	7/6	6C6	6/6	6U4GT	14/-	12SC7	8/6	85A2	15/-	DL33	9/6	EF50(E)	5/-	KL35	8/6	QP25	15/-	V1507	5/-
2X2	4/6	6C8	12/6	6U5G	7/6	12S7GT	8/6	150B2	15/-	DL65	15/-	EF54	5/-	KT2	5/-	QS150/15		VLS492A	£3
3A4	7/6	6C9	12/6	6U7G	8/6	12SH7	8/6	220P	10/6	DL92	7/6	EF73	10/6	KT33C	10/6			VMP4G	15/-
3A5	12/6	6C10	12/6	6V6G	7/-	12S17	8/6	807	7/6	DL94	9/-	EF87	8/-	KT44	15/-	QVO4/7	15/-	VP2(7)	12/6
3B7	12/6	6CH6	12/6	6V6GTG	8/-	12SK7	8/6	956	3/-	DL96	10/-	EF85	8/-	KT63	7/6	R2	10/-	VP4(7)	15/6
3D5	5/-	6D6	6/6	6X4	7/-	12S07	8/6	1203	7/6	DL510	10/6	EF85	17/6	KTW61	8/-	R12	12/6	VPI3C	7/-
3Q4	7/6	6E5	12/6	6X5GT	6/6	12SR7	8/6	4033L	12/6	DM70	8/6	EF89	10/-	KTW62	8/-	SD6	12/6	VP41	7/6
3Q5GT	9/6	6F6G	7/-	6Z4/84	12/6	12Y4	10/6	5763	12/6	EA50	2/-	EF91	7/6	KTW63	8/-	SP4(7)	15/-	VR105/30	
3S4	7/6	6F6GTM	8/-	6Z5	12/6	14R7	10/6	7193	5/6	EA76	9/6	EF92	5/6	KTZ41	0/-	SP41	3/6		9/-
3V4	9/-	6F8	12/6	6/30L2	10/-	14S7	17/-	7475	7/6	EABC80	9/-	EL32	5/6	KTZ63	10/6	SP42	12/6	VR150/30	9/-
5U4G	8/6	6F12	7/6	7A7	12/6	19AQ5	11/-	9002	5/6	EAC91	7/6	EL41	11/-	L63	3/6	SP61	3/6	VT61A	5/-
5V4G	12/6	6F13	12/6	7B7	8/6	19H1	10/-	9003	5/6	EAF42	10/6	EL42	11/6	LN152	14/-	SU61	10/6	VT501	5/-
5X4G	12/6	6F17	12/6	7C5	8/-	20D1	16/-	9006	6/-	EB34	2/6	EL81	15/-	LZ319	9/-	TP22	15/-	W76	7/6
5Y3G	8/-	6F32	10/6	7C6	8/-	25L6GT	10/-	AC6PEN	7/6	EB41	8/6	EL84	10/6	MH4	7/-	U16	12/-	W77	5/6
5Y3GT	8/6	6F33	7/6	7H7	8/-	25Y5	10/6	ACJHL		EB91	6/6	EL91	5/-	MHL4	7/6	U18/20	10/-	W81M	6/-
5Y4	12/6	6G6	6/6	7Q7	9/-	25Y6	10/6	DDD	15/-	EBC33	7/6	EM34	13/-	MHLD6	12/6	U22	8/-	X61	12/6
5Z4	12/6	6H6GTG	3/-	7S7	10/6	25Z3	10/6	ACJ/P4	8/-	EBC41	10/-	EM80	10/6	ML4	12/6	U25	13/6	X63	10/-
5Z4G	10/6	6H6GTM	3/6	7V7	8/6	25Z4G	10/6	ACJ/VPI	15/-	EBF80	13/-	EM81	10/6	ML6	6/6	U31	10/6	X65	12/6
5Z4GT	12/6	6J5G	5/-	7Y4	8/-	25Z6G	10/-	ALV60	10/-	EBF89	9/6	EN31	31/9	MU14	10/-	U43	10/6	X66	12/6
6A8	10/-	6J5GTG	5/6	8D2	3/6	28D7	7/-	AP4	7/6	ECS2	5/6	EY51		OA10	12/6	U45	10/6	XD(1.5)	6/6
6AB7	8/-	6J5GTM	6/6	8D3	7/6	30	7/6	ATP4	5/-	ECS4	6/-	(Small)	10/6	OA70	5/-	U50	8/-	XFW10	6/6
6AB8	14/-	6J6	5/6	9D2	4/-	30C1	9/-	AZ31	10/-	EC70	12/6	EY51		OA71	5/-	U52	8/6	XYF12	6/6
6AC7	6/6	6J7G	6/-	10C1	15/-	30F5	8/-	BL63	7/6	ECC31	15/-	(Large)	12/6	OC72	30/-	U76	7/6	XH(1.5)	6/6
6AG5	6/6	6J7GT	10/6	10F1	19/6	30FL1	10/-	CK506	6/6	ECC32	13/6	EY85	14/6	P61	3/6	U78	7/6	XS(1.5)	6/6
6AJ8	9/-	6K6GT	8/-	10F9	11/6	30L1	9/-	CK523	6/6	ECC33	8/6	EZ35	6/6	P215	10/6	U251	15/-	Y63	7/6
6AK5	8/-	6K6GT	8/-	10F18	12/6	30P12	13/6	CV63	10/6	ECC35	8/6	EZ40	8/-	PABC80	5/-	UA04	10/6	Z63	10/6
6AK8	9/-	6K7G	5/-	10LD3	8/6	30P16	10/-	CV85	12/6	ECC81	8/-	EZ41	13/6	PCC94	9/-	UABC80		Z66	20/-
6AL5	6/6	6K7GT	6/-	10LD11	16/9	30P11	12/6	CV271	10/6	ECC32	7/6	EZ80	9/6	PCC95	12/6			Z77	7/6
6AM5	5/-	6K8G	8/-	10P13	17/6	31	7/6	CV428	30/-	ECC83	9/-	EZ81	9/-	PCF80	9/-	UAF42	10/6	Z79	7/6
6AM6	7/6	6K8GT/G		11E3	15/-	33A/58M		D1	3/-	ECC84	10/6	FW4.800		PCF82	12/6	UB41	12/7	Z719	8/-
6AQ5	8/6		11/-	12A5	6/6		30/-	D42	10/6	ECC85	9/6		10/-	PCL82	12/6	UBC41	8/6	Z729	17/6

NEW METAL RECTIFIERS, FULLY GUARANTEED

DRM1B	15 4	RM-2	7/6	W6	3/6	14A97	25/-	14RA 1-2-8-2	19/-	16RE 2-1-8-1	8/6
DRM2B	16 2	RM-3	9/5	WX3	3/6	14A100	27/-	14RA 1-2-8-3	23/6	18RA 1-1-8-1	4/6
DRM3B	23 3	RM-4	20/-	WX4	3/6	14A124	28/-	14RA 2-1-16-1	21/-	18RA 1-1-16-1	6/6
RM-0	6/-	RM-5	24/-	WX5	3/6	14A163	38/-	16RC 1-1-16-1	8/6	18RA 1-2-8-1	11/-
RM-1	7/-	W4	3/6	14A85	18/-	14B130	35/-	16RD 2-2-8-1	12/-	18RD 2-2-8-1	15/-

HIVAC MINIATURE VALVES

Subminiature				Midget							
XE2	£5	XFW40	17/6	XFY41	17/6	XD 1.5 v.	10/6	XLO 1.5 v.	10/6	XVS 2.0 v.	15/6
XE3	£5	XFW50	17/6	XFY43	17/6	XD 2.0 v.	10/6	XLO 2.0 v.	10/6	XW 1.5 v.	15/6
XFG1	18/-	XFY14	17/6	XFY51	17/6	XH 1.5 v.	10/6	XP 1.5 v.	12/6	XW 2.0 v.	15/6
XFR1	21/-	XFY15	24/6	XFY53	17/5	XH 2.0 v.	10/6	XP 2.0 v.	12/6	XY 1.5 v.	15/6
XFR2	21/-	XFY34	17/6	XFY54	24/6	XL 1.5 v.	10/6	XSG 1.5 v.	15/6	XY 2.0 v.	15/6
XFR3	21/-	XFY35	17/6	XR4	49/-	XL 2.0 v.	10/6	XSG 2.0 v.	15/6		
XFR5	27/6										

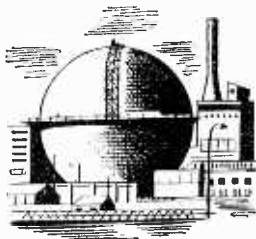
Hivac or Metal rectifier technical leaflet free on receipt of S.A.E.

TERMS OF BUSINESS:—CASH WITH ORDER OR C.O.D. ONLY. POST/PACKING CHARGES 6d. PER ITEM; ORDERS VALUE £3 OR MORE POST FREE. C.O.D. 2/6 EXTRA. WE ARE OPEN FOR PERSONAL SHOPPERS MON-FRI. 8.30-5.30. SATS. 8.30-1 P.M.

ALL VALVES, NEW, BOXED, TAX PAID, AND SUBJECT TO MAKERS' GUARANTEE. FIRST GRADE GOODS ONLY. NO SECONDS OR REJECTS. CATALOGUE OF OVER 1,000 DIFFERENT VALVES, WITH FULL TERMS OF BUSINESS, FREE ON RECEIPT OF 3d STAMP.

PLEASE ENQUIRE FOR ANY VALVE NOT LISTED. 3d. STAMP, PLEASE.

British Achievement IN NUCLEAR POWER Speaks for BRITAIN



Nuclear Power. The first artificially -induced atomic fission took place at Cambridge, England, in 1932. British development of nuclear energy for industry has been the first to bear fruit in the world's first atomic power stations.

Please send me full details of the "Operation Britain" organisation.

Corporate membership — 10 gns.

Personal membership—2 g: s.

NAME

ADDRESS

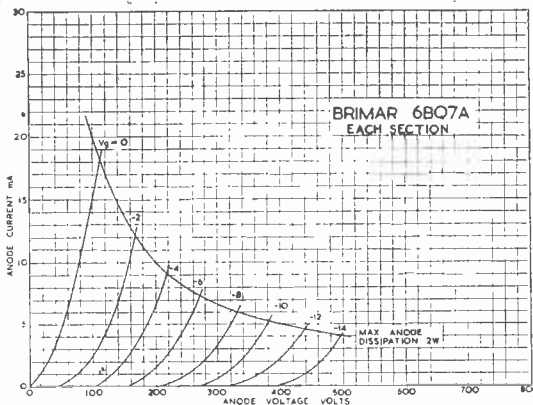
Post to:—
THE OPERATION BRITAIN ORGANISATION • 165 FLEET STREET, LONDON, E.C.4 • (FLEET STREET 5011)

This is an "Operation Britain" Organisation announcement

BRIMAR 6BQ7A

The Brimar 6BQ7A is a double triode consisting of two independent high slope sections with similar characteristics. It contains an internal screen which is brought out of a separate base pin to ensure low interaction between the two independent sections. The valve is particularly useful in all functions where high slope triodes

are required and can also be used as a cascode R.F. amplifier or a combined oscillator and mixer.



TYPICAL CHARACTERISTICS

Heater voltage.....	6.3 volts
Heater current.....	0.4 amp
Anode voltage.....	150 volts
Cathode bias resistor.....	220 ohms
Anode current.....	9 mA
Mutual conductance.....	6.4 mA/V
Amplification factor.....	39
Anode resistance.....	6,100 ohms
Grid cut-off voltage (I _a —10 μA).....	—10 volts approx.

Write to the Publicity Department for a data sheet.

Standard Telephones and Cables Limited

FOOTSCRAY SIDCUP KENT

Footscray 3333

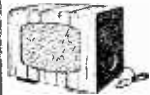
RECTANGULAR T.V. TUBES

12 MONTHS' GUARANTEE

17in. £7.10.0 14in. £5.10.0

6 months full replacement, 6 months progressive. Made possible by the high quality of our tubes. Ins., Carr. 15 6, 9", 10", 14", 15", 16" round tubes. Our special offer of these sizes, £5. 12" T.V. TUBES, £3. Three months guarantee on round tubes. Ins., Carr. 15 6.

EXTENSION SPEAKERS, 29/9



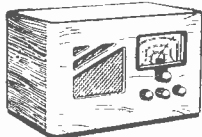
Fitted with 8 P.M. Speaker "W.B." or Goodman's of the highest quality. Standard matching to any receiver (2.5 ohms). Switch and flex included. Money refunded if not completely satisfied. Ins., Carr. 3 6.

8in. P.M. SPEAKERS, 8/9

At this price you can have one in every room. Let the lady of the house listen to that radio programme. With O.P. transformer fitted. 10". Postage 2 6.

HOME RADIO, 79/6

A.C. D.C. Universal mains 5 valve octal set. 3 waveband receiver can be adapted to gram. P.U. In an attractive wooden cabinet 9" x 18" x 11". Ins., Carr. 7 6.



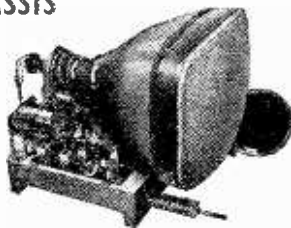
POPULAR RADIO OR RADIOGRAM CHASSIS, 39/9. A.C. or A.C. D.C. 3 waveband and gram. 5 valve superhet. International octal. Ideal table gram, but still giving high quality output. 4 knob control. 8" P.M. Speaker 7 9 extra. Set of knobs 2-. Chassis size : 15" x 7" x 8". Less Valves. Ins., Carr. 4 6.

SOLO SOLDERING TOOL, 19/6. 110 v. or 6 v. (Special Adaptor for 200/240 v. 10/- extra.) Automatic Solder Feed. Includes a 20ft. reel of ERSIN 60.40. Solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions for use. Post 2 6.

17in. T.V. CHASSIS

TUBE & SPEAKER

£19.19.6



17" Rectangular Tube on modified chassis. Supplied as single channel chassis covering B.B.C. channels 1-5, or incorporating Turret Tuner which can be added as an extra at our special price to chassis purchasers 50/-, giving choice of any 2 channels (B.B.C. & I.T.A.). Extra channels can be supplied at 7 6 each. 1 P's 10.5-14 Mc/s. Chassis size "12" x 14" x 11". Valve line up : 6SN7G, 6P25, EY51, 2-6D2s, EL38, EL41 & 7-6F1s. Similar chassis were used by well known Rental & Hire Companies because of their stability and reliability. With Tube & Speaker, £19.19.6. With all valves, £25.19.6. Complete and working with Turret Tuner, £23.9.6. 12 months guarantee on the tube, 3 months guarantee on the valves and chassis. Ins., Carr. (incl. tube) 25-.

14in. T.V. CHASSIS, TUBE & SPEAKER, £13.19.6

As above with 14" Round Tube. Chassis, valves and tube guaranteed for 3 months. With Tube & Speaker, £13.19.6. With all valves, £19.19.6. Complete and working with Turret Tuner, £22.9.6. Ins., Carr. (incl. tube) 25-.

INSULATING TAPE 1 6. Finest quality. 75" x 1" wide. Post 9d.

GANG CONDENSERS 1 9. 2 and 3 gang 500 pF Standard Salvaged. Tested. P. & P. 13.

SOUND & VISION STRIP 25 6. Sound I.F. 10.5 Mc/s Vision I.F. 11 to 14 Mc/s. Less valves. Valve line up : 6-3F1s, 2-8D2s. Any single channel 1-5 supplied, a turret tuner is easily fitted. Power Pack Supply 200 v. H.T. 6.3 v. heaters. P. & P. 2 5.

Open SATURDAY—ALL DAY.
Liverpool Street Station—Manor
Park Station—10 minutes.
FREE CATALOGUE. Terms Available.

DUKE & CO.

(Dept. 2) 621, ROMFORD ROAD,
MANOR PARK, E.12.

Tel.: 1LF 6001-3.



Practical Television



& TELEVISION TIMES

Editor : F. J. CAMM

Vol. 9 No. 97

EVERY MONTH

AUGUST, 1958

TELEVIEWS

Editorial and Advertisement Offices :

PRACTICAL TELEVISION
George Newnes, Ltd., Tower House,
Southampton Street, Strand, W.C.2.

© George Newnes Ltd., 1958.

Phone : Temple Bar 4363.

Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for trans-
mission by Canadian Magazine Post.

SUBSCRIPTION RATES

including postage for one year

Inland - - - 19s. per annum
Abroad - - 17s. 6d. per annum
Canada - - - 16s. per annum

CONTENTS:

	Page
Televiews	5
Recording TV on Tape ...	6
The Television Tube Explained ...	9
Television Troubles ...	11
ITV in Difficult Areas ...	13
Servicing Television Receivers ...	14
Heater-Cathode Tube Shorts ...	18
Universal Alignment Method ...	19
Buyers TV Guide ...	23
The Birth of Television ...	26
A TV Pattern, Pulse and Square Wave Generator ...	29
Telenews ...	33
Underneath the Dipole ...	37
Correspondence ...	41
News From the Trade ...	42
Your Problems Solved ...	45

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

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

Copyright in all drawings, photographs and articles published in "Practical Television" is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden.

RECEIVERS WITH SEPARATE SCREENS

A RECENT American development in the design of TV receivers is the separation of the screen from the chassis, which is made possible by a new picture tube which is two inches shorter than standard tubes. One of these new models has a 21in. screen which swivels on the top of a pedestal base containing the chassis and an 8in. speaker. A further model has a very small chassis which can easily be accommodated on a coffee table, or shelf. The 21in. screen can be placed anywhere within 25ft. The shallow tube has been made possible by changing the shape of the cathode from cylindrical to flat, thus permitting a shortening of the tube neck. The chassis is 6in. deep, as compared with from 12in. to 16in. of the orthodox receiver, and only 8in. high instead of 18in. The separation of the screen from the receiver enables it to be stowed away inconspicuously.

RECONDITIONED TUBES

UNDER the law, Purchase Tax becomes due on all goods subject to tax when they are sold by a registered person or firm under taxable conditions. The fact that the goods may be reconditioned goods does not affect the position, but as a concession, tax is not required to be paid on secondhand goods even if they are sold under taxable conditions provided that they have not been subjected to more than minor repairs and are kept segregated from new ones, both in stock and in trade at the counter. Thus, where only a minor reconditioning process has been carried out, the tax concessions apply. Where reconditioning, however, involves the opening of a tube, liability to tax is incurred. For example, in the case where the reconditioning virtually amounts to the production of a fresh tube, and the replacement of the electron gun, not necessarily by a new one. Where a dealer retains an old tube after he has replaced it with a new one, he must pay tax if he has it reconditioned.

There can be no doubt also that the price of tubes is excessive. One can understand that in the early days of TV, when overheads had to be covered by a comparatively small output, the price of an individual tube would be high. Millions of tubes are now sold where only a few thousand were required. Prices have remained fairly static and indeed in some cases have been increased.

"A BEGINNER'S GUIDE TO TELEVISION"

OUR recent series of articles entitled "A Beginner's Guide to Television" is now available in book form at 7s. 6d. from all booksellers or 8s. 3d. by post from the Book Department, address as on this page. A demand for back issues containing the series no longer available, resulted in the production of the articles in this more permanent book form.—F. J. C.

Our next issue, dated September, will be published on August 22nd

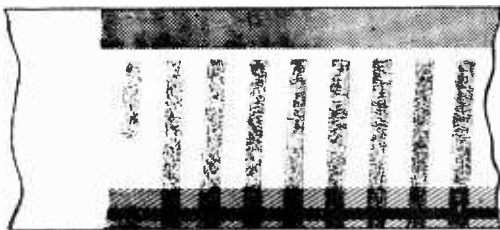
RECORDING TV ON TAPE

RECENTLY DEMONSTRATED IN
THE STUDIOS OF ASSOCIATED
REDIFFUSION LTD.

WE were recently invited to the studios of Associated-Rediffusion Ltd., to witness a recent demonstration in this country of taped television. First we saw a "live" show recorded on tape which was played back from the tape within a matter of minutes without any loss in picture quality. This achievement will have as much impact on television as ordinary tape had on sound radio. It opens the way to a whole new field of operational techniques and promises the viewer an even more comprehensive programme coverage than he already enjoys.

In 1928 the then Baird Television Company made the first recording of a 30-line definition television signal on a 78 r.p.m. gramophone record. Now Rank Cintel Ltd., in association with Ampex Corporation, have modified their Videotape Recorder, which is already in use in television stations throughout the world, for the 405 system.

Taped television will enable each hour of pro-



A magnified view of a piece of developed video tape. Editing pulses appear on the control track at the bottom.

gramme time to be planned for maximum audience viewing. For example, when an event of national importance takes place at 5 p.m. it can be taped and relayed later to reach a larger and more representative audience.

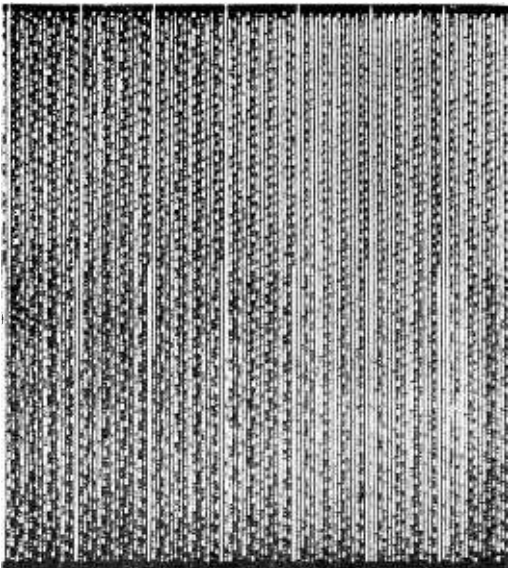
Unlike conventional film telerecordings taped television is cheap. It costs only one-quarter as much as 16mm. film and less than one-tenth as much as 35mm. film. It combines such facilities as immediate playback, immediate availability for re-use and faithfulness of original picture quality.

Like most ideas magnetic recording on tape is no new theory and this paper has been an

advocate of it for many years. But it is only in the last decade that theory, technique and materials have developed to the stage where taped television becomes a practical possibility.

Videotape Recorder

There were three basic problems which needed to be solved in designing a practical magnetic tape recorder for video applications.



A typical view of signal pattern showing audio track at top, video pattern running vertically across tape, and cue track superimposed on control track at bottom.

1. High head-to-tape velocity was required to record the high frequency components of the video signal.

2. Adequate playing time using reels of reasonable size was necessary.

3. A means had to be found whereby the entire video signal from direct current to the high frequency of 4 megacycles could be recorded and reproduced.

To solve the first two problems, the Ampex recorder has four heads mounted at the outer circumference of a rotating disc with their gaps parallel to the disc axis, and the video signal is then recorded vertically rather than horizontally on the tape. The third problem was solved by a special modulation process which will be described later.

In the head assembly, each head is spaced with microscopic precision at 90 deg. from the next on the disc. With a disc diameter of about 2in., and a rotational rate of 14,400 r.p.m. (240 r.p.s.), the writing speed or relative head-to-tape velocity is about 1,500 i.p.s.

The reel-to-reel tape velocity depends upon the width of the tracks which are to be laid down, one after another, transversely on the tape, and upon the necessary space between them. These tracks are 10 mils. wide, with an edge-to-edge separation of $5\frac{1}{2}$ mils. and a centre-to-centre spacing of $15\frac{1}{2}$ mils. It is thus possible to obtain a great reduction in tape speed and to operate at the familiar 15-ips velocity. Using thin tape, 64 minutes of recording are obtained on a $12\frac{1}{2}$ in. diameter reel of 2in. wide tape.

A 120 deg. arc is described during the complete sweep of a head transversely across the tape.

Since all four heads are fed the same currents during recording, there is a duplication of information towards the end of one track on the tape and at

the beginning of the succeeding one. Advantage is taken of this duplication in the switching system used to deliver continuous transient-free signals during replay.

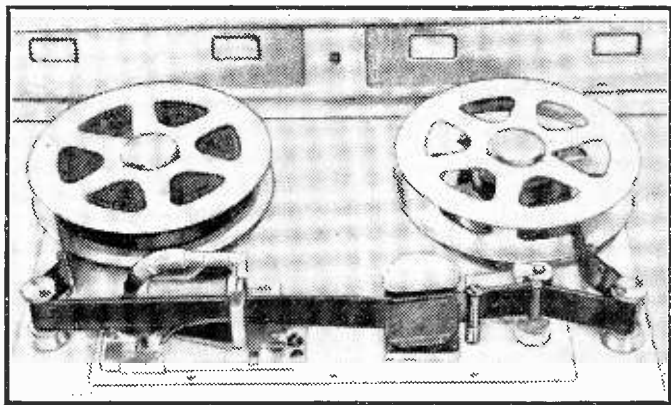
With four heads performing 960 sweeps transverse to the tape each second or each 15in. of tape, one frame occupies $\frac{1}{2}$ in. of tape longitudinally and the 525 horizontal lines which make up one full TV frame are recorded on 32 successive sweeps or tracks on the tape. Each track carries 16 or 17 horizontal lines of television information.

Four Tracks

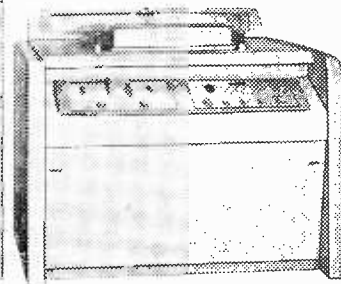
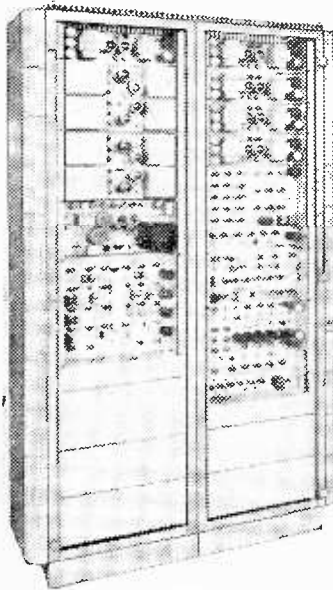
The recorded tape has four separate but synchronised magnetic tracks. The first is the series of transverse video tracks; the second is the sound track that accompanies the picture, which is impressed at the top of the tape; the third is the control track which comprises a record of the alternating currents which fed the rotating head motor during that recording. Also on the control track is an edit pulse used as a reference point in editing and splicing. The fourth is a cueing track to aid operators in the production of programmes and commercials.

During recording the sound track is wiped clean by a preceding erase head, for maximum signal-to-noise ratio.

Erasure has proved to be unnecessary on the control and cue track. Even after erasure of the top 90 mils. of the tape (for the sound track) and the destruction of the lower 50 mils. of the recording by the control-track and cue track recording head, more than 90 deg. of arc are still recorded on each transverse track. The overlap of information is approximately two TV picture lines, or around 130 micro-seconds. During replay this allows a generous time interval during which electronic switching from head-to-head can take place.



Tape transport mechanism of the VR-1000 with the head covers removed.



The Ampex VR-1000 equipment for recording television on tape.

Tape Transport

The transport mechanism used

is similar to that found in many professional magnetic audio recorders. The tape is supplied from a reel on the left; it passes around an idler and then by the rotating video head assembly which also contains the stationary control track head. The tape then goes on to two stationary stacks of heads. On the first stack is an erase head (which clears a 90 mil. strip at the upper edge of the tape), and the cue track record-replay head at the bottom edge of the tape. The second stationary head stack contains only the audio record-playback head at the upper edge of the tape.

The tape next passes between a drive capstan and its pressure idler; contacts a takeup tension arm, and on to a tape takeup reel at the right. The erase, audio, cue and control track magnetic heads are stationary.

Guiding of the tape past the rotating disc is accurately, yet delicately controlled by the concave guide, which is used to cup the tape around the disc. The relation of tape to rotating heads must necessarily be intimate, and good head contact at nearly constant pressure is required. This is accomplished by maintaining the fit of the concave guide within small tolerances to the exact path of the rotating heads and through the use of vacuum applied from the guide side of the tape.

System Operation

During both recording and replay, an intimate relation must exist between the rotation of the revolving heads and that of the capstan. This process begins at the time the signal is recorded.

While recording, the 60-cps power-line frequency is first applied to a frequency multiplier, which produces a 240-cps signal. The signal drives a three-phase power amplifier during the original recording which in turn supplies 240-cps power to the synchronous motor which drives the rotating disc.

A portion of the revolving mechanism is coated half black and half white. A light source is focused on this revolving black and white disc and reflected into a photo cell to produce a 240-cps square-wave output. This is passed through a frequency divider, coming out at 60 cycles. The signal is then passed through a filter, whose output is a clean 60-cps sine wave, which in turn is fed to a power amplifier whose output drives the capstan motor.

The whole chain is electrically analogous to a mechanical gear train, coupling the rotation of the capstan firmly to the rotation of the head disc. In playback, neither the head disc motor nor the capstan motor are driven directly by the 60-cps power line frequency. During record only the power supplied to the rotating head motor is derived from the incoming 60-cps line. In the playback mode, a phase comparator acts on the difference between the photocell signal and the signal recorded on the tape. Any difference causes a Wein bridge oscillator to change, which in turn causes the capstan motor to speed up or slow down as required.

The power supplied to the capstan is generated from the actual motion of the revolving heads, enslaving the capstan to the head disc. Thus, during the recording process, the tape is moved

precisely 62.59 mils. longitudinally during each complete revolution of the head disc. During this period, four lateral tracks are recorded, one for each head, each track being separated from the next by a centre-to-centre space of 15½ mils.

Control Track

During the process, the 240-cps output of the photocell is also fed, through a bandpass filter and a series of amplifiers, to the control track head, which records the signal longitudinally on the control track at the bottom of the tape. This control track becomes the magnetic equivalent of the sprocket-holes of a sprocketed film machine. Since the 240-cps signal is derived directly from the revolving heads, the signal on the control track bears a direct relation to the spacing of the lateral tracks on the tape and this information is available as a reference to control the relative positions of the head disc and capstan shaft during replay. Also on the control track, superimposed over the control signal are the editing pulses, and the cue track.

When the recorded video tape is to be played back, power line frequency is again multiplied to 240-cps synchronised through a phase comparator and Wein bridge oscillator, amplified and fed to the capstan motor, driving it at a rate which is at least approximately correct, for the purpose of tracing the previously recorded magnetic tracks. Again, the photocell produces a signal corresponding to the revolutions of the disc, this signal once more being fed through a 240-cps bandpass filter and then to a phase comparator in the capstan servo-amplifier chassis.

Another 240-cps signal is derived from the recorded control track, amplified, and fed to the phase comparator. The resultant signal is a function of the phase difference between the control track signal and the signal from the photocell. This is applied to a low-pass filter and then to the grid of a reactance tube which is one of the frequency determining elements of a conventional Wein bridge oscillator.

The oscillator functions nominally at 60-cps, but is slightly modified, up or down, by the correction-signal from the phase comparator. This signal is then fed to the power amplifier which drives the capstan in the same relation to the rotating disc, within narrow limits, as it did during the recording process.

Once the disc is adjusted on centre to the tracks at the beginning of replay the servo system holds the relation constant and the revolving heads indefinitely trace accurately the recorded video tracks.

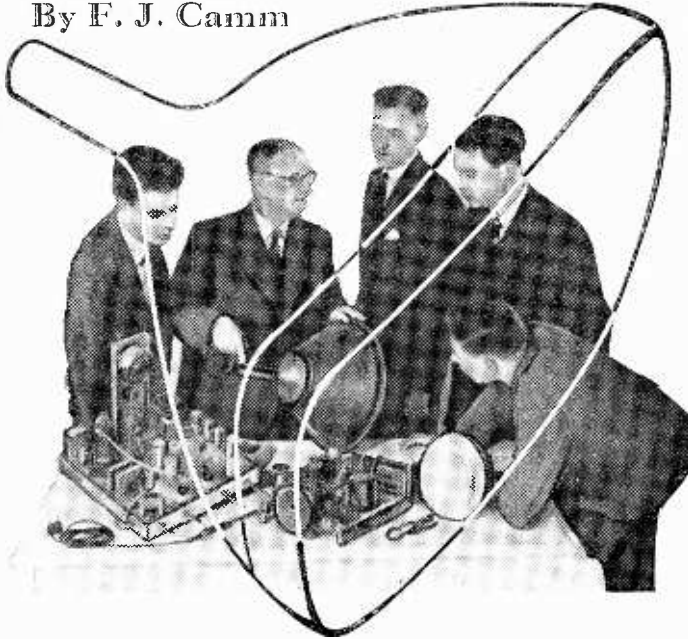
The output of the photocell can also be used to determine, in advance, the approximate moment during playback when it will be necessary to switch from one playback head to the next.

Superimposed over the control track 10 mils. above the bottom edge of the tape is a track 10 mils. wide. Since the cue track serves only as a guide for operators and directors, it has comparatively low performance qualities. A single head, located at bottom of the erase head stack performs both the record and playback functions.

(To be continued)

The Television Tube Explained

By F. J. Camm



THIS ARTICLE DEALS WITH THE PRINCIPLES OF THE HEART OF THE TELEVISION SET

the impression they make does not immediately cease. It persists for an appreciable time afterwards. In the case of the film, one picture follows the previous one before its image has ceased.

The same thing applies to a television tube. The spot of light is travelling so fast that it builds up a rectangular raster on which the picture appears. Persistence of vision as a fact lasts for approximately $1/12$ th of a second. A television picture, however, differs from a photograph in that the whole of the photograph is seen, whereas with a television picture the scene is

scanned, or broken up into a series of tiny pieces and reassembled on the screen.

THE cathode ray tube, like a wireless valve, is a device for emitting electrons, but with this important difference: the stream of electrons is controlled so that it is directed out to the fluorescent screen on the viewing end of the tube in an orderly sequence, so that it traces out the picture. The stream appears on the end of the tube as a tiny spot, and when the receiver is tuned in to vision, the spot is made to trace out the picture on the viewing end of the tube. This spot of light traverses the screen from side to side, 405 times in one fiftieth of a second, at a speed, in the case of a 12in. tube, of over 7,000 miles an hour, and at a correspondingly higher speed in the case of larger tubes.

Persistence of Vision

When you are viewing a picture, therefore, on a television screen you are merely viewing a spot of light which by persistence of vision gives the illusion of a picture. When you visit the cinema, what you see on the screen as a moving picture is in reality a series of "stills" which are jerked in front of the lens in the projector and remain stationary for a fraction of a second. The eye sees as a continuous moving picture any series of pictures which are moved at a constant speed and brought to a standstill, provided that the frequency is 16 frames a second or more. The eye cannot detect the stops in between. The frequency of cinematograph pictures is 24 frames a second and the eye will not respond to a frequency in excess of 16 per second. This is what is meant by persistence of vision. When light rays impinge upon the retina of the eye,

The Scanning Spot

The spot of light is known as the scanning spot, and it sweeps continuously over every part of the picture being televised, and the smaller the scanning spot, the finer in detail will be the televised image, for it will enable the light and shade of the picture to be picked up with greater precision. The light spot varies in intensity according to the magnitude of the received signal, which varies according to the light and shade of the picture being transmitted. The position of the spot on the front of the tube is always in the same relative position as the picture element being scanned by the television camera.

Tube Size

The size of a cathode ray tube (12in., 17in., 21in., etc.) is a somewhat misleading expression. It does not mean that the rectangle or raster has 17in. sides. The dimension refers to the diameter of the circle in which the raster is inscribed. Thus, when we speak of a 21in. screen, it should be understood that this is the length of the diagonal of the rectangle traced out by the spot. It is important also to remember that the aspect ratio of the picture area is always the same, irrespective of the size of the tube, namely 4:3. That is to say, if the width of the rectangle is 8in., the height will be 6in. Projection television receivers use a very small cathode ray tube, about $2\frac{1}{2}$ in. in diameter. It is employed in conjunction

with an optical system which enlarges the picture, which is thus viewed indirectly.

The Components of a Tube

The diagram at the bottom of this page shows the various parts of a cathode ray tube. The cathode is made of nickel in the form of a cylinder, and it is coated with material which readily emits electrons. A coating commonly used is barium strontium carbonate. The screen and the tube envelope are manufactured separately and then welded together. Surrounding the cathode is the grid and in front of it is the gun, the location of which decides the angle of scan, and this in turn decides the length of the tube. In the end of the gun is a small hole through which the stream of electrons pass on their way to the screen. When the stream of electrons hits the screen it appears as the small spot which, as already stated, is known as the scanning spot. This is guided over the screen by means of the scanning coils.

Afterglow

Directly the electrons hit the screen, they cause the fluorescent material on it to glow at that point. This glow persists for a fraction of a second after the spot has moved to another point. This is known as afterglow. No doubt you have observed that after you have switched off your receiver there is an afterglow before the screen becomes inert. The wide-angled tubes used today give a scanning angle of 70 degrees, which allows of a much shorter tube than hitherto.

Deflector Plates

Two pairs of deflector plates are placed at right-angles to each other and alongside the path of the electron stream, between the anode and the screen. When an electric charge is given to either or both pairs of these deflector plates the

electron stream is deflected, and hence they strike the screen at another point. The electrical charge, of course, varies throughout the picture trace. All modern receivers make use of electro-magnetic tubes, the electrostatic type now being obsolete. We thus see how the visual spot on the screen will move so that it may describe any definite path within the space area of the raster.

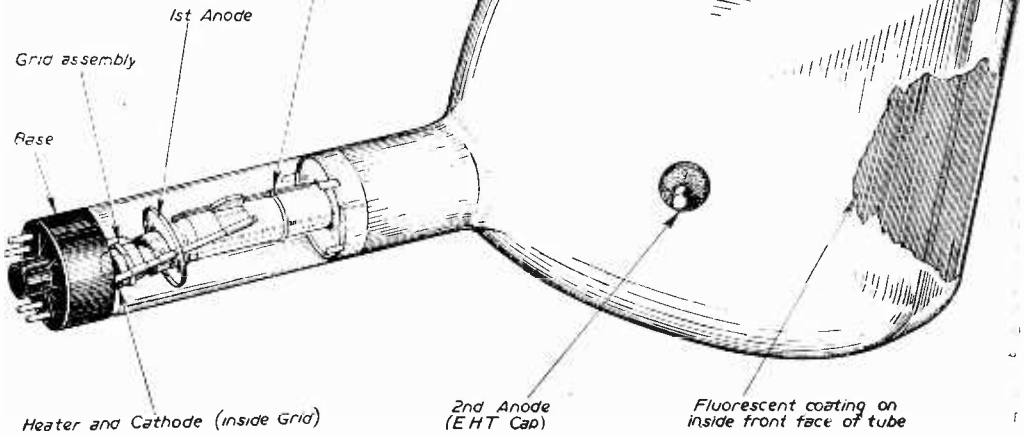
The number of lines in a television picture is constant at 405, at 50 frames per second. With all scanning processes, there is a primary and secondary movement, the primary movement depending upon the number of strips dividing the picture and the picture frequency per second, and the secondary movement simply upon the picture frequency per second. In the primary movement the spot has sufficient velocity to carry it from top to bottom of the raster when a quick return or flyback is made, and then the process is repeated, the picture being scanned horizontally.

The Timebase

Associated with the tube is the timebase and this operates in such a way that a uniform increasing voltage is applied to one pair of the deflector plates in the tube. The electron stream is thus deflected in a uniform manner, so that the spot can describe a line on the screen. A triggering action is incorporated in the circuit, so that when the electron stream is being diverted over the required scanning distance, the voltage suddenly drops. This cycle of operation is repeated. The triggering action is brought about by the charge and discharge of the condenser, in which the slow rise of voltage across the plates is made use of to attract the line spot on the screen. The sudden discharge of the condenser allows the spot to return to its initial position in readiness for the following sweep.

(Continued on page 20)

Note: 2nd Anode assembly includes concentric portion of gun and silver coating (on inside of tube) which makes contact with 2nd Anode



Showing the components of a modern television tube.

TELEVISION TROUBLES

Their Symptoms and How They May be Cured

By G. J. King

ARTICLES appearing under this title will deal with the host of symptoms exhibited periodically on television receivers of popular make and series. Details of the symptom will be given, its cause will be fully described and the action required for its removal will be discussed.

In order to ensure that these articles will be of maximum value to the service mechanic as well as to the enthusiastic amateur, and to allow rapid reference, the general aspect of the particular fault under discussion will be examined, and then the symptom will be considered in greater detail in relation to the various makes and series of receiver, which will be listed alphabetically.

Faults Affecting the Frame Scan

Symptoms caused by faults associated with the frame circuits are fairly easy to recognise, since they affect the vertical build-up and stability of the picture on the screen. The essential symptoms are: (1) lack of height; (2) vertical cramping of some part of the picture; (3) rolling of the picture; (4) vertical jitter, and (5) lack of vertical hold.

If any of these symptoms are experienced it will, of course, first be ascertained that the appropriate pre-set controls are adjusted correctly. For example, lack of height may simply be corrected by adjusting the height control, while a rolling picture may be steadied by adjustment of the frame (vertical) hold control and cramping of the picture may simply require careful adjustment of the vertical linearity (form) and height controls. It is assumed that these adjustments will be tried before going to greater lengths to remove the symptom.

Alba Models T394, T484 and TR9874

Insufficient height.—A check should first be made on the emission of the ECL80 frame oscillator valve and the PL82 frame amplifier valve. These are situated on the left-hand side of the neck of the tube when viewing from the rear of the chassis.

If the valves are in good order, attention should be directed towards the frame amplifier stage, the circuit of which is shown in Fig. 1. It often happens that C51 becomes leaky or reduces in value. Since this is located in the negative feedback frame linearising network, the symptom may be accompanied by cramping at the bottom of the picture. It has been known for this component progressively to become leaky as the temperature inside the receiver rises, in which case the frame scan will just fill the screen with the height control at maximum when the receiver is first switched on, but will gradually decrease in amplitude after an hour or so.

It should be noted, however, that a symptom of this nature may also be caused by characteris-

tic change of the PL82 or an increase in resistance of the frame transformer or coils as the temperature of their windings increases.

A check should also be made on the 100 mF electrolytic capacitor in the cathode circuit of the PL82. This has a habit of drying up and losing its value by some marked degree. This is best checked by the quick connection of a 50 mF or 100 mF capacitor while observing the effect on the picture.

A severe decrease in height, resulting in a frame scan of an inch or so, is sometimes caused by section A of the frame output transformer becom-

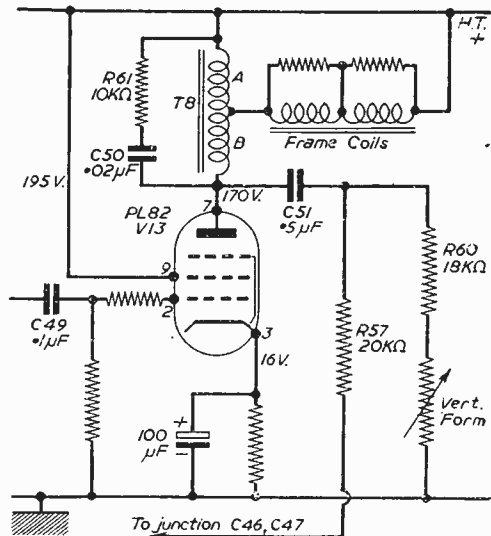


Fig. 1.—Alba frame amplifier circuit.

ing open-circuit. This may prove rather a bewildering fault, since a voltage check on the anode of the PL82 will prove pretty well normal owing to continuity of circuit being maintained through the frame coils themselves. The quickest check is by disconnecting one side of the frame coils, keeping the brightness control turned well back to avoid burning the screen, and then checking for PL82 anode volts. If they are now lacking, the transformer is due for replacement.

Total failure of frame scan.—Check valves as for previous symptom, and if normal check the voltage on the cathode of the PL82. If this is much less than the 16 volts expected, a check for continuity of screen and anode circuits should be performed, which is best done by checking the voltage on the appropriate tags on the valve holder.

If cathode voltage is normal, check the frame amplifier stage by disconnecting the frame ampli-

fier coupling capacitor (C49) at the generator, and applying a mains ripple voltage from the heater line to the amplifier through the capacitor. A normal amplifier stage will produce a somewhat distorted frame scan on the screen when such a signal is applied. If this happens, and it undoubtedly will if the PL82 cathode voltage is reasonably accurate, the trouble should be sought in the frame oscillator stage, the circuit of which is given in Fig. 2.

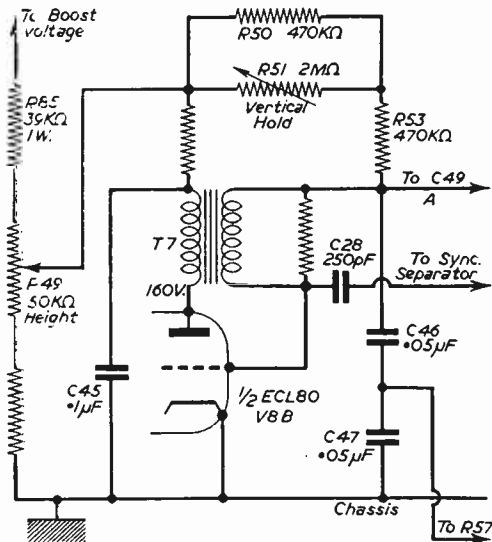


Fig. 2.—Alba frame oscillator circuit.

It is assumed that the associated ECL80 valve has been checked and found to be normal, in which case a quick check should be made to find out whether or not the stage is oscillating. An oscilloscope is an ideal instrument for this, of course, but they are not always at hand. However, a pair of headphones connected between point A on the circuit and chassis will emit a rough 50 c/s note which will alter slightly in pitch when the vertical hold control is adjusted if the stage is oscillating. Another fair test for oscillation is by the negative voltage which is indicated on a high-resistance voltmeter connected between point A and chassis.

If the stage is oscillating, and the amplifier stage has been checked normal as hitherto described, the trouble is caused either by R57 increasing in value or by open-circuit of C49 (Fig. 1).

Lack of Oscillation

Lack of oscillation, however, is invariably caused by failure of one of the windings of T7, the blocking oscillator transformer. The anode voltage of V8B has a fairly wide angle as indicated, depending upon the precise settings of the height and vertical hold control, so it is not a point representative of a conclusive test of the condition of the primary winding of the transformer, for example. The transformer should be disconnected from the circuit and a check made for continuity and resistance of the windings. Open-

circuit is obvious, but if the primary deviates greatly from 820 ohms and the secondary from 515 ohms, then the transformer should be checked by substitution.

If the frame scan jumps to life when the height control is turned to maximum, the control should be replaced, since it is open-circuit at one end of its track. If the transformer appears to be free from defect and the stage obstinately refuses to oscillate, check the voltage at the top of the height control. The voltage here is obtained from the boost diode in the line output stage, and is dropped to a suitable value by R85, and this component sometimes goes open-circuit (always replace with a 1 watt component).

No frame hold: Nearly always this symptom is caused by trouble in the frame sync coupling capacitor—the 250 pF C28 in Fig. 2. Partial failure of this component, however, may not kill the frame lock completely, but may weaken it with the accompanying symptom of poor vertical linearity.

Poor Frame Lock

A poor frame lock, sometimes accompanied by impaired linearity, may also be caused by an insulation defect in the frame blocking oscillator transformer, but this is not a common fault.

If the frame tends to lock only when the vertical hold control is set to the extreme end of its travel, the 470k resistor R53, in series with the vertical hold control, should be checked for value, and should be replaced if off value by an amount exceeding 20 per cent. If the vertical hold control is critical in terms of locking the picture, the parallel-connected 470k resistor R50 is probably high in value.

Unbalance of the frame hold control may also be incited by characteristic alteration of the ECL80 (V8B), but to save a valve change, the circuit can be brought back into balance by adjusting the value of R53 slightly by the inclusion of a padding resistor. If the picture locks when the control is adjusted in the minimum resistance direction, a 1 megohm resistor should be connected in parallel with R53, while if the picture locks only when the control is adjusted for maximum resistance, a 50-100k resistor should be wired in series with R53.

Picture jitter: This symptom is invariably caused by unstable emission of V8B, and can usually be proved only by valve substitution. Also check C45 and the frame blocking oscillator transformer.

Impaired linearity: In addition to this symptom accompanying the faults previously described, it may also appear by itself owing to failure or poor insulation of one of the following capacitors, C49, C51 (Fig. 1), C46, C47 and C45 (Fig. 2), or alteration in value of R57 or R60 (Fig. 1). If necessary, a check should also be made on R61 and C50 (Fig. 1).

REFRESHER COURSE IN MATHEMATICS

8/6, by post 8/10. 4th Edition. By F. J. CAMM

From: GEORGE NEWNES, LTD.

Tower House, Southampton Street, Strand, W.C.2

ITV in Difficult Areas

SOME PRACTICAL HINTS ON COPING WITH DIFFICULT RECEPTION

By B. L. Morley

(Concluded from page 573 July issue)

IT is by moving the dipole to obtain the best signal that the amateur stands a better chance than the dealer, as the dealer could not afford to spend a great deal of time with each installation looking for the best signal. The costs of the search would soon swallow up any profits on the aerial—especially if it was found that a simple aerial in a certain position produced a stronger signal than a more elaborate array on the chimney.

The conditions we have outlined are likely to become even more to the fore when Band V is opened. The higher the frequency, the more nearly like light do the radio waves behave.

The Lone Worker

The lone worker has his own special difficulties. It is not practicable, for instance, to note the strength of the picture, dash up on to the roof, adjust the aerial, and dash down again trying to observe the difference in signal level.

Several methods can be employed to note the difference in signal strength while remote from the television.

Perhaps the simplest is to tune the television so that the vision signal appears on the sound, giving the well-known hum. A pair of phones can be connected to the loudspeaker output taking great care to ensure that at no point is a connection made to a high-voltage point. The safest method is to use a pair of low-resistance phones across the speech coil of the loudspeaker.

Results are not entirely satisfactory because noises at roof level are inclined to mask the variations in signal strength; further, variations in picture content will vary the pitch of the signal heard. It is best to employ the time when Test Card "C" is being radiated.

It is very important not to be deceived by variations in signal strength caused by fading and not by manipulation of the aerial.

An alternative method is to use a visual signal. The sound of the vision signal can be tuned in as before and the output at the loudspeaker measured on a similar A.C. voltmeter. The voltmeter can be fitted with a long lead and taken on to the roof.

A more satisfactory method is to employ the A.V.C. voltage now available in the sound receivers of most modern televisions. This voltage can be checked on a good class voltmeter and the variations in signal strength noted. This method is very satisfactory. A visual signal is much easier to cope with than an audio one.

The same method can be employed indoors when checking for an aerial position—and up in the attic as well! When fitting an indoor aerial in the attic it often pays to try different positions so as to get the best signal.

Low-loss Cables

In most cases where signal strength is weak

the use of low-loss cables is well worth while. This is especially true where cables are of some length. For average situations their expense is probably not worth the gain; in good-signal areas the loss of two or three db is not very important.

Where interference is troublesome, low-loss cables can be an advantage in order to maintain as high a signal-to-noise ratio at the receiver as possible.

Losses Due to Mismatch

A certain amount of tolerance is allowable in the matching between aerial and feeder, and feeder and television but too great a mismatch will result in losses which cannot be tolerated.

It is a simple matter to overcome some mismatch at the television end by use of a stub. Whether or not the benefit gained is of real value will depend upon the amount of mismatch and the strength of the signal.

The method is simply to connect a short length of feeder cable in parallel with the existing cable at the aerial socket. The cable should be no more than 2ft. 6in. long and the end left free. Now, by cutting an inch from the end of the cable, the effect on the screen should be noted and if successive cuts are made it is possible to arrive at a point where the best signal is produced, see Fig. 6.

The stub acts as a resonant circuit and "tunes out" the inaccuracies caused by the mismatch.

Aerial Combiners

Most modern television receivers are equipped with a single aerial socket to take both Band I and Band III transmissions. The usual method is to fit a combining unit of some description at some point where the two feeders from the separate Band I and Band III aerials combine together and feed into a single feeder cable going to the television. The feeders are connected to the unit which is actually a high-pass/low-pass filter and operate as blocks in each aerial circuit, see Fig. 7 (July issue).

As will be seen from the diagram the high-pass filter inserted in the Band III aerial feeder allows the Band III signal to pass through but acts as a bar to the Band I signal. Similarly the low-pass filter in the Band I aerial circuit allows the Band I signal to pass but blocks the Band III.

The use of such combiner units is very convenient, but in difficult areas, where signal strength is really low, it is worth while to connect the Band III aerial directly to the television and to put up with the trouble of changing over the aerial connections when moving from one band to the other.

An alternative arrangement is to use a pre-amplifier at the television end solely for the Band III signal and then to fit the combiner unit on the output side.



Serviceing TELEVISION RECEIVERS

No. 40.—THE PYE V54C

By L. Lawry-Johns

tuner may be used with series connected valves and a 35-38 Mc/s output.

The power supply is a separate unit housed in the bottom of the cabinet and is connected to the timebase and receiver unit by means of a 12 pin plug and socket (P1-S1). Two full wave rectifiers (V6A-V6B) are used for the two H.T. supplies as shown in the power pack diagram. Apart from the two H.T. rectifiers and the C.R.T., all valve heaters (except the EY51 of course) are series connected across a winding on the mains transformer and a thermistor (R26A) is connected in series with this heater chain to limit the initial flow of current when the receiver is first switched on.

Full fuse protection is provided, F1 A-B being wired in the mains input circuit and F2 A-B in the mains transformer H.T. windings.

The rear view of the tube assembly shows the various adjusting points. The tilt control rotates the scanning coils on the tube neck and these are correctly positioned when the top edge of the picture is level with the mask (reduce frame amplitude to obtain a straight edge). The centring plates consists of two plates which are located in front of the focus magnet which may be rotated in order to centre the picture square in the mask. One plate shifts the picture in a vertical direction more than horizontal whilst the other moves the picture more horizontally.

The alignment magnets should not be confused

WE propose to deal with this receiver for several reasons. First and foremost because it persistently crops up in readers' letters as being a somewhat mysterious set of doubtful origin and even when it is identified, service sheets seem very hard to come by. Therefore we have no doubt that many readers will find the subject matter both interesting and useful. Another reason for its presentation is that it provides an interesting study of the occasional complete breakaway from an established trend of design.

However to proceed with the circuit description, the receiver chassis is very nearly a modified FV1 as far as the vision and sound stages up to the detector circuit in each case is concerned and the frame timebase is almost identical. The line output stage, video and sound output and the power pack are the sections which differ mainly and these are described in detail and the circuit diagrams are shown as complete as can be arranged. Readers possessing these receivers who are unable to obtain a sheet should obtain one for the Pye FV1 which together with the subject matter of this article will provide complete coverage. Owners of the Radio and Television Servicing volumes will, of course, already have the FV1 circuit to hand. As it stands the receiver is tunable to any of the five BBC channels and the I.F. circuits are tuned to 38.5 Mc/s sound and 35 Mc/s vision. The Pye type 124 tuner unit was originally intended for conversion to 12 channel operation but as these are no longer generally available a Cydon or Brayhead

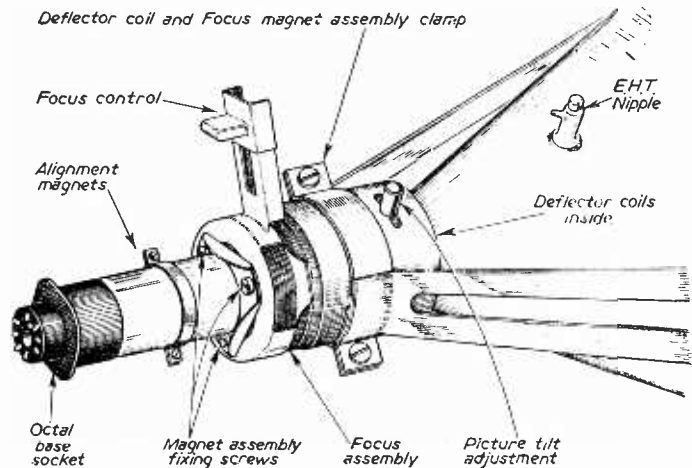


Fig. 1.—Rear view of tube assembly.

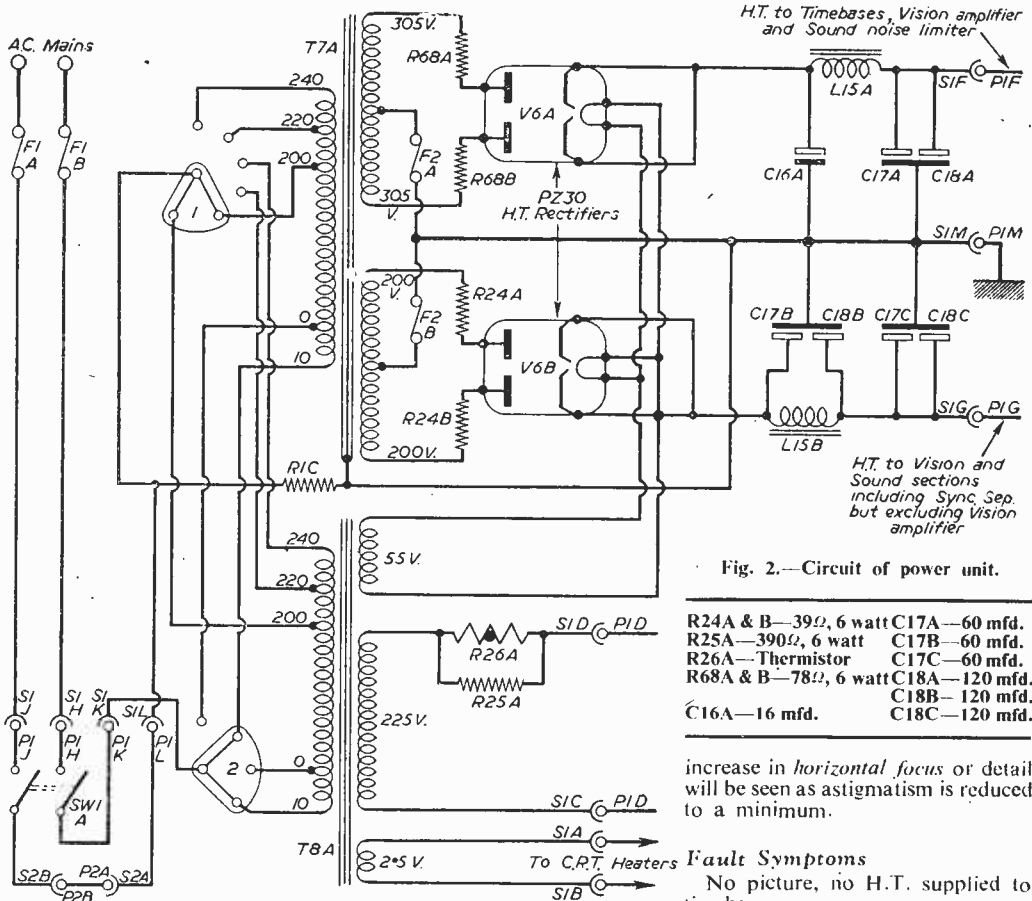


Fig. 2.—Circuit of power unit.

- R24A & B—39Ω, 6 watt
- R25A—390Ω, 6 watt
- R26A—Thermistor
- R68A & B—78Ω, 6 watt
- C16A—16 mfd.
- C17A—60 mfd.
- C17B—60 mfd.
- C17C—60 mfd.
- C18A—120 mfd.
- C18B—120 mfd.
- C18C—120 mfd.

increase in horizontal focus or detail will be seen as astigmatism is reduced to a minimum.

Fault Symptoms

No picture, no H.T. supplied to timebase.

Check H.T. fuse F2A and resistors R68A-B. If either or both are open circuit check PZ30 V6A, then C16A, C17A and C18A for shorts. If these capacitors are in order, check V7C (line oscillator) for screen-to-grid short and also V6C—efficiency diode PZ30.

If the timebase H.T. is in order but there is no sound or vision, check fuse F2B, R24A-B, V6B, etc. If the fuse persistently blows, check H.T.

with an Ion Trap Magnet. The tube, having a straight gun assembly does not require an Ion Trap Magnet. The alignment magnets should be adjusted in relation to the tube neck to a position which gives the best overall focus, i.e. adjust the focus lever to its optimum position and then adjust the alignment magnets to spread the focus evenly and reduce astigmatism. Test card C is the best display on which to align and a real

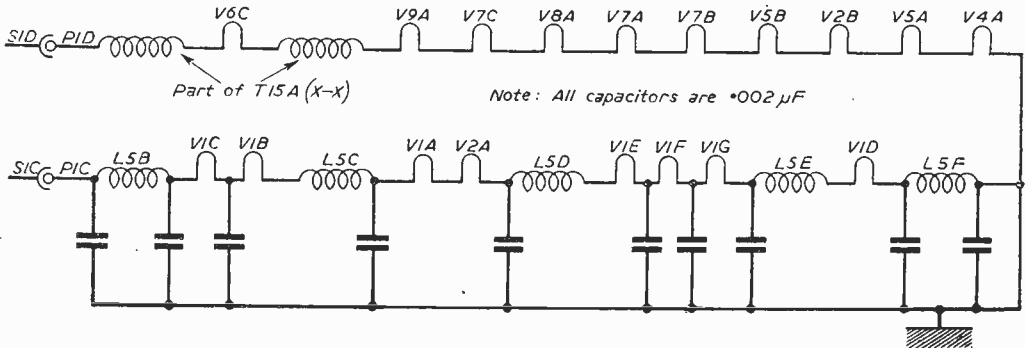


Fig. 3.—Circuit of series heaters receiver chassis.

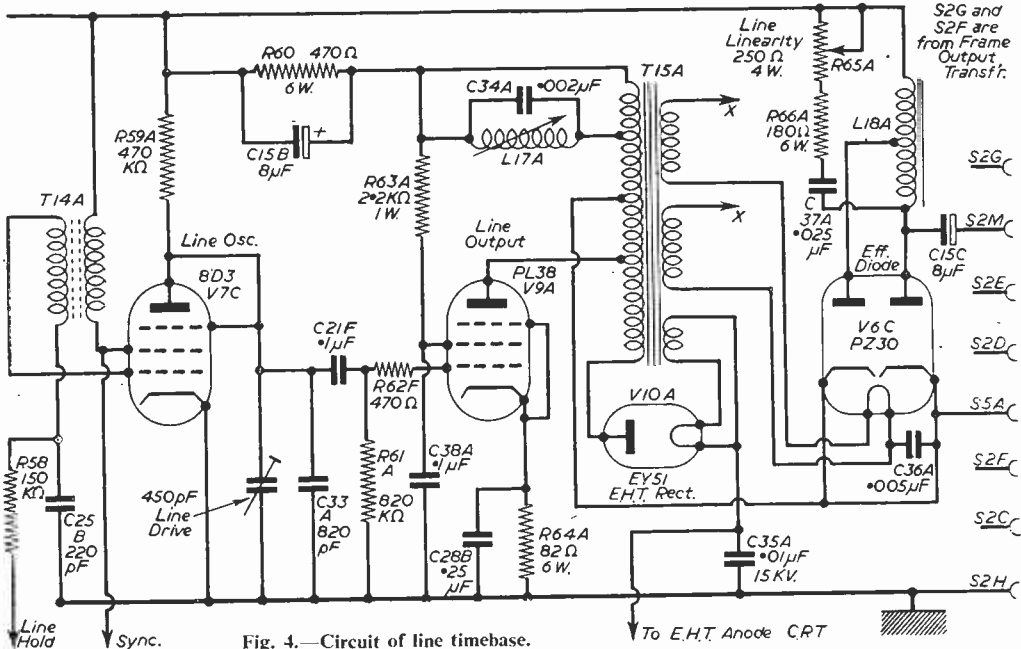


Fig. 4.—Circuit of line timebase.

line for shorts, including V7A (8D3) and V8A (25L6GT) in the sound circuit. The mains fuses will seldom blow (although they may fail due to age, etc.) unless the H.T. fuses are overrated. They should be 500 mA each, whilst the mains fuses are 3 amp.

Low H.T. leading to poor focus and reduced picture size. Check V6A for emission and then suspect C16A (reservoir capacitor) of being open-circuited.

Series Heater Chain Not Lighting Up

Check thermistor then continuity of valve heaters. Note, this fault will leave the V6A-B PZ30 valves alight and also the C.R.T.

No EHT

H.T. to timebase in order, line timebase whistle can be heard. Check EY51 EHT rectifier (on line output transformer). Also check C35A for leakage (not likely but possible). If there is no line whistle, check V7C, V9A and V6C. If only a blur is visible on the screen, due to very low EHT, check C15B and C15C. Then check V6C, C28B, C38A.

Excessive Width

No line amplitude control check L17A, this may be o.c. or disconnected.

Frame Timebase

Horizontal white line across screen—no height. Check ECL80, V2B. If in order check frame oscillator transformer, continuity of controls, etc.

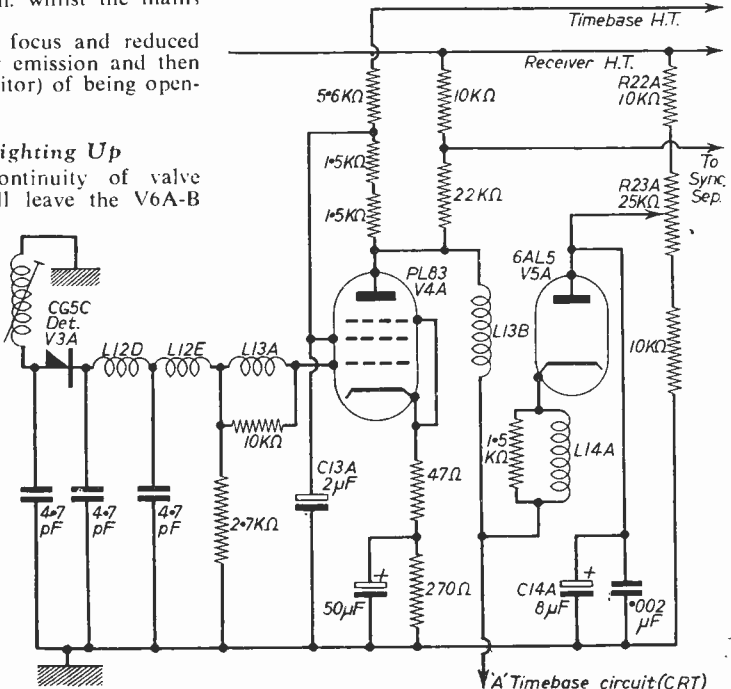
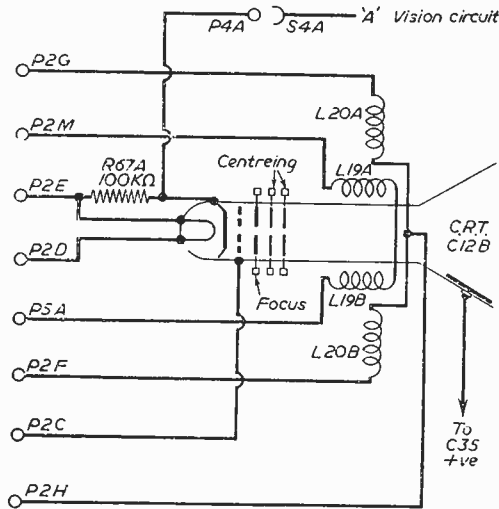


Fig. 5.—Circuit of video amplifier.

Picture crushed at bottom. check V2B and frame timebase electrolytic capacitors 50 mfd. and 12 mfd.

Picture jitters vertically. replace 220 pfd. capacitor wired from V5B cathodes to chassis (across 220 K Ω resistor).



Picture rolls up or down but does not lock. check V5B (6AL5) and above components.

Picture scrambled horizontally and vertically, check V7B (8D3).

Very weak lock. contrast over-accentuated, check C13A.

Weak lock and weak contrast—faint picture difficult to hold. Check V4A (PL83), C14A and vision detector V3A (CG5C); which is a crystal diode.

Weak picture. hold good. Picture blurs and tends to go negative on advancing contrast. sensitivity or brilliance. Suspect weak C.R.T. (Brimar

C12B). but check video amplifier and load resistors, etc.

VALVE FUNCTIONS

- V1A—R.F. amplifier—EF80 Mullard.
- B—1st I.F. amp-vision—EF80 Mullard.
- C—2nd I.F. amp-vision—EF80 Mullard.
- D—3rd I.F. amp-vision—EF80 Mullard.
- E—1st I.F. amp-sound—EF80 Mullard.
- F—2nd I.F. amp-sound—EF80 Mullard.
- G—3rd I.F. amp-sound—EF80 Mullard.
- V2A—Frequency changer—ECL80 Mullard.
- B—Frame Osc/output—ECL80 Mullard.
- V4A—Video amplifier—PL83 Mullard.
- V5A—Vision and sound limiter—6AL5 Brimar.
- B—Interlace filter—6AL5 Brimar.
- V6A—H.T. rectifier—PZ30 Mullard.
- B—H.T. rectifier—PZ30 Mullard.
- C—Efficiency diode—PZ30 Mullard.
- V7A—Sound A.F. amp—8D3 Brimar.
- E—Sync separator—8D3 Brimar.
- C—Line oscillator—8D3 Brimar.
- V8A—Sound output—25L6GT Brimar.
- V9A—Line output—PL38 Mullard.
- V10A—EH1 rectifier—EY51 Mullard.
- CRT—Brimar C12B.
- V6A—Anodes 305 v. A.C. Cathodes 345 v. D.C.
- V6B—Anodes 200 v. A.C. Cathodes 225 v. D.C.
- V10A—Cathode 12 Kv. (EHT).

New Midget Diode

WEIGHING less than three-quarters of an ounce, a tiny new silicon power diode that can handle up to 45 amperes has been produced by the International Rectifier Corporation.

Less than an inch and a half long, the miniature silicon device is expected to find wide application in military and industrial electronics.

Utilizing the latest techniques in ceramic-to-metal hermetic sealing, the new diodes can withstand great extremes of temperature, shock and vibration. They are capable of operation to 200 degrees Centigrade.

They have a maximum one-second half-wave overload rating of 500 amps peak and 150 amps average.

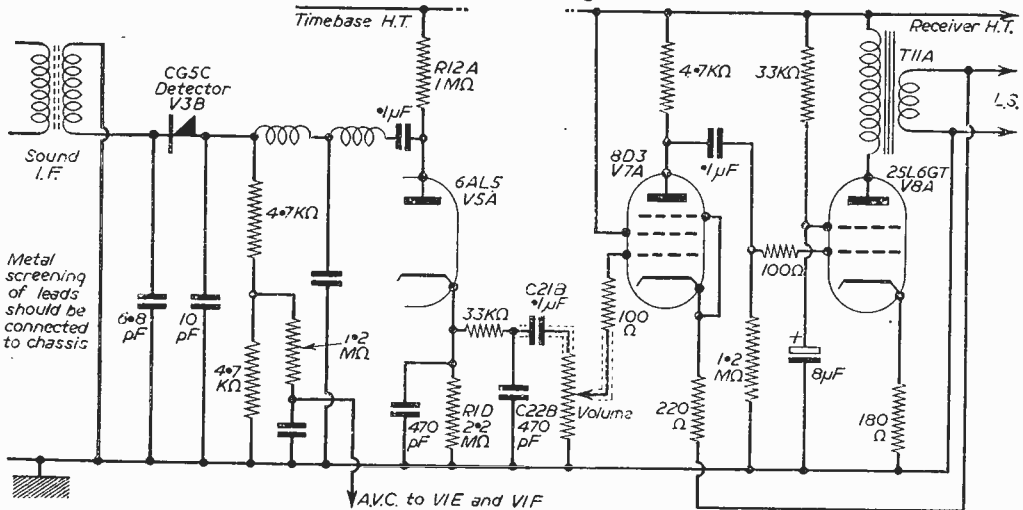


Fig. 6.—Sound detector A.F. and output stages.

Heater-cathode Tube Shorts

OVERCOMING A COMMON FAULT, OR NEW TUBES FOR OLD

By T. Deakin

(Concluded from page 575, July issue)

AS a result the grid base of the pentode is often exceeded and although the positive excursions at the grid, corresponding to peak white levels, are within a fraction of zero volts, the negative extreme is below cut-off. This is of no consequence because the negative extreme is a pulse anyway and the shape will be faithfully reproduced at the anode as a positive-going pulse, albeit of somewhat greater amplitude than the gain would predict.

However, if the video output grid waveform is inverted then it is the peaks of the video signal which are at the extreme negative level and consequently some "clipping" of peak whites will result as the signal is cut-off.

Now this is not likely to worry sets with tube sizes up to say 14in., but in certain cases could conceivably cause trouble in video stages feeding 17in. or 21in. tubes.

In such cases the video stage is best left as it stands, an extra stage of phase inversion being incorporated between video output and the tube. The only penalty paid, apart from the extra circuitry involved, is a slight loss in bandwidth, and hence picture definition.

Phase Inverter

Fig. 5 shows the circuit diagram for a phase inverter suitable for use in this connection. The

output from the video stage is taken from the tap on the divider to which the cathode of the tube is normally connected. The potential at this point will be in the neighbourhood of 100v.

It will be noted that the valve recommended is a 12AU7. This valve is a double triode on a B9A base. Only one triode of course is used as the phase inverter in which equal anode and cathode loads are used.

The other triode is connected as a diode being wired across the 1M grid leak of the tube. This diode is used for D.C. restoration. The necessity for this arises as a result of the high D.C. potential appearing at the anode from which the inverted waveform is obtained. To couple the signal from this high D.C. level to the grid, which is some 40v. or 50v. negative with respect to earth, obviously requires an A.C. coupling. The latter is provided here by the 0.25 μ F coupling capacitor.

The sync signal may be left as shown connected in Fig. 3, or alternatively may be connected to the cathode of the phase inverter where the phase of the signal is the same as that at the anode of the video stage.

It was mentioned earlier that some loss of definition arises as a result of including this

(Continued on page 25)

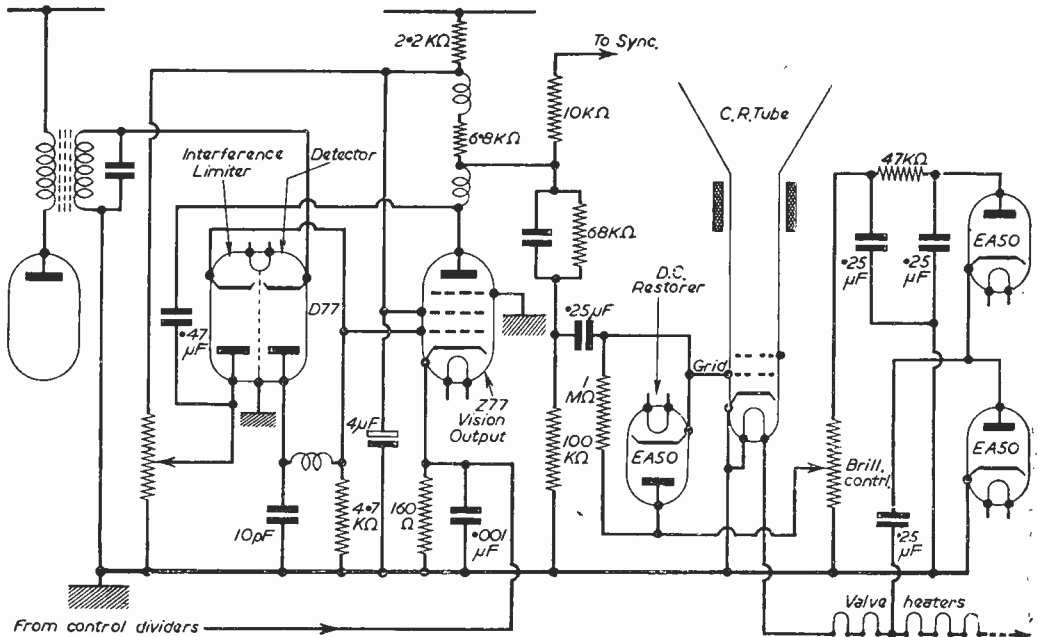


Fig. 4.—Phase inversion by reversing the limiter and detector diodes.

A Universal Alignment Method

A FORM OF ALIGNMENT PROCEDURE SUITABLE FOR THE MAJORITY OF SETS

By H. Peters

(Concluded from page 581, July issue)

IT is then only necessary to move the resistor from anode to grid, etc. This can be tricky enough with commercial crocodile clips whilst the set is running and that is the reason for the home-made clip shown in Fig. 1 (a).

Rejectors.—Without altering the signal generator frequency turn the volume control down, transfer the meter to read vision output, increase the signal generator output until the modulation shows on the screen and the meter. Adjust rejector 2 and rejector 1 for minimum indication on the tube or meter. This adjustment is very critical, and should there not be sufficient signal available from the generator to determine the precise position of each it is advisable to short one out whilst trimming the other. In fringe areas of weak sound the first rejector can be tuned to maximum sound instead of minimum picture.

Vision.—With the signal generator injected at the same place but tuned to nearly midband, i.e., at 1.25 megacycles from the vision carrier on the same side as the sound (depending on whether local oscillator beats high or low) damp T3 primary and adjust T3 secondary for maximum vision, then damp T3 secondary and adjust T3 primary for maximum vision. Carry this procedure on to T2 and T1, damping primary and adjusting secondary, etc. When complete, swing the signal generator slowly through the vision band and note the response curve. If the circuits are of the damped or band-pass types the response curve will normally be satisfactory but if the original alignment of the set was "stagger-tuned" there will be a pronounced peak at the alignment frequency, and the sensitivity will be abnormally high. To correct this type of circuit, screw in all the secondaries half a turn and screw out all the primaries a similar amount. If this does not broaden the bandwidth sufficiently repeat the process. These instructions relate to iron cored coils; for brass cores screw in the primaries and screw out the secondaries, the idea being to make the anode circuit less inductive than the preceding grid coil and thus reduce the chance of oscillation.

R.F. Stages.—Where the conventional single R.F. buffer stage is employed the alignment of the R.F. and local oscillator stages is easiest done

on a test card. The local oscillator is adjusted for minimum sound on vision, preferably using the steady tone, the aerial coil (which can be regarded as a bit of the aerial left inside the set) to maximum picture, and the R.F. transformer for best compromise between sound and picture.

Receivers with two R.F. stages need the same treatment as the I.F. stages, i.e., damp primary, tune secondary, etc. The bandwidth has, however, to encompass the sound and vision channels so that the signal generator has to be set 1.75 megacycles below the vision frequency for mid-band. If the bandwidth is somewhat restricted when aligned the strip can then be staggered the same as the I.F.'s.

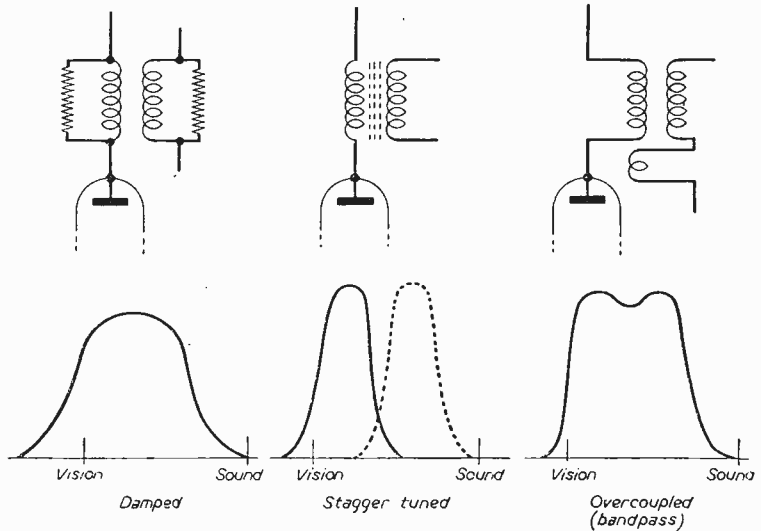


Fig. 3a.—Diagrammatic form of three common types of I.F. transformer.

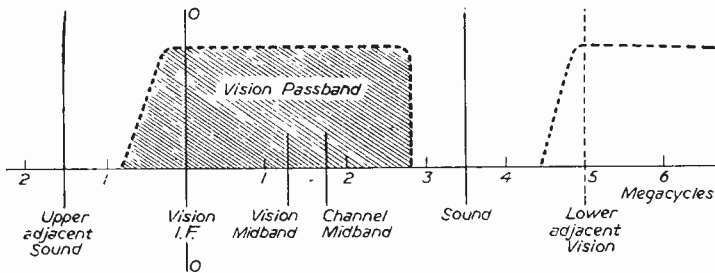
Exceptions

By now it will be noticed that the particular set that you want to align has some annoying feature which precludes the use of the above method. Some of these can be disposed of as follows:

A.G.C.—Receivers with vision A.G.C. need to have the control line tied down to a fixed negative value. This is simply done with the grid bias battery and control shown in Fig. 1 (b), which is of low enough impedance to nullify the effect of the control voltage. Since the A.G.C. voltage has a small effect on the input capacity of various valves, the alignment alters slightly with signal strength, and in fact this feature is sometimes used to provide automatic bandwidth control. It is therefore advisable to do the alignment with

between 2 to 3 volts bias on the line rather than short it down and if possible to set the battery voltage to represent the general level of bias conditions in the area in which the set is used. Do this by running the set prior to alignment giving a normally contrasted picture, connect in the battery and resistor and adjust the latter to the same degree of contrast.

Dead Sets.—Receivers with extremely low gain, faulty coils, or where some thoughtful user has "tightened up all the little screws" need to be roughly tuned before the final alignment. Apply the vision carrier to point "X" in Fig. 2 at full strength, when a faint modulation should be observed. T3 secondary will not tune properly but the test will give an indication that the detector is working. Transfer to point Y, tune up T3, transfer to point Z, tune up T2, transfer to the mixer and tune up T1. The gain of each



Note. If local oscillator beats LOW the higher frequency on the diagram is on the LEFT. If local oscillator beats HIGH the higher frequency on the diagram is on the RIGHT

Fig. 3b.—Rejector plus channel spacings relative to vision I.F.

stage will be round about the same and any stage which does not tune correctly or which shows very little gain should be checked for faults. Adopt a similar procedure for the sound channel and then re-align as in "Method."

Double Peaks.—Sometimes two peaks can be obtained when tuning and the outer one is normally correct. If in doubt unscrew the core until the top is flush with the can and then tune it up, using the first peak you come upon.

Combined V.H.F. Receivers are relatively simple. Align the sound I.F.'s on TV for maximum as previously described, using the damping unit, as the strip is almost sure to be of the bandpass type. Switch to F.M. and check that the voltage across the limiting electrolytic is at a maximum. Then tune T6 sec. for minimum sound in the speaker. This should be quite a sharp adjustment and not far off the existing setting. On some models a small compensating condenser is fitted and this should be used to tune the sharp minimum in preference to the coil itself.

Extra Rejectors.—It has become common practice to fit adjacent vision and sound rejectors and these are adjusted in the same way as the sound rejectors and after the latter but before the vision I.F. strip is lined up. The upper adjacent sound rejector is set for minimum output on the vision meter (or tube) at a frequency 1.5 megacycles away from the vision carrier on the other side from the sound carrier, e.g., if

vision I.F. is 10 Mc/s and sound I.F. 13.5 Mc/s the adjacent sound rejector is 8.5 Mc/s.

The adjacent vision rejector which is 1.5 Mc/s outside the sound carrier is treated in the same way. If there is no chance of any interference from a station on a lower channel on either band it can be tuned to assist in rejecting your own sound channel.

Words of Warning

Many sets have their coils sealed in wax and this must be loosened with a hot screwdriver before attempting to tune the core. Once loosened it is suggested that a drop of oil be introduced to stop the wax setting again.

Recent introductions to be found in many sets are dust cores with hexagonal holes instead of screwdriver slots. These need a special polythene "Allen key" to trim and the insertion of the usual "screwdriver-ended" limiting needles result in an ominous crack followed by the descent of small grey chips. One manufacturer keeps field engineers on their toes by using a mixture of both types.

The use of the wobulator-scope method is not recommended unless many sets of the same type have to be aligned, as results are very misleading. It has been demonstrated that almost any response curve in the service manual can be produced by leaving the receiver under test severely alone and altering the knobs on the wobulator and oscilloscope.

THE TELEVISION TUBE EXPLAINED.

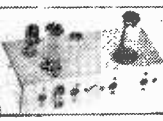
(Concluded from page 10)

The deflection of the electron beam of a cathode ray tube is dependent on the magnitude of the current flowing in the deflector coils, and for electro-magnetic scanning it is necessary, as we have seen, to produce a saw-tooth current waveform. Now the deflector coil possesses inductance as well as resistance, and therefore when a saw-tooth effect is destroyed by distortion, and to correct this, the waveform must be such that when it is applied to the deflector coils the required saw-tooth form is produced. Now consider how the scanning spot is caused to scan the fluorescent screen by a combination of horizontal and vertical time-base systems. Commencing with the spot in the top left-hand corner of the tube, a saw-tooth waveform is applied to the horizontal deflector plates, with a frequency equal to the number of lines required per frame, multiplied by the number of frames per second.

Now the image received on the end of a cathode ray tube is the counterpart of the pulses (line and frame synchronising) produced by the scanning system at the transmitting station. When received they control the scanning devices so that the spot on the frame of the received image is in precisely the same position as the picture element being scanned at the transmitter.

Band III Converter

Suitable Wales, London, Midlands, North, Scotland etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers, and resistors. (Metal case available as an extra.) Price only 19/6, plus 2/6 post and insurance. Data free with parts or available separately, 1/6.



Tube Tester and Re-Activator

We can supply all the main components for making this unit which will not only test Cathode Ray Tubes but also will re-activate them, supplied complete with full instructions. Price £3, plus 2/6 post and ins.

A.C./D.C. Multimeter Kit

Measures A.C./D.C. volts D.C. current and ohms. All the essential parts including metal case, moving coil meter, selected resistors, wire for shunts, range selector switches, calibrated scale and full instructions. Price, 19/6, plus 2/6 post and ins.

This Month's Snip

Miniature motor 2 1/2 in. long x 1 1/2 in. diameter laminated poles and armature. separate winding for reversing. Operates on 230 v. D.C. or off A.C. mains through stepdown transformer. Original cost at least £3 each. Snip price for one month only 6/8, plus 1/6 postage and insurance.



Unused and Boxed Valves

American list, others in stock, enquire or order C.O.D.			
1A4	9/-	6C4	6/6
1A6	9/-	6C6	6/6
1A7	12/6	6C8	5/-
1C5	12/6	6D6	6/6
1D7	9/-	6F5	9/6
1F6	12/6	6F6	7/6
1H5	10/-	6F8	9/6
1L D5	3/6	6G5	2/6
1T4	7/6	6H6	2/6
1R5	7/6	6J5	5/-
1S5	7/6	6J7	6/-
1T5	9/-	6K6	7/-
2A5	12/6	6L5	9/-
2A8	12/6	6L6	9/-
2A7	12/6	6L7	10/6
2X2	4/6	6N7	8/6
3A4	7/-	6P8	9/-
3A5	7/-	6Q6	9/-
354	9/-	6Q7	9/-
3V4	9/-	6R7	9/-
5Y3	8/-	6SA7	8/-
5R1	9/6	6SC7	9/-
5U4	8/-	6SH7	9/-
5Z3	12/6	6SJ7	8/6
5Z4	9/6	6SK7	8/-
6A7	12/6	6SL7	8/-
6A8	10/-	6SN7	7/6
6B4	5/-	6SQ7	9/-
6B8	4/-	6SS7	9/-
		6TH3	12/-
		6U5	8/6
		6V6	9/6
		6X5	7/6
		6Z5	15/-
		7A7	9/6
		7C7	8/6
		7F7	9/6
		7Y4	8/6
		25Y5	10/-
		25Z4	9/6
		25Z6	10/6
		27	10/6
		28D7	3/6
		36	10/-
		39,44	10/-
		41	9/6
		42	8/6
		43	10/-
		57	10/-
		58	10/-
		71	9/6
		75	12/6
		78	8/6
		81	8/6
		89	12/-
		807	6/6
		954	3/6
		1625	10/6

Latest AVO Testmeter



Can be yours for only 10/- deposit and 19 payments of 10/- weekly. Like all AVO meters it is a very fine instrument: it has a sensitivity of 10,000 ohms per volt and 19 most useful ranges as follows— D.C. volts 0-1,000 (seven 0-1 amp. (5 ranges), resistance 0-2 megs. (2 ranges) (complete with test leads). Immediate delivery. Cash price £9.10.0. Non-callers please add 3/6 post and insurance.

FREE GIFT.—All purchasers will receive Range Extender scale and data which add: capacity 0.1 m.f. in two ranges. Inductance 0-100 henrys, etc., etc.

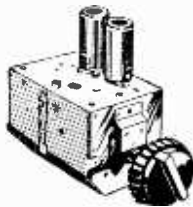
Medresco Hearing Aid

As supplied by National Health, completely over-hauled and in good working order with six months' guarantee. Only £2.15.0 plus 2/6 post and ins. Complete with earphone and new ear plug but not batteries, these can be supplied as an extra for 5/- per set.



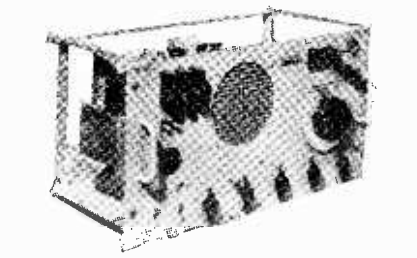
Instructions showing how to convert to pocket unit available free if requested.

Now 2 Models Turret Tuner



Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33/33 Mc/s. Series heaters Model 2 I.F. output 16/19 Mc/s. Parallel heaters. With instructions and circuit diagram. 79/6. With knobs 3/6 extra, post and insurance 2/6.

Short Wave Communications Receiver R.208. Only £6.19.6. 10/- Deposit



This is a super short-wave receiver covering 5-30 metres (10-60 Mc/s). Uses 6 valves, Has R.F. stage, 2 I.F. stages, B.F.O., etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case: size approx. 24 x 18 x 12 in.; weight 70lb. Suitable A.C. mains 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price £6.19.6, carriage and insurance 15/- Or 10/- deposit plus 15/- carriage and ins. then 14 weekly payments of 10/- each.

Summer Sale Bargains

7 Valve 5 Waveband superhet chassis. H.F. stage and magic eye. Unused but may be slightly soiled and need servicing—less valves, power pack and tuning scale. Contains really fine coil pack which alone would cost twice what we are asking for the whole unit. Price with circuit diagram. £2.15.0. Carriage and insurance 7/6.

10 Valve Superhet. 1 1/2 meter ex Government but unused, complete with valves, easily converted for Band III. 39/6, carriage and packing 7/6.

3 Amp Vitreous Dropper. Total resistance of main section 500 ohms with tappings marked 200 v., 225 v. and 250 v., also insulated separate winding of 100 ohms, 3/6 each. **Isolation Transformer.** 150 wats, mains in isolated, mains out, makes servicing safe. 29/6.

Filament Transformer. 6.3 volt 3/4 amps., tapped primary, 8/6. **Transistor Suitable A.F.** or low R.F., new tested O.K. most circuits 6/6.

Midset Output Transformer. Standard pentode matching. 4/6. **Midset Output Transformer.** Special for battery sets, pentode matching. 4/6.

14in. T.V. Cabinet by famous maker cost over £4 to make, new and perfect. 15/- carriage 4/6. **Metal Tweeter.** 250 v. 60-80 milliamps, ideal for main set or instrument or to replace that expensive valve. 4/6.

Constructors Parcel. 5-valve superhet chassis, 15 x 15 x 2 with three waveband and gridleaves, drive head, etc. 9/6, plus post and insurance 1/6.

Toggle Switch. Standard metal body, type with round dolly, fixing ring and on/off indicating plate. 1/3 or 1/2 doz.

For Extra Power Plugs. 7.029 three-core cable, 500 v. grade, 70/- for 100 yd. coil, carriage 5/-.

Thin Paxolin Panels. Size 8in. x 5in. 2/6 doz.

Midset I.F. coils 465 kc/s but with feed back winding for economy circuits. 6/6 pair.

Mains Transformer. Standard 230 v., input 250-0-250 at 80 mA., 6.3 v. at 5 A, 12/6.

Connecting Wire P.V.C. Covering. All colours. Sale price 2/6 per 100 ft. coil or 5 coils different colours, 10/- the lot.

50 Assorted Resistors. Well mixed and useful values; and 1 watt, 5/- for 50.

Ditto, but 1 watt. 6/6 for 50. **1 mfd 350.** Small tubular metal cased condensers made by Dubilier, 2/6 doz.

Speaker 8in. energised field, 9/6, carriage 3/6.

6ft. Unbreakable Mains Lead. Fine for test meters where subject to continuous bending. Normally costs 2/- per yard—we offer three leads for 2/-.

Welding Transformer. 12v.-50 amp. continuous rating—intermittent rating for spot welding—exceeds 2,000 amps, 45/-, carriage and packing 5/-.

Selenium Rectifier 36 v. 6 amp. (easily rebuilt into 4-3/4 amp. 12v. full wave carrier rectifiers), 17/6 each.

Cathode Ray Tube VCR517, 7/6. Carriage, etc. 3/6. **Thermal Delay Vacuum Relay** with book of interesting circuits 4/6.

ELECTRONIC PRECISION EQUIPMENT LTD.

Post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66, Grove Road, Eastbourne, marked Department 5.

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

66, Grove Road, Eastbourne, Sussex. Phone: ARChway1049 Half day, Saturday.

29, Stroud Green Rd., Finsbury Park, N.4. Phone: ARChway1049 Half day, Thursday.

266, London Road, Croydon. Phone: CRO. 6558 Half day, Wed.

LASKY'S RADIO

MAKER'S SURPLUS COMPONENT BARGAINS

WIDE ANGLE 3S mm.

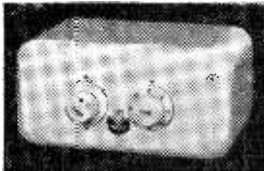
- Line E.H.T. trans. Ferro-cube core, 9-16 kv. 25/-
- Scanning Coils low imp. line and frame..... 25/-
- Ferro-cube cored Scanning Coils and Line Output Trans., 10-15 kv. EY51 winding Line Trans. with circuit dia. pair..... 50/-
- Frame Output Transformer 6 6
- Scanning Coils low imp. line and frame..... 17 6
- Frame or line block osc. Transformer..... 4 6
- Focus Magnets Ferro-cube P.M. Focus Magnets, Iron Cored..... 19/6
- Duomag Focalisers..... 22/6
- 39) m.a Smoothing Chokes... 15/-

STANDARD 3S mm.

- Line O.P. Trans. No. E.H.T. 12 6
- Line Output Transformers 6.9 kv. E.H.T. and 6.3 v. winding. Ferro-cube..... 19 6
- Scanning Coils low imp. line and frame..... 12/6
- Ditto by Igranic..... 14 9
- Frame or line blocking oscillator transformer..... 4 6
- Frame output transformer 7 6
- Focus Magnets: Without Vernier..... 12 6
- With Vernier..... 17 6
- 200 m.a Smoothing Cores 10 6

Another Lasky Special! WOLSEY BAND 3 CONVERTER

LIST £9/19/6
LASKY'S PRICE £5/19/6



Post & Pkg. 3/6

Available on Credit Sales terms: 25/- deposit and five monthly payments of 25/-.

The famous WOLSEY is a Converter of the highest efficiency and TUNABLE OVER ALL 13 CHANNELS. Incorporates own power supply for 200-250 v. A.C. mains. 2 valves, cascade R.F. amplifier PCC84 and PCF80, metal rectifier. Handsome ivory plastic Case, 7 1/2" x 3 1/2" x 4 1/2". Brand new in maker's cartons. Limited quantity only. Send to-day!

TURRET TUNERS. All types in stock—Clydon, Brayhead, Telenge, Valradio. Describe your set and we will quote you. Prices from 79/6.

C. R. TUBES, new, unused. 14", £14.19.6. 17", £16.19.6. 12", £8.19.6. 9", £5.17.6. Carr. & ins. 22/6.

MAIL ORDERS TO HARROW ROAD, PLEASE **LASKY'S (HARROW RD.) LTD.** 42, TOTTEHAM COURT ROAD, W.1. Telephone: MUSUm 2805.

370, HARROW ROAD, PADDINGTON, W.9. LADbroke 4075 and CUNningham 1979. Open all day SATURDAY. Half day Thursday.

SPECIAL OFFER OF SOLDERING IRONS

SOLOn, ex-Govt., new and unused. Pencil bit. 65 watts. 220-250 v. A.C./D.C. List 27/6. Lasky's 16/6 Price Post 1/6. Spare Bits, 1/- each. Spare Element (state voltage), 5/9.

SPEAKER BARGAIN

Special Purchase of Plessey P.M. Speakers, 5" round or 7" x 4" elliptical. Lasky's Price 14/6 Post 1/6.



COLLARO 4-SPD. MIXER AUTO-CHANGERS

RC. 456, incorporates auto and manual control. Complete with Studio crystal P.U. and sapphire stylus. List £13/17/-. Lasky's Price £7.19.6 Post 3/6.

RC. 457 or "Continental," £8.19.6. Post 3/6.

B.S.R., type UAB, 4-sp.d., with latest B.S.R. full-fi P.U., £6.19.6. Post paid.

RST

MAIL ORDER DEPARTMENT

211, Mitcham Road, Mitcham, Surrey. ALL VALUES LISTED ARE NEW STOCK. • Terms C.W.O. or C.O.D. Postage 3d. per valve. MITCHAM 6201

AZ1 15/6	EF40 15/-	ML4 12/6	TVL83 15/6	6F13 18/6
AZ31 10/6	EF41 9/6	MSP4 15/-	UF41 9/-	6F54 6/6
B65 8/6	EF42 12/-	MU14 10/-	UF89 10/-	6F7GT 10/-
DAC32 9/6	EF50(A) 4/6	MX40 15/-	UL41 9/6	6K7 4/6
DAF91 9/-	EF80 8/-	N37 18/3	UL84 9/-	6K7GT 10/-
DAF96 9/6	EF85 7/6	N78 11/6	UL89 22/6	6K8GT 12/6
DF629 10/6	EF86 12/-	N42 9/6	UV11 7/6	6L1 12/6
DF83 9/6	EF89 10/-	N153 11/3	UV85 8/-	6L6G 7/6
DF91 8/6	EF91 8/6	N154 11/3	VP4B 17/6	6L8 12/6
DF96 8/6	EF92 9/-	N727 8/6	W77 8/6	6L9 21/6
DH719 9/6	EF95 14/-	PCC84 9/-	W77 9/6	6N7GT 6/6
DK91 9/-	EF98 22/6	PCF80 12/6	W4M 8/6	6N7GT 8/-
DK92 10/6	EL41 10/-	PCF82 11/6	W142 8/6	6N7GT 7/6
DK96 9/6	EL42 10/-	PCL82 12/6	W719 8/6	6N7GT 8/6
DL33 9/6	EL81 17/6	PCL83 12/6	W727 8/6	6X4 7/6
DL35 15/-	EL84 9/-	PEN44 11/6	X18 11/6	6X5GT 8/6
DL32 8/-	EL86 10/6	PEN4VA 11/6	X78 19/-	787 12/6
DL91 8/-	EM80 10/-	PL36 15/-	X79 11/6	7Y4 7/6
DL96 9/6	EM81 11/6	PL38 15/6	Z21 10/6	8D3 8/6
EAB580 9/6	EM85 15/-	PL38 22/6	Z77 10/6	10C1 18/-
EAF42 10/-	EV81 10/-	PL82 10/-	Z152 8/6	10C2 22/6
EBH1 10/6	EV84 13/-	PL85 11/6	Z719 11/6	10C1 22/6
EB91 5/9	EV81 9/-	PS80 9/3	Z192 11/6	10L10 14/9
EBU11 9/6	EZ35 8/6	PY81 9/6	1F3 8/6	10P13 22/6
EBF80 9/6	EZ40 8/-	PY82 8/6	1R5 9/-	12A8 10/-
EBF80 9/6	EZ41 10/6	PY83 8/6	1T4 8/6	12A76 8/9
EBH21 21/-	EZ80 8/-	PTD4 15/6	3U3G 8/6	12A77 8/9
EBL31 21/-	EV81 9/-	PT22 12/6	3Y3GT 8/6	12A77 8/9
EC91 8/9	EZ90 7/9	R19 19/-	3Z4G 10/-	12A77 9/-
EC93 8/6	FC2 14/6	SP41 3/6	6A8GT 10/-	12BA6 8/9
EC94 17/6	FC4 23/6	SP61 3/6	6AL5 5/9	12BE9 9/3
EC951 8/6	FC13 14/6	TPD4 15/6	6AM6 9/-	12BH7 10/-
EC952 9/6	FC18C 10/6	TP22 12/6	6AN5 5/-	12J75 10/-
EC953 9/-	FC22 11/6	U78 8/-	6AQ5 6/6	12K7GT 10/-
EC984 10/-	H30 4/9	U142 8/6	6AT6 8/3	12K8GT 10/6
EC985 10/6	H63 10/-	U147 9/9	6BA6 8/6	12K8GT 10/6
ECF80 12/6	HBC90 8/-	U153 9/6	6BE6 8/3	12K8GT 12/3
ECF82 12/6	H192 11/6	U463 9/6	6H6 7/6	12Q7 8/6
ECF81 21/-	HL131 11/6	U801 27/6	6BR7 12/-	12Q7GT 8/6
ECF85 12/6	HL135 11/6	UADC90 10/-	6BW6 8/6	20E2 23/6
ECF84 9/6	HY90 7/6	UF42 10/-	6HW7 9/6	20E1 23/6
ECF81 9/6	KT33C 12/6	UF42 10/-	6HX6 8/6	20E1 23/6
LC90 12/6	KT66 16/6	UR41 4/6	6CDDGT 27/-	35W4 7/6
ELC32 13/6	LZ419 12/6	UBF90 8/6	6D2 5/9	35Z4GT 8/6
EP9 8/1-	MKT45 10/-	UC42 10/-	6FI 19/6	50L6GT 10/-
EP37A 10/3	(or 7) 21/-	UC81 10/6	6F12 8/6	

Quo. tations given for any types not listed. Obsolete and old types a speciality. Send for lists.

SUPER-VISION LIMITED

THE LOW PRICED COMPONENTS SPECIALISTS EVERY ITEM BRAND NEW AND GUARANTEED

CONDENSERS

2, 5, 8.2, 22, 42, 50 and 100 pf. 5d. each. 220, 500, .001, .002 and .005 mfd. 7d. each. .01, .02, .05 and .1 mfd. 8d. each. 25 mfd. 1/3 each. .5 mfd. 1/5 each. All 350 v. WKG Electrolytics 60/100 mfd. 5/6 each. 32 + 32 + 16 mfd. 350 v. 3/6 each. 40 + 40 mfd. 450 v. 3/6 each. Clips: 3d. each. 50 mfd. 12 v. 8d. each.

RESISTANCES

Carbon 10 to 5 M, 1/2 w. 3d. each. 1/2 w. 4d. each. 1 w. 6d. each. 2 w. 1/- each. Wire Wound 2,200 5 w. 1/3 each. 5, 10 and 20 ohms, 10 w. 1/6 each. 5, 10, 50 and 100 ohms, 20 w. 3/- each. Variable T/V type pots 3 k, 5 k, 25 k, and 1 M: 2/6 each. Egen slider type 3 k, 5 k, and 25 k: 1/9 each. Volume controls .5 M: 2/9 each. .5 M with DPS switch: 4/3 each.

COIL FORMERS AND SCREENS

3/4 x 3/4 x 1 1/2 dia. with iron dust core: 2/- each. 4/4 x 4/4 x 2 1/2 dia. with two iron dust cores: 3/- each. 12K8GT 10/6

VALVE HOLDERS

Int. Octal: 4d. each. B7G: 4d. each. B9A: 6d. each. CER.B9A with screen: 1/9 each.

TERMS: C.W.O. or C.O.D.

Please include a sufficient amount to cover postage. Send 3d. for full list.

Any Transformer or Choke made to order: quotations by return.

SUPER-VISION LIMITED

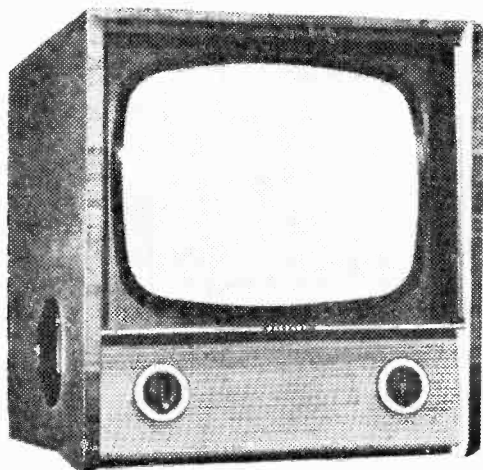
136, HIGH ST., TEDDINGTON, MIDDX. KINGston 4393

Buyers T.V. Guide

THE FIRST ARTICLE OF A SERIES REVIEWING THE LATEST SETS NOW AVAILABLE TO THE PUBLIC. WE SHALL COVER PRODUCTS OF EVERY MANUFACTURER. THIS MONTH WE DEAL WITH FERRANTI AND McMICHAEL RECEIVERS

Ferranti Model T1002

THIS 17in. model incorporates many advanced and unique features which will set a new high standard of viewing. It is housed in an attractive modern style cabinet finished in selected walnut veneers. The specification includes aluminised tube, automatic picture and



The Ferranti 17in. table model which costs 69 guineas.

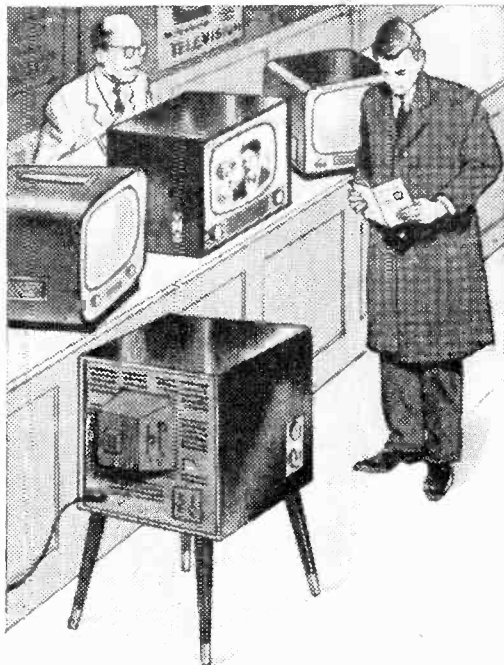
sound control, automatic bandwidth control, automatic picture interference inverter and a high-efficiency turret tuner. In addition, a high-grade speaker with an extended frequency response contributes to excellent sound reproduction.

Special Features.—Chassis of outstanding reliability with exceptional sensitivity.

Automatic interference inverter for the most effective interference reduction.

Turret tuning for easy, trouble-free tuning of all available programmes in Bands J and III.

Aluminised tube provides brighter pictures and sharper contrasts.

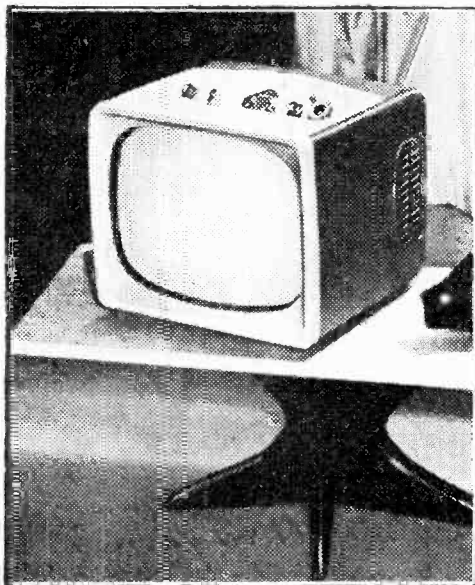


Attractive modern style cabinet finished in selected walnut veneers.

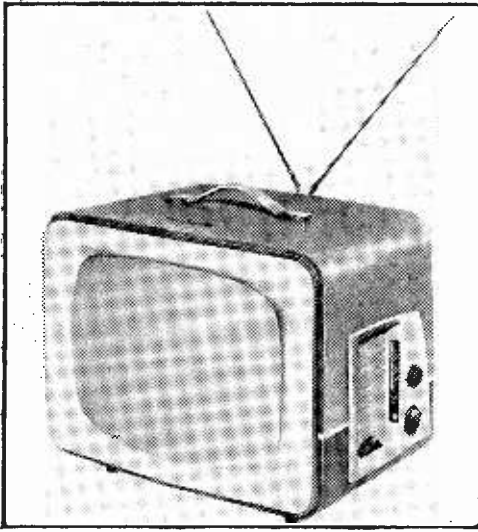
High-grade elliptical moving-coil speaker with a high flux magnet and an extended frequency response.

Circuit.—17 valve superhet receiver plus metal rectifier and crystal.

The input to the "cascode" R.F. stage is



The Ferranti transportable receiver with V.H.F. radio. It costs 59 guineas.



The McMichael 17in. portable receiver plus V.H.F. radio. It costs 66 guineas and aerial an additional 1 guinea.

designed to match an 80 ohm coaxial cable common to both Band I and III. A triode-pentode frequency-changer produces sound and vision I.F.'s of 38.15 Mc/s and 34.65 Mc/s respectively, the two signals each being amplified by a separate two-stage I.F. amplifier. The video amplifier is coupled to a cathode-follower output stage and a gating diode permits the black level to be sampled during the line blanking period, a further diode providing a proportional bias for vision A.G.C.

The cathode ray tube is cathode-modulated and is operated with an exceptionally well-regulated E.H.T. or approximately 16KV derived from the line fly-back. Frame fly-back suppression is provided to give increased latitude in the adjustment of viewing controls.

The vision interference limiter is of the "black spotter" type which can be adjusted to invert pulses which exceed the peak white level. Its bias is derived from the contrast control circuit in such a manner as to allow correct spot inversion at all normal settings of the contrast control without the need for re-adjustment.

Picture.—Aluminised tetrode cathode ray tube with ion trap gives brilliant high-definition pictures. A grey filter provides improved contrast under daylight viewing conditions.

Cabinet.—The attractive modern cabinet is of solid construction and beautifully finished in selected walnut veneers.

Speaker.—High-grade 8in. \times 5 in. elliptical moving-coil speaker with a high flux magnet and an extended frequency response.

Mains Supply.—200-250 volts A.C. or D.C. Voltage adjustment on chassis must be set at installation to suit particular supply voltage.

Dimensions.—21in. high \times 19in. wide \times 22in. deep.

Ferranti Model TP1009 Transportable Television Receiver with V.H.F.

CHASSIS.—Vision and sound: Turret tuner embracing BBC and Commercial television stations as well as V.H.F. radio band. Input to the "cascode" R.F. stage designed to match an 80 ohm coaxial cable common to Bands I, II and III.

Vision: Two-stage I.F. amplifier followed by crystal detector, video amplifier and cathode follower output stage. Automatic picture control and self-adjusting interference limiter.

Sound: Two-stage I.F. amplifier followed by an A.M. sound detector and F.M. ratio detector. Automatic gain control and noise limiter.

Cathode Ray Tube.—14in. electrostatically-focused aluminised tetrode tube with ion trap and 90 deg. angle of deflection. Grey filter improves contrast under daylight conditions.

Mains Supply.—200-250 volts A.C. or D.C. Consumption: Approximately 150 watts.

Loudspeaker.—High-grade 7in. \times 4in. elliptical moving-coil speaker with high flux magnet and extended frequency response.

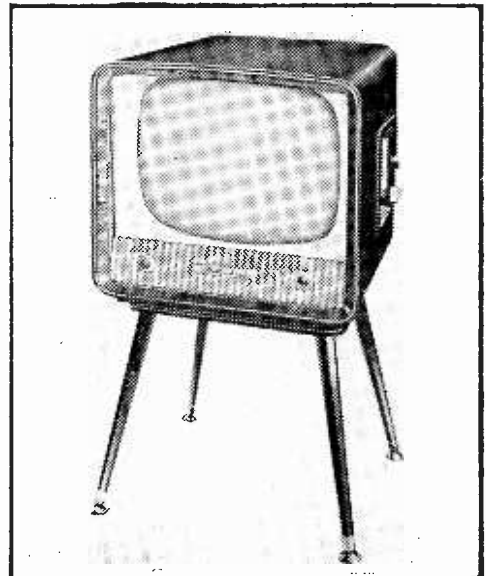
Aerial.—The high sensitivity of the receiver permits the use of an optional built-in telescopic aerial under many conditions where the directional properties of a more efficient aerial are not required. The V.H.F. radio input is via the TV aerial socket.

Case.—Press-formed in a lightweight material used in conjunction with plastic mouldings. In two-tone colour finish.

Overall Dimensions.—13 7/16in. high \times 14 1/2in. wide \times 16 1/2in. deep. Weight.—33lb.

McMichael Model MP17

SPECIFICATION.—This is a 17in. fourteen channel transportable television receiver incorporating V.H.F./F.M. radio. A 90 deg.



The McMichael 17in. table model which costs 69 guineas.

Mullard electrostatic tube is employed and the valve and crystal diode types are all of Mullard manufacture.

Voltage range.—A.C. or D.C. 200/250 volts, adjustable in 10v. steps.

Aerial.—A special aerial is available consisting of a telescopic dipole (size extended approximately 31in.) for use in good signal areas of BBC/I.T.A. and F.M. sound stations. These arms are rotatable and can be adjusted to any position. An additional aerial socket will accept input from any standard aerial with 70 ohm coaxial lead.

Main controls.—These are housed in a recessed panel at the right-hand side of the cabinet, and are as follows:—

New 14 channel tuner providing for the reception of all 13 channels in use now and allocated for BBC or I.T.A. television. Channel 14 is for V.H.F./F.M. reception.

Four controls positioned vertically on the side of the control panel are: brightness, contrast, tone, volume.

The fine tuning control sited above the tuner also serves as a programme selector on V.H.F./F.M.

A separate fingertip on/off switch is provided below the speaker.

Preset controls.—These are readily accessible at the rear of the receiver.

Circuit features.—The new high-gain low-noise 14 channel tuner combines the advantage of a turret tuner with that of an incremental tuner. The F.M. band is in the 14th channel. I.F. rejectors form an integral part of the tuner and reduce the effects of I.F. interference. An efficient A.P.C.

circuit is employed and the R.F. cascode stage has delayed A.P.C., giving an excellent signal-to-noise ratio on weak signals. The I.F. is 34.65 Mc/s (vision) and 38.15 (sound). The F.M. demodulation is achieved by ratio detector. During radio reception the television timebase and C.R. tube are out of circuit. The sound amplifier and output stage uses a PCL82 feeding a 7in. \times 3½in. speaker.

The frame and line timebases are both multi-vibrators. An efficiency diode and flyback EHT is included in the line timebase. An efficient sound noise limiter is incorporated and the vision limiters can be preset to the desired level to suit local conditions.

New plated circuit techniques are employed for the first time in this country. Plated circuits, unlike conventional etched circuits, provide continuous conductive surfaces between the two sides of the panels. The conductors can therefore be shortened, the layout simplified and the use of cross-over or jumper wires eliminated. Greater flexibility in the insertion of components is also promoted. The laminated bases are specially treated for moisture resistance.

Picture tube.—The receiver has a Mullard 17in. auto-focus electrostatic tube with a 90 deg. deflection. An ion trap is incorporated.

McMichael Model M72T

THIS table model has a similar specification as the portable model MP17 with the exception that the speaker and controls are located in the front instead of the side.

HEATER-CATHODE TUBE SHORTS

(Continued from page 18)

extra stage. An artificial way of improving the highlights of the picture is to connect between cathode and earth of the tube a resistance of value of between 1 and 2K and to couple a capacitor value, say, .01 μ F between the cathode of the phase inverter and the tube cathode.

This addition will have little effect on tubes having a very low resistance between heater and cathode but in others will give rise to an apparent highlighting of sudden changes in picture level. In actual fact a differentiated pulse corresponding to the instantaneous change in picture level is fed to the cathode and produces, effectively, push-pull modulation to the tube.

It will be noted that a 12AU7 valve has been recommended. In practice a 12AT7 will serve equally well. Alternatively a single triode such as a 6C4 may be used for the inverter stage and a single diode—EA50—may be used for the D.C. restorer.

Whatever is used, however, in A.C./D.C. sets it must be remembered that the valve heaters to these extra stages must be connected in series with the existing set heater chain. The valves chosen for these extra changes, therefore, must have heater currents compatible with those already in use even though some series-paralleling of heaters may be necessary.

Final Circuits

To complete the information on modifications, Fig. 4 gives the full circuit diagram of the first solution, showing the inclusion of the D.C. restorer. The second solution is a straightforward combination of circuits 2, 3 and 4.

To the reader with a box of spare parts bigger than his bank balance, either of these two solutions is more suitable than the use of a heater-to-cathode isolating transformer.

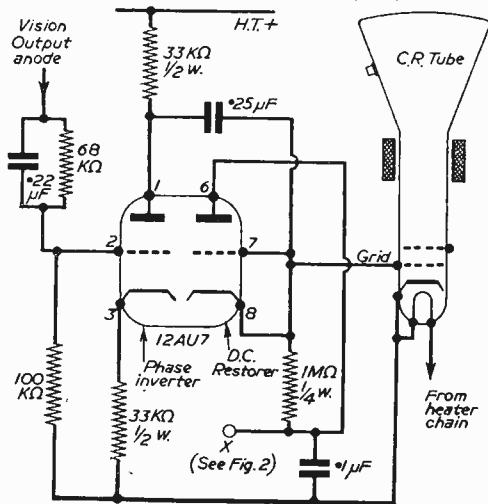
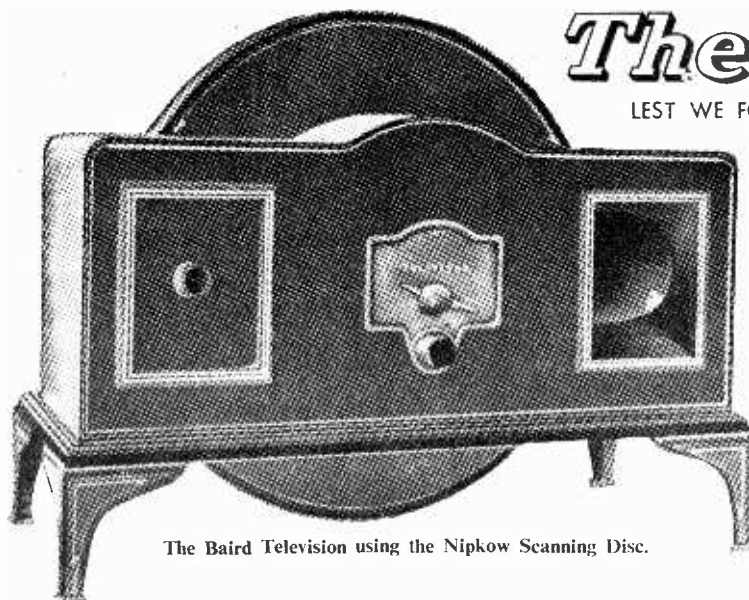


Fig. 5.—The phase inverter for grid modulation.

The Birth of

TELEVISION
LEST WE FORGET! A SUMMARY OF DEVELOPMENTS

by F. J.



The Baird Television using the Nipkow Scanning Disc.

TELEVISION as a public service, if we include the early 30-line transmissions of Baird, is now over 25 years old. Television had hence arrived before many of the present generation were born, and to them it was an accepted part of our life, like the aeroplane, the telephone, radio, and the gramophone. They are thus unaware of the numerous experiments going back for over 80 years which finally led to the high-definition TV system in use today.

Selenium

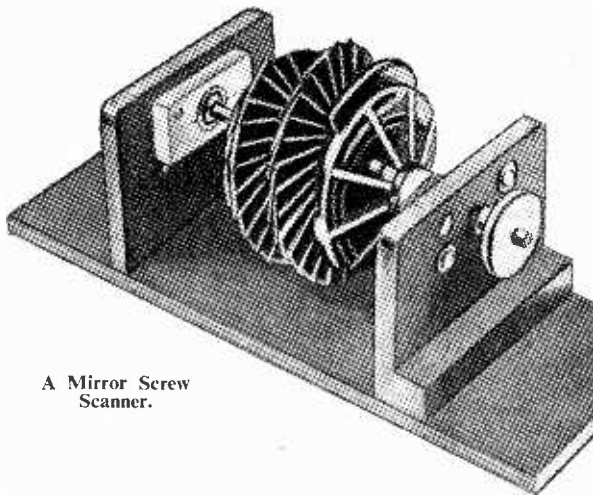
It may come as a surprise to many to learn that the idea of television occurred in the 1870's, and it followed the discovery some years before that the element selenium is capable of exhibiting a remarkable sensitivity to light, and that its electrical resistance varies according to the amount of light which impinges upon it. This property is made use of in photo-electric exposure meters. It was in 1873 that Willoughby Smith, Chief Electrical Engineer of the Telegraph Construction Company, happened to use some rods of selenium to increase the resistance of some of his experimental electrical circuits. The results, however, were inaccurate and resistance varied from day to day. Closer investigation revealed that the changes in resistance were centred in the selenium rods, the resistance of which varied according to the intensity of the light to which they were exposed. They showed maximum resistance, or minimum conductivity, in the dark, and exactly the opposite when they were exposed to full sunlight. Thus was born the selenium cell, and the mysterious property was soon incorporated in a large number of photo-sensitive devices and numerous patents were taken out. There were many discussions and lectures in scientific circles and lecturers spoke of the possibility of "seeing by electricity."

The First Televisor

This fired the imagination of an experimenter named Carley, and he contrived a crude instrument

based on selenium, which can truly be said to be the first televisor. Unfortunately, the instrument does not now exist, but its description has been handed down to us. It was undoubtedly successfully demonstrated. It could only deal with rough black and white silhouette designs, and its transmissions were by cable or land line, radio transmissions then being unknown. A description of Carley's instrument was published in 1880. It consisted of a blackboard surface about the size of a small drawing board and inset into

its surface were rows of miniature selenium cells. The receiver consisted of another board, but instead of selenium cells, it was inset with corresponding rows of



A Mirror Screw Scanner.

small electric bulbs. Each selenium cell had its corresponding electric bulb on the receiver. It was battery-operated. When a shadow image was projected on to the cells, those with the highest light intensity decreased in resistance so that their corresponding lamps on the receiving panel glowed with maximum brilliance, and those cells which were the least illuminated caused their corresponding lamps to glow with the minimum illumination. Intermediate light intensities falling on the selenium cells set up corresponding glow lamp intensities on the receiver panel. The idea was, of course, no more than a laboratory experiment, but it sparked off developments amongst a number of highly qualified experimenters and towards the latter end of the last

of Television

DEVELOPMENTS WHICH LED TO MODERN TELEVISION

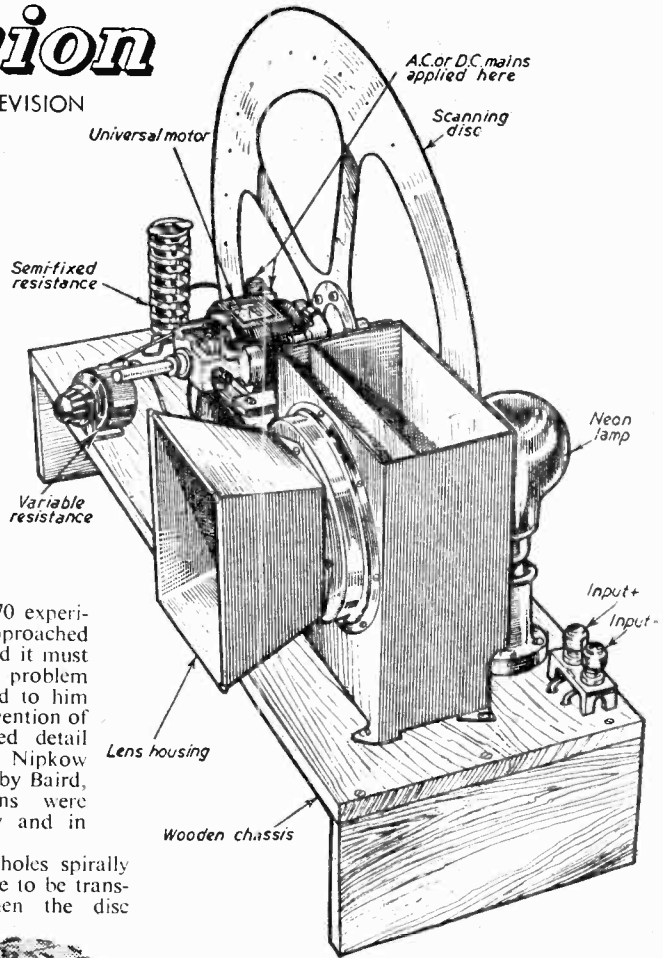
Camm

century many suggestions were made for television transmitters and receivers. The selenium cell, therefore, as far as vision is concerned, performed the same functions as the carbon microphone, the resistance of which varies according to the intensity of the sound which impinges upon it. The varying resistances of selenium were first discovered in 1873. Scientists soon made the disappointing discovery, however, that there is a marked difference between the problems of hearing and seeing. The Frenchmen, Rignoux and Fernerier in 1906 demonstrated a transmission system making use of 64 selenium cells and a similar number of electric light bulbs.

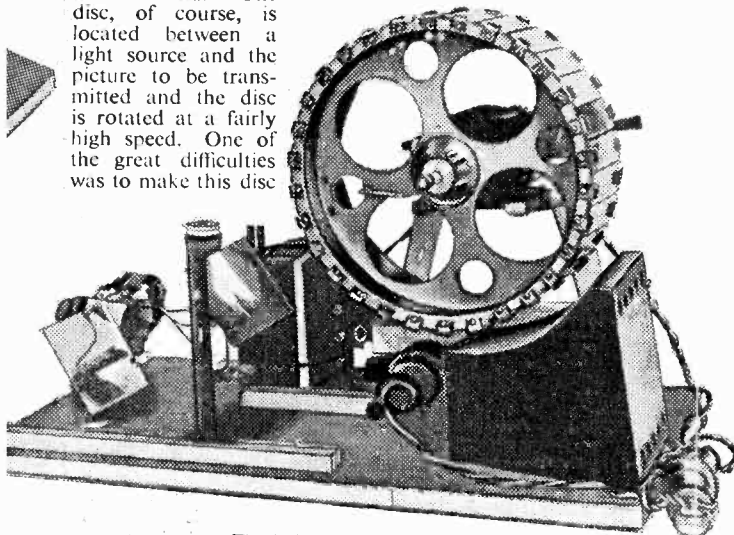
The Nipkow Disc

Some years passed between the 1870 experiments and then, in 1884, Paul Nipkow approached the problem from a different angle and it must be said that his new approach to the problem resulted in present day television, and to him must be given the real credit for the invention of it. Baird and others later introduced detail improvements. Making use of the Nipkow scanning disc, identical with that used by Baird, the first experimental transmissions were carried out by Baird, in this country and in New York, from 1927 to 1931.

His scanning disc had a series of holes spirally arranged in such a way that the picture to be transmitted was completely scanned when the disc was rotated. The disc, of course, is located between a light source and the picture to be transmitted and the disc is rotated at a fairly high speed. One of the great difficulties was to make this disc



The elements of a Nipkow Disc Television, as marketed by Baird.



The Mirror Drum Scanner.

rotate at a constant speed. Baird achieved this object by producing his synchronising system, and it is for this that Baird should be mainly remembered. As the disc rotates, each light spot in succession flies across the picture. If the disc, for example, has 18 holes there will be 18 scanning paths quite close to one another. The scanning lines, of course, will be slightly curved. The scanning disc thus splits the picture up into a number of small pieces, so to speak, which are arranged in their correct order on the viewing screen. Each picture element will emit a greater or lesser amount of light according to its composition. These variations, registered on a selenium cell, produce the illusion of the picture.

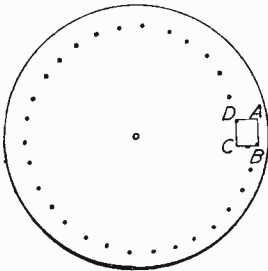
Other Scanning Systems

Much more complicated methods of scanning are employed to-day in the television studios but the principle remains the same. There have been hundreds of inventions for scanning systems, and of these perhaps the most common are: The Apertured Disc; The Lens Disc; The Prismatic Disc; The Apertured Drum; The Mirror Screw, and the Cathode Ray.

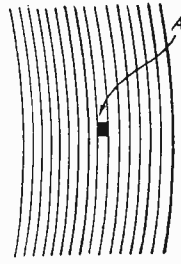
The Scanning Disc

The apertured Nipkow scanning disc is perhaps the simplest of them all. It consists of a thin flat disc, circular in shape with a single turn spiral of holes punched at regular intervals near the periphery, and is shown on page 27. As the disc revolves about its centre, concentric strips, which touch one another, are described by each hole. The disc in this form is suitable for vertical or horizontal scanning, and if we examine the area shown by A B C D in the diagram, it will be seen that each hole as it passes across the area describes a small arc of a circle, thus dissecting the area into the same number of strips as there are holes in the disc.

The actual scanning area is a factor of the disc diameter, hole size, number of holes, and the shape of



The holes in the disc form a light opening having an area embraced by the letters A B C D.



The complete area is subdivided into small light squares in this manner.

the television picture, and simple formulae can be derived to enable anyone to mark out a scanning disc accurately. Usually the holes are square, but when a disc is made for a large number of scanning lines, then hexagonal holes are used. When using a disc for scanning a film at the transmitting end, the exploring is carried into effect by having a circle of holes instead of a spiral of holes and as the disc revolves the film is moved relative to it and the same effect produced as a stationary film or object with spiral exploration.

The Prismatic Disc

Another very interesting type of scanning disc is that invented by Jenkins, of America. It is called a prismatic disc. It is a disc of thick glass, the outer edge of which has been ground into the shape of a prism, the section varying gradually and continuously round the circumference so that at one point the base of the prism is outward, while diametrically opposite this point the base is inward. If a beam of light be directed through the edge of such a disc it will be bent in a certain direction, the angle at which the beam bends depending upon the angle of the prismatic section at that point. By superimposing a second disc over the first so that their overlapping edges

revolve in directions at right angles to each other, a lateral as well as a vertical movement can be given to the light beam.

The Mirror Drum

While the lens and prismatic disc provide more intense illumination than the plain apertured disc, some form of drum scanning is preferable when it is desired to carry out experiments for projecting the television image on to a screen. One of the simplest arrangements for this purpose is the apertured drum. It consists of a hollow drum having a spiral of holes pierced through the side. It is possible to place the source of light inside the drum and, by revolving the drum at constant speed, each hole will pass across a definite light area and throw a beam on to a screen placed in any convenient position.

In another system the light from an arc lamp has its beam condensed by a lens on to a right-angled prism mounted inside the hollow drum. The beam of light is in this way bent at right-angles and made to cover a definite rectangular area. As the drum revolves, each aperture passes across this light field and the pencil of light emerging from the drum side can be focused on the subject or object that has to be televised.

If desired, lenses may be inserted in each drum aperture, and in this way the advantages mentioned for a lensed disc are secured. One development from the apertured drum is the belt scanner which has a thin strip of flexible material with holes punched in it diagonally from end to end. When the ends are joined together a belt is made, and this can be passed over two wheels or pulleys which drive the belt when they are caused to revolve through the medium of a motor coupled to one of them. The source of light is placed between the belt bands and observation made in the usual manner.

One of the most efficient methods which can be used for projecting television images on to a screen at the receiving end, or alternatively for governing light spot movement at the transmitting end, is to employ a mirror drum. A beam of light from the arc lamp is focused on to an inclined mirror, which in turn reflects it on the drum. Round the edge of this drum is a number of rectangular mirrors made from optically-tested glass. Each mirror is canted at a slightly different angle with reference to the drum axis when compared with its immediate neighbour, and in consequence if the drum is revolved the beam of light is reflected from each mirror in turn and made to move upwards until it comes outside the area focused on the drum from the bottom reflecting mirror.

In this way the drum causes the single light beam to create a number of strips of light, disposed side by side.

The Mirror Screw

One objection which is levelled at the ordinary mirror drum is its relatively bulky nature, and in consequence one idea which has been developed on the Continent to replace the mirror drum is called the mirror screw. One of the best ways of picturing this device is to recall a spiral staircase. Arms radiate from the centre, and on the end of each one of these arms is a reflecting device such as a mirror or thin piece of stainless steel.

As the "screw" revolves the reflecting surface at the end of each arm comes into any beam of light that may be focused on it.

A TV Pattern, Pulse and Square Wave Generator

FOR SETTING UP VERTICAL AND HORIZONTAL LINEARITY

By J. Hillman

Description

THIS instrument was designed primarily for setting up TV sets for vertical and horizontal linearity, and gives a series of vertical or horizontal straight lines, the number of which can be varied from one to a great number. It can also be used to provide square waves from 50 cps to 10 kcs and gives fairly good wave form thus enabling amplifiers of all types to be checked for distortion. The square wave can be changed to a pulse wave, either negative or positive being selected by means of a switch. The range of the pulse waves is greater than that of the square

wave being about an inch deeper than shown. It will be noted that extra smoothing is incorporated using C16 R16 and that the power requirements are 250 v. 17.5 mas H.T. and 6.3 v. 0.75 amps heater supply. Details of a suitable power pack will be given later.

Construction

First mark out the front panel as Figs. 1 and 2 then bend the $\frac{1}{8}$ in. edges at right-angles and cut the corners off the edges as shown in Fig. 2. Now drill the various holes as shown in Fig. 1 and proceed with the chassis. Mark off as in Fig. 3 and cut out as shown, then bend the two 6 in. sides at right-angles and then the back side to form the chassis as in Fig. 4. Drill $\frac{1}{8}$ in. holes as shown in Fig. 4 and bolt the chassis together with two 6 B.A. bolts. Now place the chassis and front panel together and mark off the holes through the chassis on to the front panel and drill $\frac{1}{8}$ in. holes and secure with 6 B.A. bolts. Now make sure the front panel is at right-angles to the chassis and drill a hole each side $\frac{1}{8}$ in. through the edge of the front panel and on through the chassis side and secure with 6 B.A. bolts. Now mark out the holes as in Fig. 6 and drill and punch them out. The large square hole is to enable the tuning condenser vanes to clear the chassis as the condenser is mounted upside down. Next mark out and cut the top cover as Fig. 7 and bend the edges to form cover as Fig. 8, drill $\frac{1}{8}$ in. holes and use 6 B.A. bolts to secure it at the sides. Also drill $\frac{1}{8}$ in. holes about $\frac{1}{4}$ in. from the edges two to a side for securing to front panel and chassis. Now make up the base cover as Fig. 5 and drill $\frac{1}{8}$ in. holes around its edges $\frac{1}{8}$ in. in from the edge. Place the base cover in position and mark off one hole only then drill $\frac{3}{32}$ in. and secure with 6 B.A. self tap screw. Adjust cover to fit correctly and then drill another hole and secure in the same way. The rest of the holes can now

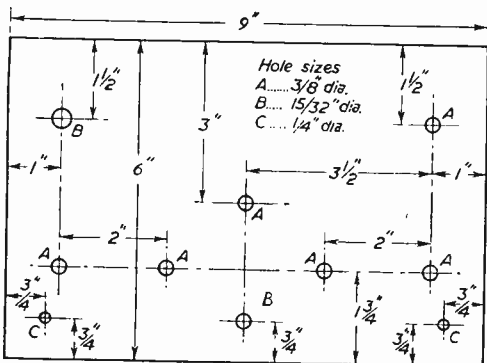


Fig. 1.—Drilling details for front panel.

waves being from 50 cps to 100 kcs. Unlike most pattern generators there is very little radiation of signal and even when the cover is removed and the instrument placed beside the TV set no pattern appears on the screen until the co-ax lead is connected from the generator to the set. The circuit consists of an electron coupled oscillator 6C4 which covers all the channels in Band 1. This is modulated by means of a crystal diode with either a pulse or a square wave. The oscillator is a cathode coupled 12AT7 having a coarse frequency selector switch S2 and a fine frequency control VR2. With a high value of cathode resistance good square waves are produced and by operating S3 the bias resistor can be reduced to give pulse waves. Valve EF91 is used to reverse the phase of the wave to give either negative or positive waves. negative feedback being introduced to stabilise the valve. It will be noted that the instrument does not incorporate a power supply. The reason for this is that by using a separate power pack it is only necessary to have one power pack for several pieces of test gear, that is, gear that would not normally be used at the same time. However, there is no reason why the power supply shouldn't be fitted to the existing chassis if expense is of no importance, but in that case the chassis would need to

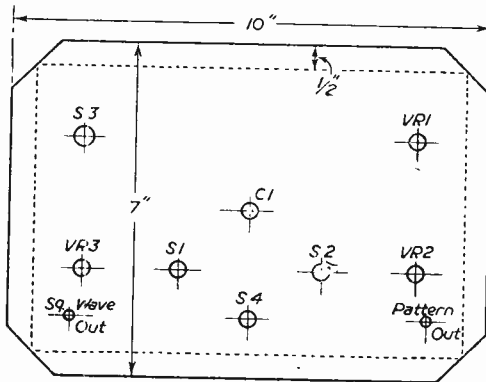


Fig. 2.—Layout of the front panel.

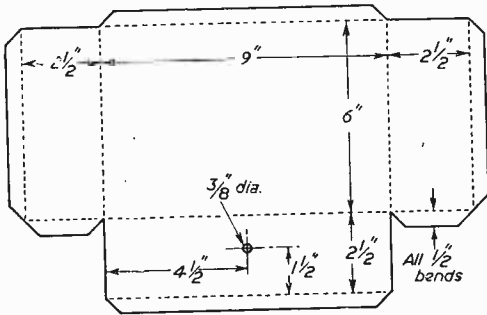


Fig. 3.—Measurement details of the chassis.

all be drilled and screws fitted. Similarly, the top cover is fitted using one screw only at first to ensure a good fit and then the second screw and then all the rest of the screws. Now remove the top and base covers and fit the various components to the front panel not forgetting to mount the tuning condenser upside down. The pots are mounted as follows: the VR1 is mounted so that its tags are downwards nearest the chassis and VR2 and VR3 are mounted so that their tags are horizontal, facing inwards towards the centre of the panel. Fig. 9 shows layout of major components.

Wiring

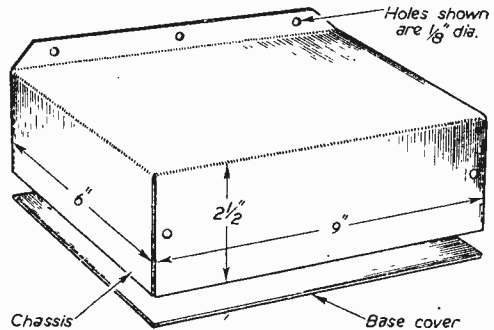
The coil is made by winding 14 turns of 16 tinned copper wire on a 3/8 in. former and then slipping it off the former and separating the turns so that they are spaced about one diameter, the distance is not important at this stage as it will be altered later on. The R.F. choke is made up by winding 60 turns of 36 enamel wire on to a 1 watt 2.2 meg resistor, soldering the ends of the wire to the ends of the resistor. The coil is mounted direct on to the lugs of the tuning condenser, the one used being an ex-government 10C/3996 which has wide spaced vanes and is mounted on a ceramic base. R8 and R9 are mounted above the chassis and attached to S3. C17 is mounted close against the front panel between VR3 and S4. Condensers C9 to C14 are mounted direct on the switch S2, their other ends going to a wire soldered vertically from pin 6 of

V2, the C9 being nearest to the pin 6 and C14 the farthest.

A seven-tag strip is mounted close to the edge of the square hole in the chassis and the power supply lead comes in through the back of the chassis and connects to three of the tags. C16 is mounted between this tag strip and the back of the chassis. One point to notice is that instead of using an R.F. choke in the heater lead of V1 a ferrite bead is used as this makes a more efficient choke at Band 1 frequencies. The germanium diode is mounted in the wiring as is the R.F.C. Condenser C15 is mounted direct to pin 1 of V2 and its other end is joined to junction of R11 R12. Wire up the heaters first using a 20 t.c. wire as an earth return for all under chassis wiring and keep it close to the chassis and nearest the square hole. The other heater wire runs close to the chassis around the outside of the valveholders and the tag strip. If the valveholders are placed exactly as shown in Fig. 9 no difficulty should be experienced in wiring correctly.

Testing

Having completed the wiring and checked it over leave out the valves and connect the power supply and check from the circuit diagram the



Figs. 4 & 5.—The chassis and the base plate.

pin voltages to ensure that the heater and H.T. supply goes to the correct pins of each valve. Now put in the valves and reconnect the supply and check the voltages which should be approximately as follows: V1 Pin 1 115 v.; V2 Pin 1 145 v.; Pin 6 170 v. with S3 in square wave position; V3 Pin 5 160 v.; Junction R15, R16 190 v.; input at R16 250 v. 17.5 mas. If an oscilloscope is available then connect Y input of scope to square wave output and check each range of S2 for a good square wave, using the direct input of the scope to ensure perfect reproduction of the wave. That is, using the scope without its internal Y amplifier. It will be found that the wave will have sloping tops and bottoms below about 100 cps., but from 100 up to about 10 k/cs the top and bottom of the wave will be horizontal with sharp edges where the verticals meet the horizontal. The two halves of the wave will not be quite the same length, but this is not important as the main portion of the wave is its edges which should remain perfect for perfect reproduction. Now switch to pulse and observe the wave, which should be spiky, this spike will be at the top in

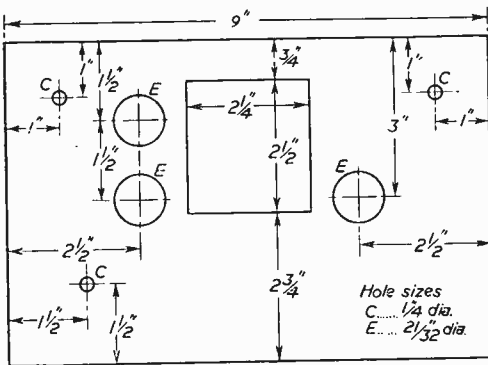


Fig. 6.—The chassis layout.

one position of S4 and at the bottom in the other position.

Next couple up a TV set with co-ax lead from its aerial socket to the pattern socket of the generator. Set S2 to range 5 and adjust VR2 until a whistle becomes audible then rotate C1 until a pattern appears on the screen of the TV set, this should consist of a number of horizontal lines. By adjusting VR2 the lines can be locked so that

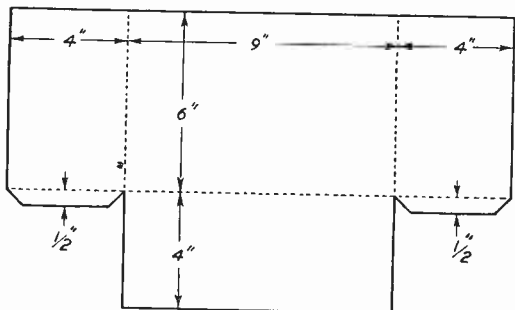


Fig. 7.—Method of marking out the top cover.

they are stationary and the number can be varied.

Now check that the tuning condenser covers all the channels by setting the turret tuner of the TV set to each channel in turn and tuning the generator until a pattern appears. If the channels do not appear spread out enough then bend the turns of L1 to widen the spaces between each turn until the channels are well spread out. As an indication of the sort of readings you will get the following is the calibration of the prototype: Channel 1 152

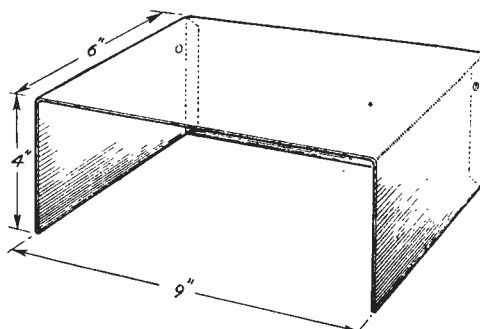


Fig. 8.—The top cover bent to shape.

to 124; Channel 2 118 to 95; Channel 3 95 to 72; Channel 4 72 to 46; Channel 5 50 to 16. Should the tuning condenser not cover all the channels then coil L1 can be altered by either widening or narrowing the space between the turns. The tuning knob is marked 0 to 180 degrees.

Use

To check a TV set proceed as follows: first couple up the aerial socket of the TV set to the pattern output socket of the generator. Switch on both TV set and generator and allow them to warm up. Set S2 to range 5 and rotate tuning knob of C1 until some sort of pattern appears on the screen of the TV set. Now adjust VR2 until steady horizontal lines appear, S1 being set to pattern position. Use the number of lines that enable you to check the distance between them which should be the same both top and bottom

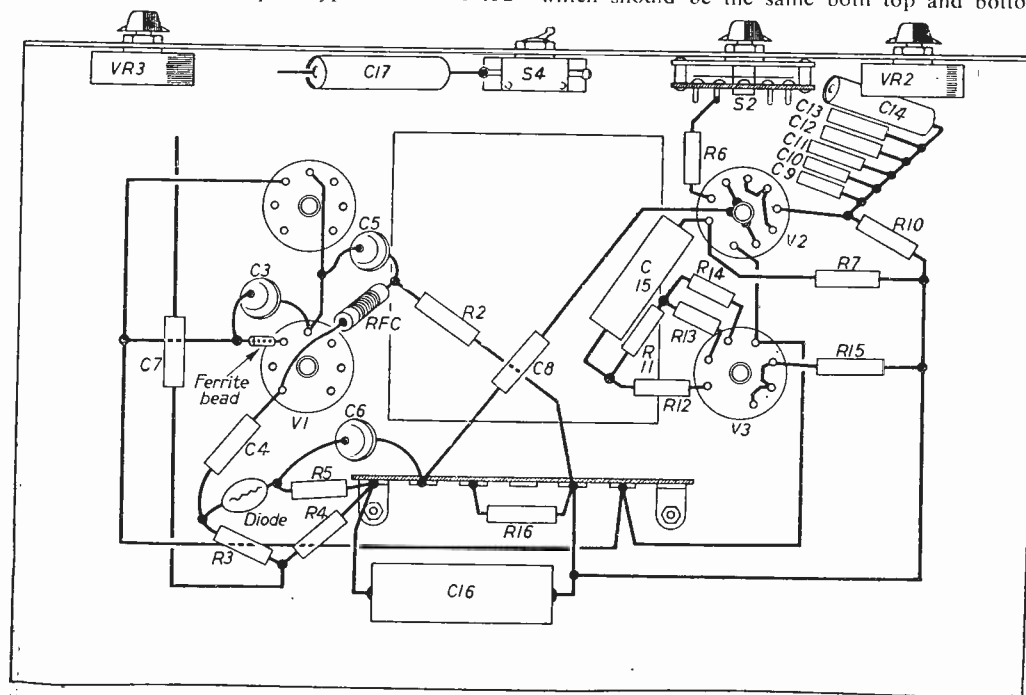


Fig. 9.—Wiring details of the generator.

for perfect linearity of frame time-base. If the lines are not spaced the same distance apart then use the linearity controls of the set to get the lines equally spaced. Now switch to range 2 and adjust VR2 to give steady vertical lines which



Fig. 11 (left).—Waveform shows poor L.F. response.
Fig. 12 (centre).—Waveform shows poor H.F. response.
Fig. 13 (right).—Perfect waveform.

should be spaced evenly. If the lines are not spaced evenly then use the linearity controls of the line time-base to correct them. In all these tests the contrast control of the set is set at maximum and VR1 is usually set near maximum. By using S3 and S4 either double lines or single lines will appear, but it is usually easier to check the linearity with single lines.

When testing amplifier circuits the switches S1, S3 are put to square wave position and the output taken from the socket marked square wave. Amplifiers will vary in their reproduction of the square wave and if they have poor L.F. response the wave will appear as Fig. 11 whilst for poor H.F. response the wave will appear as Fig. 12. For perfect reproduction the wave will appear as Fig. 13. By varying the frequency of the square wave using VR2 and S2 the range of reproduction of the amplifier can be checked. This applies equally to video amplifiers of TV sets. For those not possessing an oscilloscope the square wave generator can still be used for checking radio sets as quite an audible signal can be obtained from it and by injecting this from the square wave

output socket to the set either TV or radio audio stages can be checked. It can also be used to supply bridges.

The approximate ranges of S2 are as follows: range 1, 25 k/cs to 100 k/cs; range 2, 4.5 k/cs to 60 k/cs; range 3, 1.2 k/cs to 30 k/cs; range 4, 100 cps. to 9 k/cs; range 5, 60 cps. to 6 k/cs; range 6, 50 cps. to 2 k/cs.

LIST OF COMPONENTS

- R1—22k
- R2—10k
- R3—22k
- R4—1k
- R5—22k
- R6—1k
- R7—22k
- R8—470
- R9—2.2k
- R10—22k
- R11—1 meg.
- R12—1k
- R13—220
- R14—4.7k
- R15—4.7k
- R16—3.3k, 1 watt
- VR1—50k carbon pot.
- VR2—500k carbon pot.
- VR3—25k carbon pot.
- C1—30 pfd. tuning
- C2—47 pfd ceramic
- C3—.005 ceramic
- C4—.005 ceramic
- C5—.005 ceramic
- C6—.001 ceramic
- C7—.005 ceramic
- C8—500 pfd ceramic
- C9—10 pfd ceramic
- C10—100 pfd ceramic
- C11—500 pfd ceramic
- C12—.005 ceramic
- C13—.01 ceramic
- C14—.05 tubular
- C15—.1 tubular
- C16—8 mfd, 450 v.
- C17—.1 tubular
- RFC 60 turns 36 enamel wound on 1 watt 2.2 meg. resistor
- L1—14 turns 16 tinned copper 3/8 in. diam. former tapped 4 turns from earth end and spaced
- V1—6C4
- V2—12AT7
- V3—EF91
- S1—S.P. 2-way wavechange switch
- S2—1 pole 6-way wavechange switch
- S3, S4—S.P.D.T. toggle switches
- 3 wander plugs
- 1 B9 valveholder
- 1 Ferrite bead
- 2 B7G valveholders
- 2 co-ax sockets
- 1 7-tag strip

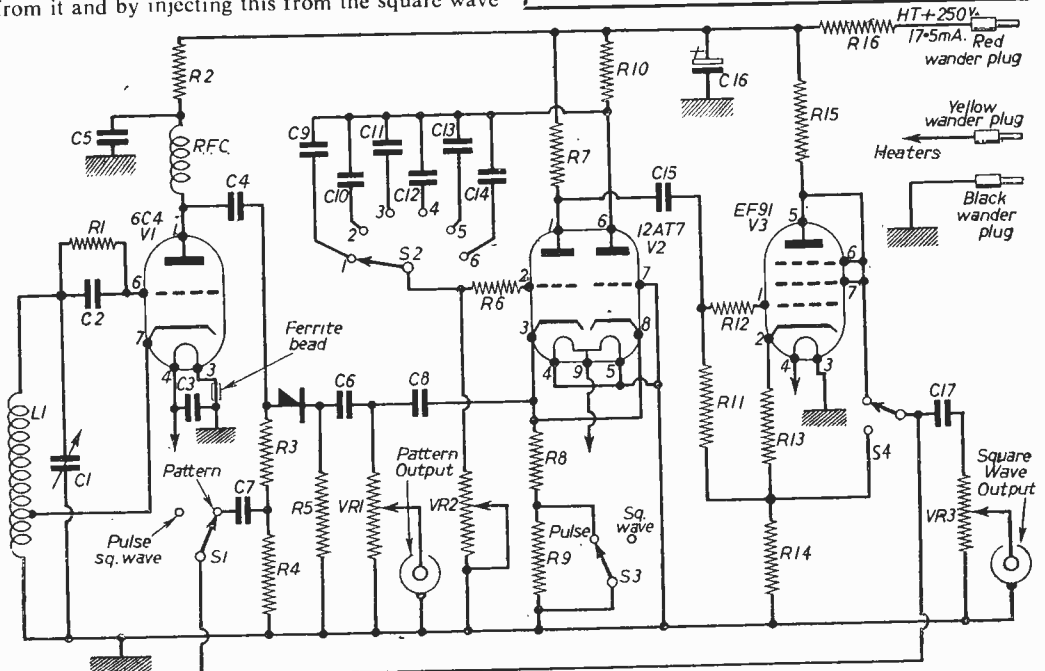
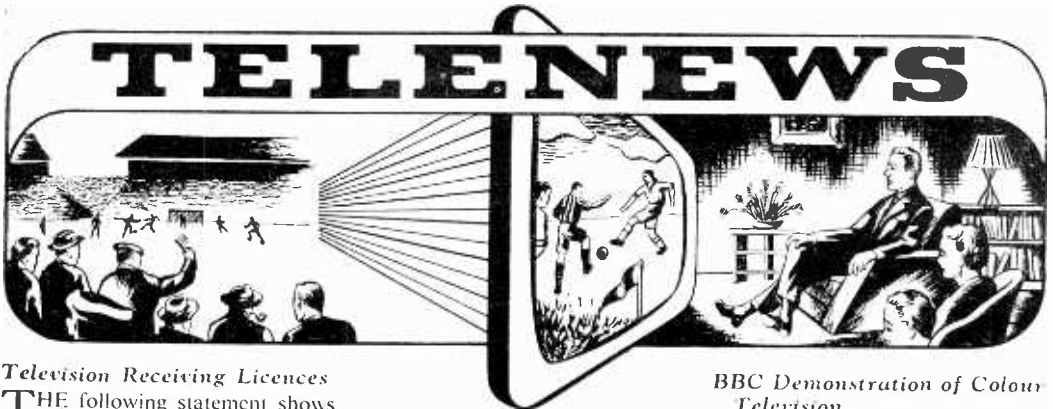


Fig. 10.—The circuit diagram.



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of May, 1958, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	Total
London Postal	1,589,325
Home Counties	1,012,771
Midland	1,315,928
North Eastern	1,320,751
North Western	1,147,507
South Western	637,644
Wales and Border Counties	473,928
Total England and Wales	7,497,854
Scotland	615,435
Northern Ireland	87,809
Grand Total	8,201,098

Price Reduction

COSSOR Radio and Television Limited announce that Models 939 and 942 17in. Television Consoles are now price decontrolled.

Limited stocks of both models are still available. Further orders will be dealt with in strict rotation whilst stocks last.

Also Philips Electrical Limited announce that the prices of their 1757U. console television receiver and 653A. radiogram are decontrolled forthwith.

TV Sales Boom in Australia

RETAIL sales of electrical goods in Australia rose to £124 million in 1957, an increase of 17 per cent. in twelve months. This is revealed in a census by the Commonwealth Bureau of Census and Statistics.

The increase was largely due to sales of television receivers in Victoria and New South Wales.

Latest returns show that 220,221 television licences were

in force in Australia on March 31. Of these 114,097 were in Victoria, 106,085 in New South Wales and 39 in Tasmania.

Production of television sets jumped from 49,010 in 1956 to 208,360 last year.

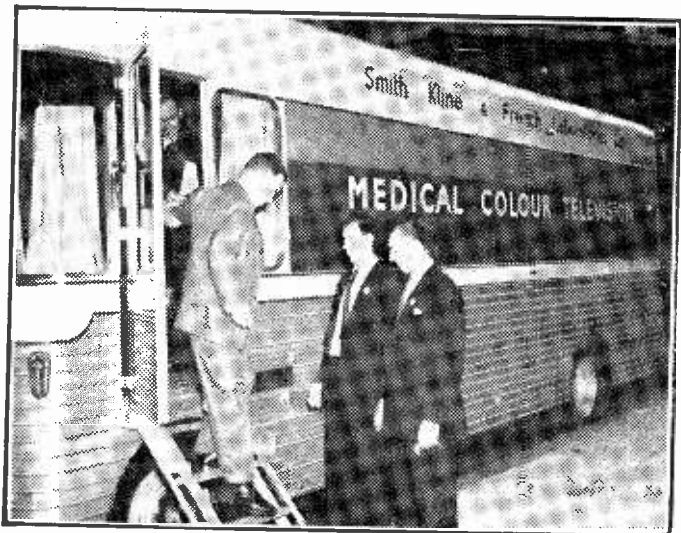
Colour Television Unit

IN June this year the first Mobile Medical Colour Television Unit of its kind to be designed and manufactured in Great Britain was officially handed over by the manufacturers, Marconi's Wireless Telegraph Co. Ltd., to its owners, Smith Kline & French Laboratories Ltd. For complete details see next month's issue.

BBC Demonstration of Colour Television

AMONG more than 70 exhibits shown to members of the Institution of Electrical Engineers and their guests at the conversations held by the Institution at the Royal Festival Hall on Wednesday, June 25, was a demonstration of colour television on a closed circuit arranged by the BBC. Guests were interviewed by Miss Sylvia Peters and the pictures were seen on five-colour receivers distributed about the Festival Hall. Between the interviews colour slides were displayed.

The colour television equipment was some of that used by the BBC in their colour television studio at Alexandra Palace for the recent series of experimental transmissions. The colour camera used at the Festival Hall was manu-



Mr. R. Pfizenmaier, managing director of Smith Kline & French, descending from the colour television vehicle.

factured by Marconi's Wireless Telegraph Company Limited, the colour receivers by Murphy Radio Ltd., and the slide scanner by the BBC.

ITV's Share

INDEPENDENT Television's share of the total time spent viewing television in homes with a choice of BBC and ITV programmes continued to increase during May, reports Television Audience Measurement Limited. It reached 71 per cent., one per cent. more than the April figure, and four per cent. higher than in March.

ITV's share in BBC/ITV homes in each ITV area was: London 71 per cent.; Midlands 78 per cent.; Northern 73 per cent.; Scottish 71 per cent.; South Wales and the West of England 63 per cent.

"A Beginner's Guide to Television"

OUR recently concluded series of articles entitled "A Beginner's Guide to Television" has just been published in book form at 7s. 6d. or 8s. 3d. by post, from the Book Department, George Newnes Ltd., Tower House, Southampton Street, Strand, W.C.2. The edition is limited and early application for copies should be made.

Tyne Tees Television Appoint Managing Director

TYNE TEES TELEVISION LIMITED announce the appointment as Managing Director of Mr. Anthony Jelly.

Mr. Jelly was Associated Television's first Sales Manager, afterwards their Assistant Sales Director, and at 35 he became the youngest Sales Director of any contracting company when in January, 1957, he left to join Scottish Television in this capacity. With James Coltart, S.T.V.'s Managing Director, he was responsible for setting up operations in the Theatre Royal, Glasgow, from the outset.

ITV Progress in TWV Area

A MID-APRIL survey of the TWV area carried out by Television Audience Measurement Limited (TAM) showed that 295,000 homes in the area could receive ITV programmes, an increase of no less than

39,000 since the TAM mid-March survey.

Parallel with the steady growth in ITV homes, there was a marked rise in the number of homes with good reception of ITV programmes—from 206,000 in mid-March to 243,000 in mid-April. Over the same period the number of Band III homes still unable to receive ITV fell sharply from 104,000 to 88,000.

Commercial TV and Free Trade Area

TO be fully successful, all European Free Trade countries must make the best use of commercial television, the most effective advertising medium of all, the Earl of Bessborough, President of the European-Atlantic Group and a director of Associated Television, said recently.

He was addressing an audience of distinguished visitors to the European Television Exhibition, Park Lane, London.

Lord Bessborough said: "We know that television in the United States and in Canada and now in the United Kingdom is indispensable in all major marketing campaigns. We know also that Germany, Italy and Portugal have gone ahead with their own forms of commercial television and that Finland, a newcomer to the medium, has planned its television service dividing the time between sponsored and government programmes."

New Scan Coil

DIRECT TV REPLACEMENTS of 138, Lewisham Way, New Cross, S.E.14, announce a new scan coil, suitable as a "Direct" replacement in Ferranti Models 14T2 and 1225. Primarily designed for use by a large rental organisation the coil has been subjected to extensive chassis test before being released. Of castellated Ferroxc-core construction it requires no electrical or mechanical modifications. The retail price of the unit is 50s.

Noisy Switches

NOISY switches on turret tuners are becoming a major problem for the service engineer, particularly when the sets are subject to a maintenance

or rental contract. Cleaning the contacts with normal switch cleaner fluids acts as a temporary remedy but engineers report that this usually lasts for only a short period, after which the fault recurs.

Direct TV Replacements, 138, Lewisham Way, New Cross, S.E.14, have discussed this problem with one of the largest tuner units manufacturers and they state that only M.S.4 (Silicone) Grease should be used on tuner units. Knowing silicone grease to have good insulation properties, this matter was taken up with Midland Silicone. They strongly recommend the use of M.S.4 on all wave change and tuner unit contacts.

Carbon Resistors

IN recent years manufacturers of resistors have upgraded the rating of all resistors; the $\frac{1}{2}$ w. resistor is now $\frac{3}{4}$ w. and now there is in fact no $\frac{1}{2}$ w. resistor.

However, some designers and writers appear to be ignorant of these facts. Similarly the old $\frac{1}{2}$ w. rating is 1 w., 1 w. are $1\frac{1}{2}$ w., 2 w. are 3 w., $\frac{1}{4}$ and $\frac{1}{2}$ w. are advertised for sale in response to demand, but only $\frac{1}{2}$ w. are supplied.

Approximate length of resistors will indicate wattage 10 mm., $\frac{1}{2}$ w.; 20 mm., 1 w.; 40 mm., $1\frac{1}{2}$ w.; 50 mm., 3 w.; diameter can be ignored.

Russian Industrial Television

THE Leningrad Television Research Institute is reported to have produced a television unit for use in industry in badly-lit places such as smelling shops and rolling mills. The unit consists of a transmitting camera with a range of about 500 yards, a receiving set, manual control apparatus and a supply unit. A distinct picture is claimed for the unit as a result of the high sensitivity of the transmitting tube.

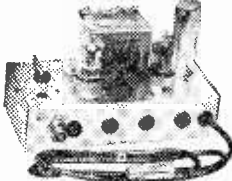
New Plessey Executive Director

MR. ANDREW M. BROWN, M.A., Ph.D., has been appointed an Executive Director of The Plessey Company Limited, with special responsibilities as Personnel Co-ordinator. He joins Plessey from the Mars Group of Companies, where, since 1952, he has been Executive Director (Administration and Personnel).



Our specialist buying knowledge and reputation ensure a square deal... and enable us to

offer the best for your money!



Volume Controls 80 ohm COAX
Log ratios, 10,000 ohms
-2 Megohms. Long
spindles. 1 year
guarantee. Midget Edi-
swan type.
No Sw. D.P.Sw.
3- 4.9
Linear Ratio. 10,000
ohms - 2 Megohms.
Less switch, 3- each.
Coax plugs, 1- Coax
sockets, 1- Coax
1.3. Outlet boxes, 4.6.

8d. yd.
SPECIAL - Semi-air
spaced polythene. 80
ohm Coax 4in. diam.
Standard core. Losses
cut 50%.
Ideal Band 3. **9d. yd.**

RECORD PLAYER CABINETS



Contemporary style, genuine covered cabinet in
moisture proof with cream interior. Size 18 1/2 x 13 1/2 x ht.
8 1/2 in. fitted with all accessories, including speaker
baffle board and plastic fret. Space available for all
modern amplifiers and autochangers, etc. Usual
record player mounting board 14 x 13 in.

Cabinet Price **£3.3.0.** Carr. and Ins., 3/6.

2-VALVE AMPLIFIER Mk. 1.

200 250 v. A.C. Modern circuit with High Gain
ECL4 output and double wound Main Transformer,
variable tone and volume controls, wired and tested
with 6in. Speaker and O.P. Trans. Complete with
knobs and drilled ready to fit Battle Board in above
cabinet. Only **£3.12.6.** Carr. & Pack, 2/6.

2-VALVE AMPLIFIER Mk. 2.

200 250 v. A.C. Specification as above but a higher
fidelity and greater output capacity. 3 watts! Is
obtained by using latest Twin Stage Triode-pentode
Valve ECL2 and negative feedback Tone Control.
Complete wired and tested as above **£3.19.6.** Carr.
& Pack, 2/6.

SPEAKER FRET—Expanded Bronze anodised
metal 8 x 5in., 2.3; 12 x 5in., 3/-; 12 x 12in., 4/6;
12 x 16in., 6/-; 24 x 12in., 9/-, etc.

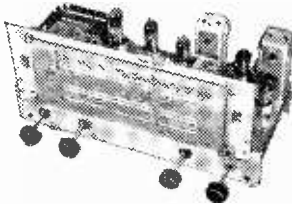
TYGAN FRET (Muphy patent) 12in. x 12in., 2/-;
12 x 15in., 3/-; 12 x 24in., 4/-, etc.

BAND 3 T/V CONVERTER—180 Mc/s - 205 Mc/s

Suitable for London, Birmingham, Northern, Scottish and Welsh ITA Transmissions.

Mk. 2 Model as illustrated. Latest Cascade
circuit using ECC84 and EF80 valves giving
improved sensitivity (+ 18 db) over standard
circuits. Built-in Power supply AC 200-250 v.
Dimensions only 6 1/2 in. x 3 in. Ht. 4 in.
Simple and easy to fit—only external plug in
connections, wired, aligned and tested ready
for use. State Channel required. Guar.
Bargain Offer—good results or full refund,

only **£3.19.6.** Carr. & Pack, 2/6. Band 1,
Band 3 Change-over Switch and B.B.C.
aerial socket, 8/- extra.
CONVERTER ACCESSORIES
Band 1-Band 3 Cross-over Unit, 7/6. Var.
Attenuators 6db-36db., 7/6. BBC Pattern
Filter, 8/6. Band 3 Aerials—outside Single
Dipole with 4 yds. co-ax., etc., 13.9. 3
Element Beam, 27.6. 5 Element, 35/-, etc.



ALL-WAVE RADIOGRAM CHASSIS
3 WAVEBANDS
S.W. 16 m.—50 m.
M.W. 200 m.—500 m.
L.W. 800 m.—2,000 m.
Brand new and guaranteed. A.C. 200 250 v., 4 pos. W.C.
sw. Short-Medium-Long-Gram. P.U. socket. High
Q dust core coils. Latest circuit technique, delayed
AVC and neg. feedback O.P. 4 watts. Chassis
size 13 1/2 x 3 1/2 x 2 1/2 in. x 4 1/2 in. Hor. or Vert.
Station names. Walnut or ivory knobs to choice.
Aligned and calibrated ready for use. Sensitivity
and Quality at Low Cost.
Chassis isolated from mains. **BARGAIN 9/1 gns.**
Carr. and Ins., 4/6.

RECORD PLAYER BARGAINS
4 sp. PSR (TU9), 92 6 sp. COLLAR JUNIOR,
£4.10.0. 4 sp. GARRARD (4 S.P.), £7.15.0.
Carr. & Ins. 3/6.
AUTO CHANGERS—4 sp. ESR (T.A.S.) £7.19.6.
4 sp. COLLAR, £7.19.6. 4 sp. GARRARD
(TU9, 4H.2), £10.5.0. Carr. & Ins., 4/6.
All above units are latest models and are
fitted with modern styled lightweight Xtal. P.U.
with turnover head and twin sapphire stylus.

RECONDITIONED TV TUBES.
Revacuumed and Re-activated.—(Guaran. 6 mths.
12in. Mullard, Mazda, etc., £6.10.0. (As available).
14in. Mullard, Mazda (Rect.), £7.0.0.
17in. Mullard, Mazda (Rect.), £8.10.0.
Carr. & Ins. 12/6.

AND NOW—New Heater, Cathode, and Gun
assemblies fitted to your own tubes—reconditioned
virtually as new, only 20/- extra. Repair only
Mull. r1 & Ma-da. types at present. Fully guar.
7-10 days delivery.

I.F. TRANSFORMER—465 kc/s.
Brand new vacuum former budget I.F.T.
size 2 1/2 in. x 3 in. x 3 in. dust core tuning. Litx
wound coils. High Q. Bargain offer, 7/6 pair.

NEW BOXED VALVES

NEW BOXED	VALVES	GUARANTEED	ALL
1R5, 1T4 7 6	DF96	9/- EF41	10/6 PCF82 10 6
1R5, 1R4 7 6	DK96	9/- EF80	10/6 PCL83 12 6
384, 3V1 8	DL96	9/- EF86	13/6 P181 14 6
6Z4	9/6 35L5	10/6 EF91	8/6 P182 10 -
6AT6	8/6 6AR5	9/6 EL41	10/6 P183 11 6
6K7	8/6 EB01	6/6 EL84	11/6 PY81 9 6
6K8	8/6 EB04	10/6 EM55	11/6 PY81 9 6
6Q7	8/6 EC03S	9/6 EY51	12/6 PY82 8 6
6XN7	8/6 EC84	12/6 EY86	14/6 PY83 10 6
6V6	7/6 EC90	12/6 EY40	8/6 T22 8 6
6X4	7/6 EC92	12/6 EY80	8/6 T25 12 6
6X5	7/6 EH42	10/6 EY81	8/6 TCH42 10 6
7C5	9/- ECR81	10/6 M114	9/6 UF41 10 -
7X4	8/6 ECL80	12/6 PC84	10/6 UL41 10 6
DAF96	9/- ECL82	12/6 PCF80	10/6 UL41 8 6

SPECIAL PRICE PER SET
1R5, 1T4, 1R5, 1R4 or 384, or 3V4 ... 27/6
DK96, DL96, DAF96, DL96 ... 35/-
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... 35/-

ELECTROLYTIC ALL TYPES NEW STOCK

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

C.R.T. Heater Isolation Transformers

New improved types—mains prim.
200/250 v. tapped.
All Isolation Transformers now supplied with
alternative no. cost, plus 25%, and plus 50%
foot taps, at no extra charge.
2V. 2A type 12.6 (P & P, 1.6)
6.5V. 1A " 12.6 " "
10.5V. 1A " 12.6 " "
15V. 1A " 12.6 " "
Other voltages on course of production.
Small size and tag terminated for easy fitting.

JASON F.M. TUNER UNIT 87-103 Mc/s.
Designer Approved Kit of parts to build this modern
highly successful unit, drilled chassis and superior
type dial. Coils, caps, and all quality components
etc., for only 5 gns. post free. Set of 4 spec. EPR1's
or similar valves, 30/- post free. Illustrated hand-
book with full details, 2/- post free. EPR1 WITH
KIT. 48 hr. alignment service, 7.6 plus 2/- P. & P.

TRANSFORMER & COIL WINDING CAPACITY AVAILABLE FOR PROTOTYPES & SMALL RUNS.

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

Terms: C.W.O. or C.O.D. Kindly make cheques, P.O.s, etc., payable to T.R.S. Post Packing up to 3lb. 7d., 1lb. 11d., 3lb. 1/6, 5lb. 2/-, 10lb. 2/9.
Hours: 9 a.m.-6 p.m. 1 p.m. Wed. Open all day Saturday.



RADIO COMPONENT SPECIALISTS (Est. 1946)
70 BRIGSTOCK ROAD, THORNTON HEATH, SURREY (THO 2188)
50 yards Thornton Heath Station.
Buses: 130A, 133, 159, 165 and 193

PREMIER RADIO CO.

(Regd.) B. H. MORRIS & CO. (RADIO) LTD.
 207, EDGWARE ROAD, LONDON, W.2. 23, TOTTENHAM COURT ROAD, LONDON, W.1.
 Telephone: AMBassador 4033. PADDington 3271/2. Telephone: MUSeum 3451.

The "Petite" PORTABLE

May Be Built For
£7.7.0



plus 3/- p. & p.
 ★ Size only 8in. x 8in. x 4 1/2in.
 Batteries Extra. HT 10/- (Type B126) or equivalent. LT 1/6 (Type AD35) or equivalent.
Battery Eliminator now available for 37/6.

8-WATT AMPLIFIER

This design includes 5 miniature Valves of the latest types, an Ultralinear Output Transformer suitable for Speakers of 3 and 15 ohms and a very attractive Perspex front panel with gold lettering, complete set of parts, £8.8.0.
 Built and Tested £10.19.6. Postage & Packing 5/- extra.

Read what a customer says about the MAYFAIR Televisor

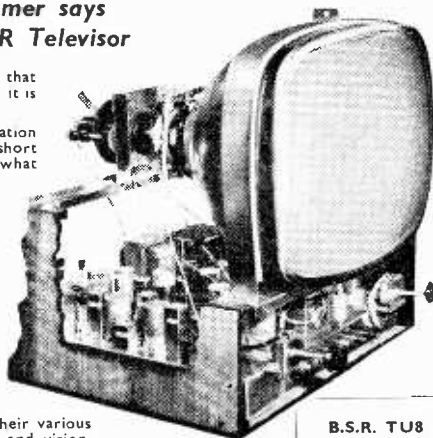
"I am writing to tell you that this set is a complete success. It is all you claim for it—Plus.

"Some 40 miles from the station a picture was obtained with a short length of flex, while a somewhat crude loft aerial produces results which astounded my neighbours with their expensive factory-made sets.

"Construction was begun in some trepidation, the groans implying that this was a somewhat risky operation to undertake, that the picture received would be an inch wide stripe on the screen, that the coils would be out of line, etc. You can imagine my delight when I switched on for the first time to find all the controls performed their various functions exactly—on sound and vision.

This achievement on your part and mine gives added pleasure to viewing. Congratulations on an excellent circuit and kit."

MAY BE BUILT FOR **£33.7.11** Plus cost of C.R.T. Send for Inst. Book 3/6.



B.S.R. TU8

3-speed record player £3.19.6, plus 2/6 postage and packing.

PLEASE ADDRESS ALL MAIL ORDER ENQUIRIES TO Dept. (PT3), 207 EDGWARE RD., LONDON, W.2

REVACUUMED T.V. TUBES

SIX MONTHS' STRAIGHT GUARANTEE

Mullard

in.	£	s.	d.
14 MW 36-22	5	10	0
14 MW 36-24	5	10	0
14 MW 36-44	5	10	0
14 AW 36-21	5	10	0
16 MW 41-1	7	0	0
17 MW 43-43	7	10	0
17 MW 43-64	7	10	0
17 MW 43-69	7	10	0
21 MW 53-20	10	10	0
21 MW 53-80	10	10	0

Mazda

in.	£	s.	d.
14 CRM 141	5	10	0
14 CRM 142	5	10	0
14 CRM 143	5	10	0
15 CRM 153	6	10	0
17 CRM 171	7	10	0
17 CRM 172	7	10	0
21 CRM 211	10	10	0
21 CRM 212	10	10	0

Brimar

14 CI4BM	5	10	0
14 CI4FM	5	10	0
17 CI7BM	7	10	0
17 CI7FM	7	10	0
17 CI7JM	7	10	0

14 in. Marconi, Emitron, Ferranti, G.E.C. **£5 10 0.**
 17 in. Marconi, Emitron, Ferranti, G.E.C. **£7 10 0.**

Carriage and Insurance 12/6 (U.K.). Cash with order. Personal Callers Welcome.

VIDIO REPLACEMENT CO.

HALES ST., DEPTFORD HIGH ST., LONDON, S.E.8
 Telephone: TIDEWAY 4503

BAND III CONVERTOR for ANY SET in ANY AREA

This unit has been widely used since I.T.A. Transmissions began to convert all types of sets, Superhet and T.R.F., to receive on Band III.

Unlike many other convertors this unit is small enough to be fitted inside your cabinet, enabling the job to appear finished and perfectly safe for all to use.

- ★ The wiring is simple to follow, and alignment is not difficult.
- ★ IT will convert any set, any age, T.R.F. or Superhet.
- ★ IT includes station switching.
- ★ IT provides pre-set contrast balancing.
- ★ IT uses only one aerial input for both bands
- ★ IT provides manual tuning on Band III.
- ★ IT is totally screened.
- ★ IT completely rejects unwanted signals.
- ★ IT requires no additional power supply where either 6.3 v. or .3 amp. heater line is available.

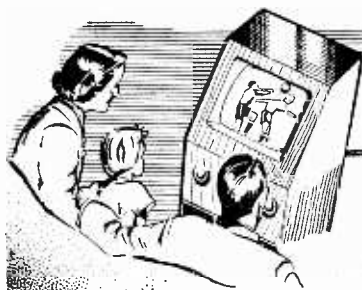
CONVERTOR wired and aligned with fitting instructions	£3 10 6
KIT complete in every detail, less knobs	£2 10 6
KNOBS each	1 0
CIRCUIT and instructions in detail (free with kit)	1 6
KITS made up by customers checked and aligned, including post	12 6

When ordering please state present B.B.C. Station and I.T.A. Orders over £2 post free.

C. & G. KITS

285, LOWER ADDISCOMBE ROAD, ADDISCOMBE, CROYDON, SURREY

Phone: ADDIScombe 5262



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

Television Studios of the Future

WHAT is the ideal shape and size for a television studio? The BBC has made up its mind, so far as the White City Television Centre is concerned, by building a number of stages 70ft. \times 50ft. \times 33ft. high, for "general purposes," with 100ft. \times 80ft. \times 44ft. high, for dramatic and spectacular shows. It is significant, however, that at least one of the large stages will be built so that it can be readily converted into two smaller studios, if required. And now, many of the I.T.A. chief engineers are planning ahead, working out the shape of their future stages as they survey the cramped operation of some of their somewhat makeshift existing facilities. Naturally, expansion has followed success—and now long-term planning of specially designed premises must follow the use of expedients.

Site Values

UP to now, most of the I.T.A. companies followed the lead of the BBC in converting existing buildings—ex-music halls, theatres, cinemas, chapels or warehouses. The dimensions of the studio stages and their adjacent service rooms—offices, dressing rooms, workshops, control rooms—have largely been a matter of luck. Time has been a big factor, too, because not many months elapse between the signing of a programme companies' contract with the I.T.A. and the opening of the station, during which period plans have to be drawn up and passed by the authorities, premises to be modified and equipment to be installed. Programme companies also value the site location, which is of enormous publicity value if it is in the centre of a city. Scottish Television's con-

version of the Theatre Royal, Glasgow, is a good example of theatre modification, enabling a first-class public relations job to be done, both for keeping the name of the organisation well in the public eye and for enabling audience participation programmes to be carried out in the best possible manner. Wood Green Empire, London, A-TV's main studio of this type, is also favoured with reasonable facilities and space for workshops and scene docks, though I have always been puzzled at the decision to dispose of the original pleasant theatre frontage on the High Road, Wood Green.

New Buildings

GRANADA were lucky in Manchester in finding a fine central site on which to build new premises, with plenty of space for expansion. This foresight is now paying off.

Granada's original main stage was 65ft. \times 48ft. and their new one is 60ft. \times 76ft. \times 37ft. high. Other I.T.A. companies, riding the waves of success, are already considering expansion on a large scale and are feeling the restrictions imposed by their converted premises. T.W.W.'s decision to build new at Cardiff, and to build a very large stage on a site which allowed for future expansion, was a good one. Here, the main stage is 60ft. \times 80ft. with a clearance height to the lighting grid of 19ft. This seems low, but in practice is entirely satisfactory and economical to operate for lighting. It also fulfils the requirement of a "general purpose" studio of ample space for a large number of small sets on one stage. I hear that Tyne Tees Television at Newcastle-on-Tyne are planning two stages, each 65ft. \times 75ft., together with a small presentation studio—all in brand new buildings. South-

ern Television, at Southampton, have converted a cinema into a main 50ft. \times 65ft. studio and an interview studio with an area of 600 sq. ft., but much of the building work is new and there is plenty of adjacent land for expansion.

It is a curious fact that the building of new studio premises, if economically carried out, is not very much more expensive than modifying existing buildings. New television studio buildings enable full advantage to be taken of the latest time and labour-saving devices for lighting, camera operation and production control. By comparison, the traditional fittings and fixtures of the theatre or the film studio appear to be almost prehistoric! The new television stages now coming along will owe little to the one-direction mechanics of the theatre or to the heavyweight lamps and restrictive practices of the film studio.

"As the Twig is Bent"

A-TV's play *As the Twig is Bent* could scarcely be called a cheerful subject. The steady downward path of a juvenile delinquent, influenced either by environment or heredity, was the basic theme of Ivor Novello's play *Downhill* and of the Rex Harrison film *Rake's Progress*, but the downbeat atmosphere of these subjects was relieved by the charm of the principal actor and by occasional comedy. Barbara Couper's play *As the Twig is Bent* did not have these advantages and yet, surprisingly, held the attention of viewers. With a rather documentary approach to the development of the story, producer Lionel Harris presented the principal character, Chris, in such an unsympathetic light that one wondered at the dumbness

of the other characters in the story in ever believing in his integrity. Brian Bedford played this role with great brilliance, as did Margot van der Burgh in the part of his long-suffering mother. Smoothly directed and with fine production values, it steadily moved towards the inevitable end—prison for the son and suicide for the mother.

Television Films

THE number of films specially made in England for television is on the increase, and one authority has claimed that no less than £8,000,000 will be spent on them this year. A large proportion of this huge sum is accounted for by several joint Anglo-American serial films, in which American television film companies have a large investment. These include *Ivanhoe*, and *The Tales of Frankenstein*, in which Screen Gems Inc. are participating, *Dial 999*, which is partly financed by ZIV, *Glencannon* for Gross and Krasne Inc., *Robin Hood* and *Four Just Men* by Sapphire Films and *William Tell* by I.T.P.C. All of these film series will be shown on major American networks, in addition to being shown either by the BBC or I.T.A. As the average cost per 24-minute episode is about £9,000, it would not be possible to recoup this amount in Britain alone—which rarely pays more than £2,000 per episode.

Next year, I am told, the output of British-made television films will be even greater, with dozens of studio stages devoted to this new form of "quickie." Some of the older studios for feature films which were turned over to other work, such as the Teddington Studios, may come back into the films—for television purposes only. Teddington, at one time used by Warner Brothers, but it has for many years been used as an aircraft factory. It has two large stages, 123ft. × 70ft. and 130ft. × 80ft. with adequate workshops and ancillary buildings.

Special Negative

KODAK LTD. and other film stock manufacturers are making special 16mm. negative with much greater accuracy in

the perforations. Experiments are going ahead with lacquering the negative film so that it can be handled more easily for editing purposes without getting damaged. And there is every possibility that a special heavy-duty 16mm. projector will be manufactured, for use with Vidicon telecine machines, to replace the light-weight amateur type projectors now in use. In this way, good quality 16mm. films should be able to be made at a cost of about £1 per minute for film stock and processing, including the cost of magnetic striping on the film. This will certainly be a boon to the regional stations of both BBC and I.T.A.

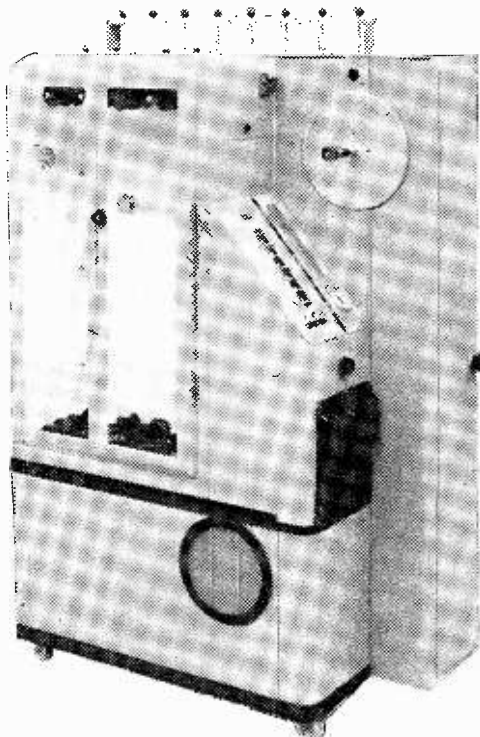
Reduction Prints

ALMOST all the big television series or serial films are photographed on 35mm. film, from which are made optical reduction prints in the 16mm. gauge. This is essential in U.S.A., where a large proportion of the 250 or so television stations are equipped only with 16mm. telcine machines. Local newsreel or magazine items, on the other hand, are photographed on 16mm. film, processed at the television studio in a small automatic developing machine and televised in negative form, a positive picture being obtained by phase reversal. This system is used here by both BBC and Independent Television News, and is likely to be extended to other features if improvements in equipment and techniques now being worked out prove successful. Technical Cinematographic Requirements Ltd. "Lawley Junior" automatic 16mm. or 35mm. film pro-

cessors are now in action at the BBC. I.T.-News and various programme companies.

Farce and Satire

PRIVATE'S PROGRESS and *Brothers In Law* were so successful in the cinemas that it is not surprising that the same formulae have inspired quite a few television plays. Granada's *The Army Game* must be one of the most successful series that this go-ahead organisation have turned out, having obtained top ratings from the public opinion polls week after week. During the process of adapting it to the television medium, it has lost some of the satirical touches and descended into the light-headed regions of farce without losing its appeal. With the BBC play *Touch Wood*, descent to farce was avoided, but the mixture was none the less highly acceptable. This was the story of an unfortunate young serviceman whose blunders in the Army and on being demobbed lead to tremendous complications of nation-wide importance.



The Technical Cinematographic Requirements Ltd. "Lawley Junior" Film Processor.

Yours the easiest way!

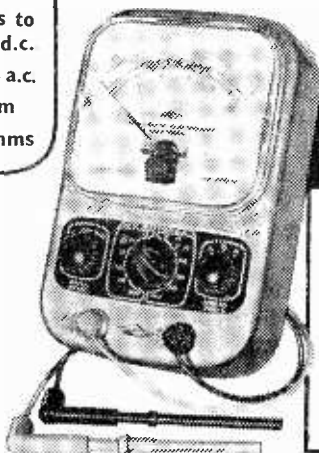
21 RANGES

covering
 10-1000 d.c. volts
 10-1000 a.c. volts
 100 Microamps to
 500 Milliamps d.c.
 100 Microamps a.c.
 0 to 1 Megohm
 0 to 10,000 ohms

★ *There is also
 the SERIES 90*

Terms for the Series 90
 Test Set (19 self-
 contained ranges ac/dc
 200 micro-amps 5,000
 ohms per volt).

Deposit 35/- and six
 monthly payments of
 28/10. (Cash price
 £9.15.0.)



MULTI-RANGE TEST SET - SERIES 100

To MEASURING INSTRUMENTS (PULLIN) LTD.
 Electric Works, Winchester Street, Acton, London, W.3
 Please send illustrated leaflet of the series 100 Test Set with
 details of new easy payment scheme

.....
 Ditto, Series 90
 * Please indicate instrument required

NAME
 ADDRESS

D858

GD20

LINE OUTPUT TRANSFORMERS

Most types available. State Make and Model
 Number of Receiver when ordering.

S.A.E. please with all enquiries.

HOWORTH

51 POLLARD LANE, BRADFORD, 2, YORKS

Tel. 37030

BAR-VACS

(Tel. RIP 1591)

8 WILMINGTON GARDENS,
 BARKING, ESSEX

REBUILT TUBES

	12 in.	14 in.	17 in.	21 in.
MAZDA	£8	£10	£12	£14
MULLARD	£8	£10	£12	£14

GUARANTEED SIX MONTHS. P.P. & Ins. 12/6,
 BRAYHEAD CONVERTERS £6.15.0. 5/- P.P. & Ins.

Terms C.W.O.

PLEASE SEND S.A.E. FOR ANY ENQUIRIES

EDDY'S (Nottm.) LTD.

(DEPT. P.T.)

172, ALFRETON ROAD, NOTTINGHAM

ACOS CRYSTAL MIKES. List Price £2.10.0. OUR PRICE,
 29/11, Plus 3/- Postage and Packing. New and Boxed. Excellent
 for Tape Recorders, Amplifiers. Baby Alarms, etc.

MIDGET BATTERY ELIMINATORS. To convert all types
 Battery Portables to mains operation, 57/6 each, 2/6 Post and Pack-
 ing. Smaller than H.T. battery alone. (Please state make and
 model No.) New and Boxed.

ACOS CRYSTAL TURNOVER PICK-UPS (2 Sapphire
 Styli), 29/11 each, Post 2/6 extra. New and Boxed.

MAP CASES, 2/11 each, Plus 6d. extra Postage. Ideal for the
 Motorist, Service Sheet holders, Job Cards, etc.

ACOS MIKE INSERTS, 4/11 each. High Quality. Can be
 used for Tape Recorders, Baby Alarms, Musical Instruments,
 etc. Post and Packing 8d. extra. New and Boxed.

AZ31	12/11	ECC82	8/-	IPC80	12/6	1T4	7/3	6SN7GT	
CY31	12/11	ECC83	8/11	PCL83	15/6	3Q5GT	9/6		5/11
DAF96	9/6	ECC84	8/11	PEN36C		5U4G	6/6	6V6G	5/11
DF96	9/6	ECC85	8/11			14/6	5Z4G	9/11	6X5GT 6/6
DK96	9/6	ECH42	10/11	PL81	16/6	6BB8	2/11	12AT6	8/9
DL96	9/6	ECL80	13/6	PL82	9/-	6F1	13/11	25A6G	12/11
DM70	7/11	EF80	8/6	PY81	8/6	6F13	13/-	35A5	10/6
EB91	5/11	EF91	6/11	PY82	8/6	6F15	13/-	35W4	7/6
EBC41	9/6	EY51	12/6	TDD4	12/6	6J5G	2/11	807	4/11
EBF80	9/6	EY86	15/-	1D5	10/6	6K7G	2/11	95A	1/6
ECC81	8/-	IPCC84	9/-	1R5	7/11	6K8G	7/11	955	3/11
				1S5	7/3	6Q7G	8/11	956	2/11

Any parcel insured
 against damage in
 transit for only 6d.
 extra per order.
 All uninsured parcels
 at customer's
 risk.

SURPLUS, NEW AND GUARAN- TEED VALVES.

All tested before
 despatch. C.O.D. or
 C.W.O. only.

Postage and Pack-
 ing 6d. per valve
 extra. Over £3
 Free. S.A.E. with
 all Enquiries.

VALVES • SAME DAY SERVICE

All Guaranteed New and Boxed

1.4v. midget, 1R5, 1S5, 1T4, 3S4, 3Q4, 3V4, DAF91, DF91, DK91, DL92, DL94; ANY 4 for 27/6.

1A7GT	19/6	6U4GT	11/-	DAF36	8/6	EP55	9/6	PL82	8/6
1C5GT	13/-	6V8G	7/6	DC80	10/6	EP80	7/6	PL83	10/6
1D5	12/6	6V9GT	7/6	DF30	11/-	EP86	14/-	PY80	8/-
1H5GT	11/-	6X4	7/6	DF36	8/6	EP91	6/9	PY81	8/-
1N5GT	11/-	6X5GT	6/6	DH76	7/6	EP92	5/6	PY82	8/6
1R5	8/-	7B3	12/6	DH77	7/3	EL33	16/9	PY83	8/6
1S4	10/-	7B7	8/-	DK32	19/6	EL38	22/6	PZ30	18/-
1S5	7/6	7C5	8/-	DK32	19/6	EL41	9/6	R19	13/-
1T4	7/-	7C6	8/-	DK96	8/6	EL42	11/6	SP41	3/6
1U5	6/6	7H7	8/-	DL33	9/6	EL84	8/9	SP51	3/6
3A5	10/6	7S7	9/-	DL35	13/-	EM80	9/6	U25	15/-
3Q4	7/6	7Y4	8/-	DL86	8/6	EM81	10/6	U50	7/6
3Q5GT	9/6	12AH8	9/-	EABC30	7/9	EY5T	11/6	U76	7/6
3S4	7/6	12AT7	8/-	EAF42	9/6	EY86	13/6	U78	7/-
3V4	8/6	12A07	7/-	EB91	5/6	EZ40	7/9	UABC80	9/-
5U4G	8/-	12AX7	8/-	EBC33	7/6	EZ41	10/3	UAF42	9/6
5V4G	11/9	12K7GT	7/6	EBC41	9/6	EZ30	6/6	UBC41	8/6
5Y3GT	7/6	12K8GT	12/6	EBC49	8/9	EZ91	9/-	UBF80	9/6
5Z4G	9/6	12Q7GT	7/6	ECC81	8/-	FW4.500	10/6	UCC85	9/-
6AL5	5/6	12Z3	7/6	ECC82	7/-	GZ32	11/-	UCH42	9/-
6AM5	5/-	14S7	12/-	ECC83	8/-	KT33C	8/6	UCH81	9/6
6AM6	6/9	19AQ5	7/6	ECC84	9/6	KT83	6/6	UCL83	14/6
6AQ5	7/6	25A8G	13/6	ECC85	9/6	MH4	6/-	UF41	8/-
6AT6	7/6	25L6GT	8/6	ECP80	10/6	MU14	9/-	UF42	15/-
6BA5	7/-	25Z4G	9/6	ECP82	11/-	N18	7/6	UF89	9/-
6BB6	7/-	25Z6GT	9/-	ECH21	16/9	PCC84	9/-	UL41	8/9
6BH6	9/-	35L6GT	9/6	ECH35	10/-	PCF80	9/-	UL44	22/6
6BJ6	7/-	35Z4GT	7/6	ECH42	9/-	PCF82	10/-	UL84	8/6
6BR7	8/6	35Z5GT	9/6	ECH81	11/9	PCL82	10/-	UR1C	12/6
6BW6	7/6	43	12/6	ECL80	11/9	PCL83	12/-	UY21	15/-
6BW7	7/6	50CD6G	18/9	ECL82	11/9	PENA4	11/-	UY41	8/6
6CD6G	25/-	50L6GT	8/6	EP37A	8/6	PEN36C	14/6	UY85	8/-
6FG6	6/6	AZ31	11/6	EP39	9/6	PEN46	6/-	VP41	6/6
6K7C	4/6	B36	15/-	EP41	9/6	PL36	15/-	W76	7/6
6K7GT	8/-	CL33	19/9	EP42	11/6	PL38	22/6	W77	5/6
6KB6	7/9	D77	5/6	EP50 (SYL)	6/6	PL81	16/-	Z77	6/9
6Q7GT	9/-	DAC32	11/-					Z79	8/3
6SL7GT	7/6								
6SN7GT	7/6								

Postage 6d. per valve extra.

Any Parcel Insured Against Damage in Transit 6d. extra.

READERS RADIO

24, COLBERG PLACE, STAMFORD HILL, LONDON, N.16 STA. 4587

REBUILT TUBES

SEND YOUR DUD MULLARD AND MAZDA TUBES TO US FOR REBUILDING

Via B.R.S. (Parcels) Ltd., or BRITISH RAILWAYS.

MULLARD	-	12"	£7.10	14"	£8.10
		17"	£10.10	21"	£12.10
MAZDA	-	14"	£8.10	15" & 17"	£10.10

Carriage and Insurance 15/- each tube.

FULLY GUARANTEED SIX MONTHS

LINE OUTPUT TRANSFORMERS AND DEFLECTOR COILS

Most types can be supplied. State set make, model number and part required. S.A.E. please.

BRAYHEAD TURRET CONVERTERS

CONVERTERS £6.19.6. Plug-in Adapter if needed 7/6. Postage and packing 2/6. State set make, model number and channels required.

Terms C.W.O. or pro forma

PRIME ELECTRICS (Dept W/2)

36, QUEENSDALE ROAD, LONDON, W.11. (Near Shepherds Bush Central Line.) Phone - PARK 1131. CALLERS: 10.30-3 MON.-SAT. Closed WED.

NOW IN BOOK FORM—

Just Published

A BEGINNER'S GUIDE TO TELEVISION

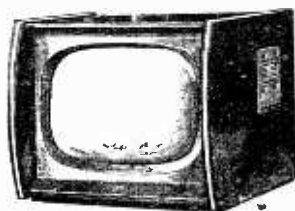
By F. J. CAMM

THE outstanding success of F. J. Camm's "A Beginner's Guide to Radio" has prompted the writing of this companion volume. It contains a series of lessons for the student, enthusiast and teacher covering such subjects as persistence of vision and scanning; the cathode-ray tube and timebase; interlacing; the aerial; the TV camera; scanning systems; colour and stereoscopic television, etc. There is a valuable section on technical terms. With 61 illustrations.

7s. 6d.
FROM ALL BOOKSELLERS

... or, in case of difficulty, 8s. 3d. by post from GEORGE NEWNES LTD., Tower House, Southampton Street, W.C.2.

59 Gns.—'17'



A full specification 17in. Television Receiver to Spencer-West standards now available at your Dealers. Remarkable performance and priced at 59 Gns. only, complete.

For Leaflet apply to:—

SPENCER - WEST LTD.
Quay Works, Great Yarmouth
Norfolk

Phones: Works 4794; Sales 3009
Grams: Spencer-West, Great Yarmouth

CORRESPONDENCE

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

MORE FOR THE BEGINNER?

SIR.—Could you not publish more articles for the beginner? I know that you have published such articles in the past, but I am sure you are aware of the fact that newcomers enter the field every year, and that it is necessary to some extent to go over the same old ground—as the gardening papers do. A feature of your paper which I find most interesting is “Your Problems Solved” pages. I regularly cut these out each month, classify them according to make and stick them into a book. I work for a radio and TV dealer and am often able from this source of information to remedy troubles which have baffled the dealer, and he is quite hot stuff. My book of cuttings is in constant demand.—P. B. (Westerham).

TROUBLE WITH A PROJECTION RECEIVER

SIR.—After my Philips 1400A projection receiver had been operating for about an hour of so, the picture began to deteriorate and focus control required frequent adjustment until the tube finally blacked out. After about 10 minutes' rest, the picture reappeared normally, and then started to fade out again. The EHT amplifier valve and video amplifier were renewed. The tube no longer blacked out but the picture was not very strong and showed three or four diagonal lines at times. Brightness control was fully retarded and if advanced the picture disappeared. Contrast control also could only be slightly advanced. Focus control had to be almost fully advanced and when the television cameras switched the strength of the picture altered giving two different qualities of picture, one fairly good and the other faint and misty. When a voltmeter was applied between the grid of the tube and earth the picture became normal and there was plenty of adjustment on all controls. The set is now operating satisfactorily with a 100,000 ohm resistor connected in place of the voltmeter. Sound is perfect with no hum or interference.—D. F. (Glasgow).

FAULT WITH THE T161

SIR.—Your diagnosis of the trouble with my T161 proved correct. I have fitted an isolating transformer as you suggested and the picture is now perfect. Prior to writing to you, I had not thought to look to the tube heater which had a separate winding on the filament transformer and this had led me into a sense of false security. I should like to add that I was only able to obtain service information through one of your advertisers, a request for a theoretical circuit from Messrs. Ekco having been turned down flat with the suggestion that I took the set to a service agent. Would it not be

possible through your columns to list firms who refuse to supply this very necessary diagram, so that the public may be warned before purchasing a new receiver? Some firms do supply this information without quibble and these firms should be patronised to the detriment of others who do not. Good wishes to your practical journals.—C. B. C. (Pinner).

A VISION ABOUT TELEVISION

SIR.—I read in my local paper that a local man had invented a brand new system of colour television which he claimed was revolutionary. So I went along for a demonstration.

A weird contraption was generating a smoky gas on which the inventor claimed a picture would appear. He said the receiver did not always work as it was only in the experimental stages. Needless to say, a picture did not appear. I asked him how he had arrived at this weird device, and he informed me in all

seriousness that as a spiritualist he had been informed that he was sent to produce colour television and his “guide” had told him to persevere with the experiments and he would become more famous than Baird! Aren't there some crazy people in this world? The line of demarcation between sanity and lunacy must be a very fine one in such cases as that quoted. I suggested to him that he was either a conceited humbug or a borderline case. I wrote to my local paper, asking them, not, in future, to publish such tosh and giving the editor the facts.—D. C. (Orpington).

TV ON TAPE

SIR.—Several years ago you defied the critics, who said that recorded TV was impossible, except by film, by stating that it was possible to record on wax and on tape. You have seen both your prophecies come true. The Ampex system now being introduced over here to record both sound and vision on tape is the justification for your belief, and it should go a long way to cheapen programme production. Artists will be able to record at their leisure. It will dispense largely with telecine and repeat performances can be given without the personal appearance of the cast.

Whilst I am writing, I should like to congratulate you upon the high standard you have set in your journal. It not only gives us the gen on servicing which the manufacturers refuse to supply, but your technical articles are written for all to understand. News of new developments always appear first in your journal and I for one should like to see it published as a weekly.

I have all the pre-war issues of PRACTICAL TELEVISION.—B. O. (Plymouth).

SPECIAL NOTE

Will readers please note that we are unable to supply Service Sheets or Circuits of ex-government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

News From the Trade

The New "Vantenna"

THE "Vantenna" All-band Room Aerial has been designed to satisfy every possible requirement for a high quality all-band room aerial at a remarkably low price (25s. retail). It is intended for use in good signal areas which are free from interference. It will stand on top of a television receiver or hang on the wall as required. It is the ideal "second aerial"—enabling the television receiver to be used in any room.

A special feature of this new aerial is the capacity coupling provided by high grade silvered mica capacitors in each lead which give complete anti-shock protection enabling the aerial to be handled in complete safety with the receiver switched on.

The "Vantenna" is well designed, soundly constructed and superbly finished. It can be used as a "Vee" or as a straight dipole (vertical or horizontal), the wide range of adjustment providing exceptional performance on all channels is achieved by specially designed spring loaded ball-joints giving a 90 deg. cone of rotation to each rod. The high impact Polystyrene moulding is black and mounted on a heavy casting with a highly polished copper rim. The twin telescopic rods have a bright copper anodised finish and black tip protectors to match the base. The adequate weight of the base together with the rubber/cork composition non-slip friction pad prevents the aerial from slipping, toppling or scratching when placed on a polished surface.

Two alternative "key hole" positions are provided on the underside of the base to enable the aerial to be hung on the wall as a "Vee" or as a straight dipole for vertically or horizontally polarised signals.

A 10ft. coaxial lead fitted with a standard coaxial plug to R.E.C.M.F. specification is provided so that it is "ready to plug in."

Supplied in attractive display cartons the "Vantenna" will be available almost immediately through all Antiference distributors at 25s. each (retail).—Antiference Ltd., Bicester Road, Aylesbury, Bucks.



The "Vantenna" all-band room aerial.

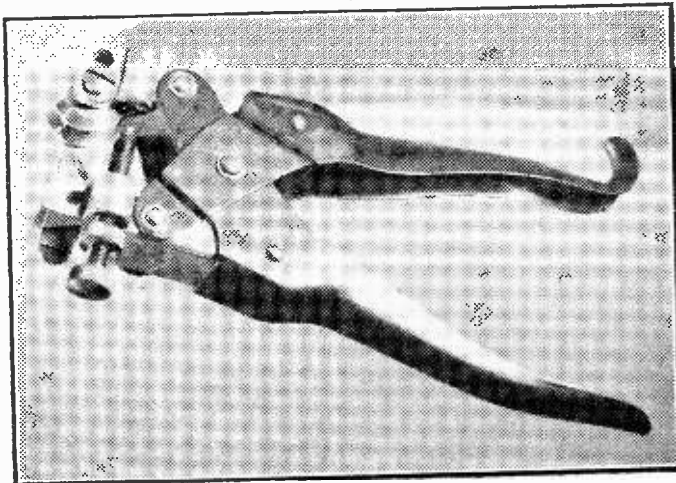
Cable Stripping Pliers

CREATORS LTD., of Woking, have pleasure in bringing to your attention their new roller-type cable stripping pliers, which have been specially designed to remove the insulation from electric cables of $\frac{1}{8}$ in. to $\frac{3}{8}$ in. diameter.

The cable passes over an aluminium V-pulley in one of the jaws and is guided in a straight line along the inside of a shaped handle. The other jaw carries a replaceable steel stripping blade and an adjustable and lockable stop-screw which prevents the blade from cutting into the cable core.

Three blade positions and two roller positions are provided to accommodate cables of different diameters, and the blade clamping plate can be adjusted to limit the depth of the cut. Two sizes of roller are available, the smaller for cable diameters from $\frac{1}{8}$ in. to $\frac{3}{8}$ in., and the larger for diameters from $\frac{3}{8}$ in. to about $\frac{1}{2}$ in.; rollers for special cable sections can be made up as required.

Retail price £2 7s. 6d., delivery four to six weeks.—Creators Ltd., Plansel Works, Sheerwater, Woking Surrey.



The new roller-type cable stripping pliers.

Wanted!

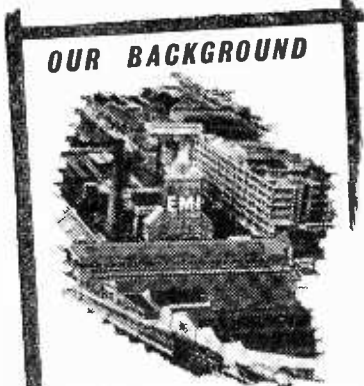
QUALIFIED MEN AND WOMEN

Industry and Commerce offer their best posts to those with the qualifications—appointments that will bring personal satisfaction, good money, status and security. As part of a modern industrial organisation, we have skilled knowledge of what is required and the best means of training personnel for present day and future requirements. We specialise also in teaching for hobbies, new interests or part-time occupations in any of the subjects listed here. Write to us to-day for further information. There is no obligation of any kind.

PERSONAL & INDIVIDUAL TRAINING IN —

- | | | | |
|---------------------------------------|-------------------------|-------------------------------|--------------------------------|
| Accountancy | Draughtsmanship | Mathematics | Sales Management |
| Advertising | Economics | M.C.A. Licences | Sanitary Engineering |
| Aeronautical Eng. | Electrical Eng. | Metalurgy | Salesmanship |
| A.R.B. Licences | Electrical Instal. | Motor Eng. | Secretaryship |
| Art (Fashion, Illustrating, Humorous) | Electronic | Painting & Decorating | Servo Mechanisms |
| Automobile Eng. | Draughtsmanship | Photography | Shorthand & Typing |
| Banking | Eng. Drawing | P.M.G. Certs. | Short Story Writing |
| Book-keeping | Export | Police | Short Wave Radio |
| Building | Gen. Cert. of Education | Production Eng. | Sound Recording |
| Business Management | Heat & Vent. Eng. | Production Planning | Telecommunications |
| Carpentry | *Hi-Fi* Equipment | Radar | Television Time & Motion Study |
| Chemistry | High Speed | Radio | Tracing |
| City & Guilds Exams | Oil Engines | Radio Amateur (C & G) Licence | Transistors |
| Civil Service | Industrial Admin. | Radio Engineering | Welding |
| Commercial Subjects | Jig & Tool Design | Radio & Television Servicing | Workshop Practice |
| Commercial Art | Journalism | Refrigeration | Works Management etc., etc. |
| Computers | Languages Management | | |
| Customs Officer | Maintenance Eng. | | |

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H.&V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Exams, R.T.E.B. Servicing Certificates, R.S.A. Certs., etc., etc. Moderate fees.



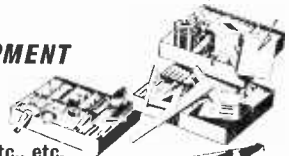
The E.M.I. Factories at Hayes, England.
The only Home Study College
 operated by a world-wide
 manufacturing organisation

EMI

INSTITUTES

NEW! Courses with PRACTICAL EQUIPMENT

in RADIO • TELEVISION • MECHANICS
 CHEMISTRY • ELECTRICITY
 DRAUGHTSMANSHIP • PHOTOGRAPHY etc., etc.



POST THIS TODAY

To: E.M.I. INSTITUTES, Dept. 138K, London, W.4.
 NAME _____ AGE _____
 (if under 21)

ADDRESS _____

I am interested in the following subject(s) with/without equipment _____

AUG./58 (We shall not worry you with personal visits)

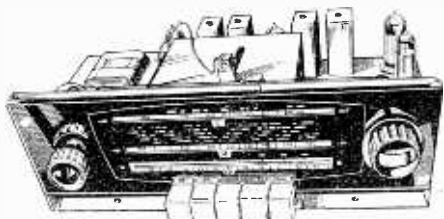


BLOCK
 CAPS
 PLEASE

1C92

-Part of "His Master's Voice" Columbia, etc., etc.

WONDERFUL OFFER OF A.M.-F.M. CHASSIS BY FAMOUS MANUFACTURER



Why buy a F.M. Tuner at the same price?
 Only 50 available at £12.12.0 (P. & P. 8/-). **UNUSED.**
 Tapped input 200-225 v. and 226-250 v. A.C. **ONLY.**
 Chassis size 15" x 6 3/4" x 5 1/2" high; 7" x 4" Elliptical speaker.
 Dial 14 1/2" x 4" in gold, red and deep brown.
 Pick-up, Extension speaker, Ae., E., and Dipole sockets.
 Five "piano" push buttons—OFF, L.W., M.W., F.M. and Gram.
 Covers 1,000-1,900 M.; 200-550 M.; 88-108 Mc/s.
 Aligned and tested. With all valves.
 Valves EZ80 rect., ECH81, EF89, EABC80, EL84, ECC85.
 Cabinet to fit, polished, with back, 47/6.

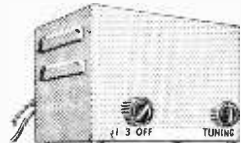
WORTH TWICE THE PRICE.

TERMS:—£5 Down and 4 Monthly Payments of 42/-.

£4.7.6

ECC81 valves.

With metal cabinet as illustrated. Stove enamel grey hammer finish. 5" x 7 1/2" x 4 1/2".



FINAL OFFER of last few hundred of highly successful High Gain Band 3 I.T.A. T.V. Converters (over 20,000 sold in 2 years). (After this batch we are supplying only the Moulded Case design to use materials already in stock.) Walnut Finish Cabinet, 5/- extra. Fully Guaranteed. 2 valves. Internal Power Pack with Metal Rectifier. All exactly as in previous issues of P.T. and P.W. (Post 3/-; C.O.D. 2/-)

Write for details of our 2 Valve + Rectifier Portable Guitar Amplifier in Carrying Case. Less than £8.

GRAMOPHONE AMPLIFIER with 6 1/2" (or 7" x 4") SPEAKER

WHY PAY MORE? ONLY 60/- (POST 3/-)

Mains and Output Transformers. Metal Rectifier. ECL82 Valve. Tone and Volume Controls. On-off switch. Plenty of Volume. Fully Guaranteed. Two Knobs supplied.

BATTERY ELIMINATOR. Converts your Battery Set to Mains. For 4 Low Consumption Valves (DK96 range). 90 v. 15 mA. and 1.4 v. 250 mA., 42/6 (2/6 Post). 200-250 v. A.C. Size 5 1/2" x 3 1/2" x 2".

Posted Orders to Camberley, please. Delivery by return. Terms:—One-third down and balance plus 7/6 in four equal monthly payments. Postage with down payment.

GLADSTONE RADIO

82B, High Street, Camberley, Surrey, and 3, Church Road, Redfield, Bristol. Tel.: 51207.

NEW-MAX ELECTRONICS LTD.

For London's Finest Bargains in electronics, television and radio equipment.
 50) REPOSESED AND SHOP SOILED T.V. SETS IN STOCK. ALSO LARGE SELECTION OF TAPE RECORDERS ALL GUARANTEED.

T.V. TUBES

RECLAIMED & GUARANTEED
 10in. and 12in.. 8s; 14in.. 15s; 15in. and 17in.. 17s.10.0.
BRAND NEW FULLY GUARANTEED
 14in. M.W. 36-24 tubes, 16s.10.0.
 17in. M.W. 43-24 tubes, 17s.10.0.
 P.P. & Insurance on all tubes. 15/-.
BRAND NEW T1291 12in. flat face 2 volt filament. Ferranti tube will replace Brimar-Mazda-G.E.C. 12in. tubes. Price 10.10.0. Guaranteed 6 months.
 Also Ferranti 9in. T9/3 brand new 4 volt filament will replace G.E.C., Mazda or Brimar. 7s.0.0.

SPECIAL OFFER. The Schmidt T.V. projection optical box for 22in. picture back projection including focus and frame coils, less tube. Original price £30. Our price including P. & P., 15.10.
 A full range of F.M. and A.M. Tuners, Hi-Fi and stereophonic amplifiers, record players, record changers, radiograms, F.M. and A.M. Chassis. All types and makes of test Instruments, shavers, typewriters, radios, including portables.

SPECIAL OFFER. 1,200ft. recording tape on 7in. reels, well-known make—list price, 35/- . Our price 22/6 or 6 for 120 .

Orders and Calls to:
NEW-MAX ELECTRONICS LTD.
 220 Edgware Road, London, W.2.
 PAD 5607

TRANSFORMERS?

CONTACT Forrest FIRST!

Rewinding and manufacture of all types for Television, Radio and Electronic Application.

FORREST (TRANSFORMERS) LTD.,
 Shirley, Southampton, Warwickshire.
 Phone: SH1. 2483. Est. 34 years.

ALUMINIUM, LIGHT ALLOYS, BRASS, COPPER, BRONZE,

IN ROD, BAR, SHEET, TUBE, STRIP WIRE, ANGLE, CHANNEL, TEE

3000 STANDARD STOCK SIZES

H. ROLLET & CO., LTD.

6, CHESHAM PLACE, LONDON, S.W.1.
 SLOane 3463

Works:

35, ROSEBERY AVE., LONDON, E.C.1.

Branches at Liverpool, Manchester, Birmingham, Leeds.

"No Quantity too Small"

RES/CAP. BRIDGE 35/-

Checks all types of resistors and condensers.

Easy to Build Up Easy to Use
READY CALIBRATED

Stamp for details of this and other kits.

RADIO MAIL (Dept. VC)
 Raleigh Mews, Raleigh Street, Nottingham

B.S.R.4-speed Type AU8 Record Changer 12.12.6, 3/6 carriage.

Ion-trap Magnets, 5/-. 7in. x 4in. P.M. Speakers. 18/-.

Air-spaced Coaxial Cable, 9d. per yd. 70/- per 100 yds.

Sapphire Stylus Replacement Needles. Standard or L.P. All types at 6/- including T.C.4, H.G.P. 37, H.G.P. 59, Studio "O", G.C.2, T.C.8, etc. Please state cartridge number when ordering or enquiring. Postage 3d.

Television Aerials. Band III 3 element, 28/6; 5 element, 39/6; 8 element, 58/6; B.B.C. Single Dipole, 32/6. We carry large stocks of all types of aerials. Send S.A.E. with your enquiry and we will reply by return.

Television Tables. Walnut finish 20in. x 20in. x 24in. high. Packed flat in carton, only 4 wing nuts to assemble. 72/6.

Electrolytic Condensers. 8+8 mfd. 350 v., 2/6; 107 mfd. 450 v., 6/6; 16 mfd. 450 v., 2/6; 16+16 mfd. 450 v., 4/6; 32 mfd. 450 v., 3/6. **Polished Aluminium Kettles.** Fully guaranteed. 59/6.

Crossover Boxes for T.V. 12/-; Coax Plugs, 1/-; Fuses 11in., 500 m.A., 1 amp., 1.5 amp., 2 amp., 3 amp., 5 amp., 4/- per doz.

Valves

OZ4	5/-	6SN7	6/-	6BG6G	12/6	GZ32	15/-
1A5	3/-	6B8G	3/6	19/6	PZ39	17/6	
11N5	2/6	1625	5/6	EF85	7/6	EY86	17/6
2X2	2/6	807	5/6	6X4	8/-	PY31	17/6
3D6	2/6	616	1/6	UBC41	8/6	PY32	17/6
615	4/-	EB91	6/-	ECL32	PL23	17/6	
12J5	4/-	EL38	21/6	12/6	PL38	21/6	
EL33	15/-	6CD6G	12AT7	10/-	PCF39		
6SL7	6/-	24/6	CL33	17/6	12/6		

MAIL ORDER ONLY—NO CALLERS

Terms: C.W.O. or C.O.D. Minimum C.O.D. charge 3/6. Postage and Packing per valve, 6d.; other items, under £2, 1/9; £5, 2/-. Aerials 3/- carriage.

ELECTRO-SERVICES & Co.

221 BATTERSEA PARK ROAD,
 LONDON, S.W.11. MAC 8155



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 constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 46 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

MURPHY V310

My set was six months old on the 30th June. To date, my original choice and confidence in this set has been fully justified, with the following exception. Under normal transmission conditions I receive a first-class picture on BBC or I.T.A. but on viewing either test card and following all instructions re controls I find it impossible to obtain full picture height without slightly elongating vertically the large circle centrally situated on test card "C." If I make the necessary correction on the test card I am left with an $\frac{1}{2}$ in. + gap at the top and bottom of the screen. As I am interested in attaining the maximum performance from my set I find this minor distortion somewhat irritating. Incidentally the mains supply voltage has been tested and found correct by the Electricity Authority.—G. W. Warner (Morecambe).

The original V310 had a 30P12 frame output valve and subsequent ones had a 30P16 (PL82). We suggest you check this valve's performance. You can get to it by laying the set on its face, removing the two bottom bolts and lifting the cabinet off. We assume you have adjusted "frame linearity" which is above "height" and is accessible through the hole in the cabinet.

PHILIPS 1446V

I have been getting excellent reception both vision and sound for quite a while, now I am being troubled by a very bad hum which almost drowns the music or speech and also spoils the picture, the hum is only present when the vision signal is on. If you would let me know what you think may be the cause and what I could do about it I should be extremely grateful.—W. Waygood (Southampton).

The fault would appear to be due to "vision on sound." This usually develops as a result of a change of characteristics in the PCF80 valve on the tuner unit. However, it is quite in order to

retune the oscillator coil core so as to tune to maximum sound with the fine tuner in the mid position. A hole is provided in the front of the tuner unit so that a suitable insulated trimming tool can be inserted. To gain access to the tuner unit turn set on its side and remove bottom cover.

MURPHY V280

The trouble is that the whole picture jumps now and again, it does not flicker into any line break up and does not roll up or down. The picture remains complete but this vertical jumping effect takes place now and again. I have watched carefully to see if it was sound on vision but the jumping effect only seems to tie in now and again with sound. Can you help me with this problem?—F. Roach (Roufford).

We suggest you check the 6/30L2 frame clipper/oscillator which is beneath the deflector coils. As the set is a bit critical on frame in fringe areas the 470 pF connected to pin 6 of this valve can be increased to .001 mfd.

SOBEL TS17

The picture of my three-year-old TV set of the above model is falling off rather badly and I am uncertain as to whether I require a new tube or that the trouble lies in another direction. When the set is first switched on in the evening the picture is very poor. Basically, it lacks brightness. If I attempt to overcome this by turning up the brilliance control the result is still unsatisfactory. Black areas become a dark grey, and detail is lacking. It is as if the screen is covered with a fine bluish-grey veil. Flyback lines are prominent when the screen holds no picture between programmes. If the contrast is turned to the right, the picture becomes flooded with light. On the BBC the sensitivity control gives little difference except that when fully extended to the right, both sound and vision are affected by some interference, a drumming noise on sound, and lines across the picture. As the evening goes on so the picture improves and generally when I switch off around 11 p.m. the picture is quite a good one. It is clear, detail prominent in "dark" areas and white areas but it has a faint sepia cast. There is just one other detail. If when the set is first switched on and the programme is tuned to the ITV, then an effect of lightning is received. The dark picture is illuminated at irregular intervals very momentarily. If you think that a new C.R.T. is needed would you care to advise me whether I could fit such a tube? That is, whether the fitting of a tube is a mechanical job, similar to fitting a new valve only requiring more labour, etc. The point that worries me is that it may be that after a new C.R.T. is fitted the set will require some realignment. I shall be most grateful to you for your advice.—J. F. Morris (Cheshire).

From your description we would agree that your C.R.T. is failing. Tube changing on this model is fairly straightforward. You unbox the set, remove the tube holder and EHT cap (discharge it first) and ion trap. Slacken off the band around tube face and pull forward, support-

ing scanning coils. Remove all dust prior to replacing in reverse order. You may like to try a boost transformer first and we certainly recommend you to check the ion trap setting, which should be positioned for maximum brightness.

R.G.D. 1746

For the last few months I have been experiencing interference from another channel when I am tuned to Channel 9. Recently it has worsened. The interference takes the shape of springy coils at the top and bottom of the picture. The set has had no servicing as yet and as the picture on Band I is perfect I am sure that I am right and that the fault is only interference.—E. Platt (Shoreditch).

The patterning experienced, if present at all times, is likely to be due to adjacent channel interference. There is no wave trap included in the circuit to reject this, and if the fine tuner cannot be set to minimise it, try redirecting the aerial. If there is no improvement, separately tune the R.F. and aerial cores under the tuner unit (ganged to move in and out with the oscillator core). It may then be necessary to retune the rearmost I.F. transformer cores, just to the left of the focus magnet.

STRAD TA1414

My problem is lack of width. The picture usually has a $\frac{1}{4}$ in. or $\frac{1}{2}$ in. gap at either side, and no amount of manipulation by movement of the width control can put this right. Can you help me, please?—G. Stevenson (Co. Durham).

Lack of width denotes a failing H.T. rectifier as a general rule, but if this is found to be in order, have the line timebase valves checked.

DEFIANT MODEL 71

I cannot get the picture centred properly and am unable to find any control that moves the picture from side to side, only up and down. The picture was perfect when I first had the set (about 10 months ago), but for about six weeks the picture has gone to the right and has a blank margin down the left and all captions are cut off at the right-hand side. Could you tell me how to centre the picture?—C. Patmore (Ilford).

The shift lever on the focus assembly is capable of "in and out" movement as well as "side to side." Thus the picture is moved horizontally as well as vertically.

MURPHY V178

I have recently acquired this chassis cheaply, less valves, tube and metal rectifier, and intend it for experimental purposes with the idea of conversion to W.A. 17in. screen. I have searched through my Newnes "Radio and Television Servicing," also my copies of *Practical Television*, which I have bound for reference, but cannot trace any

reference to this circuit. In appearance it resembles the V120 but has been modified by the makers to use miniature eight-pin valves in place of octals, in two places on the S/V chassis, also, Line Flyback EHT and metal rectification are used. Would it be possible for you to inform me of the valve line up and positions, also the connections to the Line transformer (which have been disconnected)? Any information regarding the EHT voltage available, and your opinion as to the feasibility of carrying out the conversion already mentioned will be appreciated.—T. E. Soan (Orpington).

We doubt if the V178 has enough scanning power for a 17in. C.R.T. Its EHT when new was 10kV and there are five connections to the original line transformer. The two thick ones go to EHT condenser and EL38 anode. Of the other three one should read 86 ohms to EL38 anode (this goes to H.T.+). The other two have a reading of seven ohms between them and go to the scancoils via width, etc. The line-up is as per V120 with these differences: extra 6F12 R.F. amp., 6F13 video amp. Extra 6F12 sync scp. 6D2s instead of 6D1s. 6K25s instead of T41s. 6P25s instead of Pen 45s. C.R.T. cathode mod., bridge metal rectifier 14A124. EY51 EHT rect. U281 efficiency diode.

PAM 13-CHANNEL COMMERCIAL TV ADAPTOR

Can you tell me if the above can be used with a Stella Television set Type ST8314U-15. No. M10661. 180 watts?—G. Parkinson (Chorley).

The converter delivers an I.F. of 38.15 mc/s sound, but your Stella has 8.5 mc/s I.F.s. The unit is therefore unsuitable for the receiver and it is not practical to adapt it as it is of the incremental tuning type with preset local oscillator tracking.

FERGUSON 306T

The picture has disappeared altogether from the screen. After the set had been running for a short time the picture disappeared for about five minutes then it came back again, but about ten minutes later it disappeared altogether. The volume is perfect but it seems that a faulty valve is the cause of the loss of the picture. Please let me know the valve that is faulty, or other cause of the fault.—W. Thomson (Renfrewshire).

If illumination cannot be obtained on the screen by turning the brightness control fully on we suspect lack of EHT voltage. This is often caused by failure of one of the following valves: EY86, PL81, PY81—V9, V7 and V8.

QUERIES COUPON

This coupon is available until AUGUST 21st, 1958, and must accompany all Queries sent in accord with this notice on page 45.

PRACTICAL TELEVISION, AUGUST, 1958

FOR VALVES

GUARANTEED ALL TESTED BEFORE DESPATCH



ACCPEN 8.6	6CH35 10.6	EZ61 11.10	PLC88 14.6	U801 31.4	Z359 9.6	6BA3 7.6	6K70T 7.6	6X50T 7.6	12K90T	30FL1 11.6
ACCTH 1.6	6CH43 10.6	EZ90 8.6	PL38 27.10	UABC80	Z759 8.6	6B65 8.6	6K7M 6.0	6X30L2 12.6	13.6	30P4 21.7
ATP4 34.0	6CL82 12.8	EZ118 2.6	PL81 16.6	UAF42 10.6	Z759 3.6	6B66 24.4	6K9G 8.6	6B7 8.6	12Q7GT 7.6	30P12 12.6
AZ31 12.6	6E22 8.6	GZ32 12.6	PL82 8.6	UB41 9.6	1A5GT 11.6	6B66 16.6	6K8GT 10.6	7C5 8.6	12R7 1.8	30P11 12.6
CB131 24.4	6E36 6.6	H30 5.6	PL83 11.6	UB41 9.6	12.6	6B66 9.6	6K25 20.11	7C6 8.6	12R7 7.6	35L6GT 9.6
CB135 24.4	6E37A 12.6	H123D18 6.6	PX25 12.6	UB41 10.6	12.6	6BR7 11.6	6L6G 9.6	7D6 13.6	12R17 5.6	35W4 8.6
CL33 20.2	6E39 6.6	K40N 9.6	PY30 9.6	UBE80 9.6	10.5	6BW6 8.6	6L7 7.6	7H7 9.6	12R17 8.6	35Z4GT 9.6
CY31 17.5	6E40 13.6	KP35 8.6	PY81 10.6	UC8420 11.6	12.6	6BW7 10.6	6N7 7.6	7H7 9.6	12R17 6.6	35Z4GT 9.6
DAPF6 10.6	6E41 9.6	KK32 23.6	PY82 8.6	UC842 10.6	14.5GT	6C4 7.6	6P28 27.10	7H7 9.6	12R17 8.6	42 8.6
DP95 10.6	6E42 14.6	KL32 8.6	PZ30 20.11	UC880 11.6	11.4	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C5 11.6
DP63 9.6	6E43 4.6	KT31 5.6	PEN4DD 27.10	UC882 23.6	11.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C10G 31.4
DK96 10.6	6E44 6.6	KT36 10.6	PEN4VA 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
DL96 10.6	6E45 10.6	KT36 27.10	PEN45 15.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
DM79 8.6	6E46 8.6	KT55 12.6	PEN47 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EA30 1.6	6E47 9.6	KT66 15.6	PEN48 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EABCS0 10.6	6E48 14.6	KT66 15.6	PEN49 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EA791 7.6	6E49 10.6	KT66 15.6	PEN220A 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EAP42 10.6	6E50 10.6	KT66 15.6	PEN45 15.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EB34 2.6	6E51 10.6	KT66 15.6	PEN47 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EB41 9.6	6E52 27.10	KT66 15.6	PEN48 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EB43 7.6	6E53 10.6	KT66 15.6	PEN49 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EB44 10.6	6E54 10.6	KT66 15.6	PEN45 15.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EBP80 10.6	6E55 10.6	KT66 15.6	PEN47 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EBP89 18.1	6E56 10.6	KT66 15.6	PEN48 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EL121 24.4	6E57 10.6	KT66 15.6	PEN49 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EB131 24.4	6E58 11.6	KT66 15.6	PEN25 5.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EC84 10.3	6E59 13.6	KT66 15.6	PEN47 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EC85 9.6	6E60 13.6	KT66 15.6	PEN48 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EC86 13.6	6E61 9.6	KT66 15.6	PEN49 7.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EC87 12.6	6E62 10.6	KT66 15.6	PEN220A 27.10	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6
EH21 24.4	6E63 8.9	KT66 15.6	PEN45 15.6	UC885 25.9	12.5	6C6 8.6	6P28 27.10	7H7 9.6	12R17 8.6	50C11 21.6

RICHARD ALLAN "BAFFLETTE" EXTENSION SPEAKERS

Attractive walnut finished cabinet on black plinth—expanded metal grille, fitted volume control, 8in. p.m. speaker 2-4 ohm. Large purchase from Relay Company of used units as above. Only require removal of matching transformer. All are in good working order. Offered at a fraction of original cost. 25% post paid.

ALPHA RADIO SUPPLY CO.

103 LEEDS TERRACE
WINTON STREET
LEEDS 7

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/-, unless otherwise stated. Minimum C.O.D. fee and postage 3/-. All single valves posted 6d. Personal shoppers Monday-Friday 9 a.m. to 5 p.m. Saturdays 10 a.m. to 1 p.m.

St. Mary's Electronics

(Tel. AMBassador 9795)

18, PRAED STREET, LONDON, W.2.

REBUILT TUBES

	12 in.	14 in.	17 in.	21 in.
MAZDA ...	£8	£10	£12	£14
MULLARD ...	£8	£10	£12	£14

P.P. & INS. 12.6.
GUARANTEED SIX MONTHS
BRAYHEAD CONVERTERS £6.15.0. 5/- P.P. & Ins.
TERMS: C.W.O.
PLEASE SEND S.A.E. FOR ANY ENQUIRIES

A practical book on conversion—

T.V. CONVERSION FOR I.T.A. by C. E. Lotcho

THIS book provides information on the conversion of those television sets which receive B.B.C. programmes only so that they will receive both B.B.C. and I.T.A. stations. Included in the Reference Data given in Section 3 are the sound and vision intermediate frequencies of many hundreds of television models. The book contains over 170 illustrations and circuit diagrams, and is fully indexed.

25s. FROM ALL BOOKSELLERS

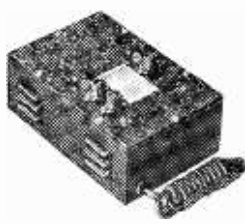
... or in case of difficulty 26s. 3d. by post from the publishers,
GEORGE NEWNES LTD., Tower House, Southampton Street, London, W.C.2.

NEWNES

SOMETHING NEW!!

A PRE-AMP FOR BOTH I.T.V. AND B.B.C.

Following the success achieved by our Band III Pre-amp, we introduce a combined unit designed to overcome the difficulties experienced in situations where reception of both I.T.V. and B.B.C. is extremely poor.



- Units now available:—
"DUAL BAND"
★ Co-ax Inputs for Bands I and III.
★ I.T.V.—amplified.
★ B.B.C.—amplified.
★ Single Output to Receiver.
Price £9.10.0 C.W.O. or C.O.D.
"SINGLE BAND"
★ Co-ax Inputs for Bands I and III.
★ I.T.V.—amplified.
★ B.B.C.—Diplexed.
★ Single Output to Receiver. Price £6-6-8, C.W.O. or C.O.D. Please state channels required.

Both Units have a high signal to noise ratio, and will produce excellent results in localities where the signal is normally unusable.

Units have Built-in Power Packs 200-50 v. A.C. Dimensions: 6 x 4 x 2½ in. (Fly Lead, 3/6 extra).

"AIRVISION"

(Electronic Equipment Manufacturers)

14 BOULTON RD., SOUTHSEA, HANTS.

SETS & COMPONENTS

UNREPEATABLE OFFER.—12in., 5-channel T.V., £15; 14in., £22; good working order. C. EDWARDS, 1070 Harrow Rd., London, N.W.10. (Phone: LADbroke 1734.)

12 MONTHS' GUARANTEE! The very best reconditioned c.r.t. ever offered. 12in. £9, 14in. £10, 15in. and 17in. £12/10/-; 21in., £16; carriage and insurance 22/6. S.C.L. 77, Cranleigh Road, Bournemouth.

ELECTRADIO. Co-ax. low loss. 9d. yd.: Plugs, Sockets, 1/- each. Multicore Solder, 2/6 per packet. Stirling Band III Converter, all channels. 6 gns., post free. 18. Broadlands, Av., Keynsham, Som.

RECLAIMED TUBES, 12in., 14in., 17in., all at £5 each, guaranteed; 100 (5 channel) T.V. Ekco 161, Ferguson 988, £15 each. C. EDWARDS, 1070, Harrow Rd. (Phone: LADbroke 1734.)

CATHODE RAY TUBES used but in good working order, with three months' written guarantee. 12in. to 17in. Mazda, Mullard and Equivalent types only, at £4/10/- plus 12/6 for carriage and insurance. Enquiries and orders to BHP DISTRIBUTORS (LONDON) LTD, 379, Staines Rd., Hounslow, Middlesex. (Tel.: HOU 5141.) Our terms are c.w.o. or c.o.d.

LOUDSPEAKERS repaired promptly. MODEL LOUDSPEAKER SERVICE, Bullington Rd., Oxford.

T.V. TUBES

We offer a really good reconditioned tube with a six-months' guarantee. 12" Mullard, £6; 14" Mullard and Mazda, £5.10; 17" Mullard and Mazda, £7.10; Customer's Repair Service. Your own Red Label Mullards repaired at prices as above less 10/-.

MIDLAND TUBES LIMITED
37, George Street, Manchester, 1.
Central 0432.

T.V. TUBES as new, revacuumed; all makes; 6 months' straight guarantee; 14in. £5/10/-, 17in. £7/10/-; carriage and insurance 12/6 U.K. Free delivery Greater London. VIDEO REPLACEMENT CO., Hales St., Deptford High St., London. S.E.8. (Tideway 4506.)

MAKE YOUR AERIALS with our fully machined parts. Examples: Band 1 "H" complete with lashings, for £3/10/-; 5 Element, Band 3, with folded dipole, mast and clamp for 45/-. Get further details from our illustrated lists and data on all aerials, sent for 1/- P.O. (Trade supplied.) SKYLINE WORKS, Burn-sall Rd., Coventry. (Tel.: 0418.)

SOUND & VISION STRIP. 25/3. Sound I.F. 10.5 Mc/s Vision I.F. 11 to 14 Mc/s. Less Valves. Valve line-up: 6 6F1's, 2 6D2's. Any single channel I-S supplied, a turret tuner is easily fitted. Power Pack Supply 200 v. H.T. 6.3 v. heaters, P. & P. 2/6.
R.F. E.H.T. COIL, 19/6, 7-10 KV. R.F. frequency approx. 10 kc/s. Uses 6V6 or 6P1 as osc.; suitable for ULTRA model V90, W70 and others. Size: 4" x 2" dia. Base: 4" x 4". Circuit drawings available. Postage 2/6.

DUKE & CO.
21-3, Romford Road, Manor Park, E.12.
LIF 6001/3.

RATES: 4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Television," Tower House, Southampton St., Strand, London, W.C.2.

SETS & COMPONENTS continued

CALLING CENTRAL SOUTHERN REGION: Convert NOW. It's simple with the BRAYHEAD TURRET TUNER. In stock for ANY AREA. State Channels, set make and model No. £9.19.6. post/ins., 2/6.
THE RADAR KILOVOLTER measures E.H.T. 3-30 KV., £3.17.6. post/ins. 2/6. Line and Frame osc. and O.P. transformers for 500 sets. EXACT REPLACEMENTS. State make and number with enquiry (3d. stamp).

WESTWAY RADIO
5, Westward Way, Harrow, Middx.

TELEVISIONS. London only. 12in., £10; 5-channel, 12in., £14; 14in., £18; 17in., £27; 13-channel, 12in., £20; 14in., £25; 17in., £35. (Callers only.) JOHN GILBERT TELEVISION, 1B, Shepherds Bush Rd., London, W.6. (SHE 8441.)

COMPONENTS. Valves, Tubes, etc. Write or phone for free list. ARION TELEVISION, 4, Maxted Rd., Peckham, S.E.15 (New Cross 7152.)

TELEVISION

CATHODE RAY TUBES

Reconditioned and Guaranteed 6 months.
14" round Mazdas—£5.0.0.
15" round Mazdas—£6.0.0.
17" rect. Mazdas—£6.0.0.
Carriage and insurance, 10/-.
Cash with orders to "TELESPEED," Dept. 2/B, 6 Clements Street, Coventry. Tel. 41062.

TUBES. Valves and Spares for every set from the year dot. Sets from £8. Tubes £4. Tube reconditioning at 4/- inch (patented process). Send s.a.e. for lists and details. LES HOWE AND SONS, 5, Auckland Close, Tilbury, Essex.

CONVERTERS (Rotary), 24 v. d.c. to 50 v. a.c., 4 amps, 50 cycles, new. 40/- (rail 5/-). Bargain list (500 items), 3d. S.A.E. W. A. BENSON, 139, Rathbone Rd., Liverpool, 15.

GUARANTEED TELEVISION, 12in. 5-Channel models; first-class picture. £26 each, cash paid. THE GRAMOPHONE SHOP, 19-21, Brockley Rise, London. S.E.23.

TELEVISION SPARES for 9in., 10in. and 12in. T.V.s. Valves, Components. Brayhead I.T.V. Converters, £4/18/-; s.a.e. PETTY SPARES, 9, St. Mary's Crescent, Portsmouth. (Phone: 6452.)

TELEVISION TUBES

NEW in Manufacturers' cartons and with Manufacturers' SIX months guarantee. GENUINE replacements for: BRIMAR C12B, C12A, FERRANTI T12.91, MAZDA CRM121 and CRM123. Limited number at £10 each. State make and model of set when ordering. FACTORY reconditioned tubes with SIX months guarantee also available: 12" £7, 14" £7.15.0, 17" £9.15.0, 21" £13.10.0.

CATHODE RAY TUBE SERVICE
35, Broomwood Road, St. Paul's Cray, Orpington 21285.

SETS & COMPONENTS continued

RECONDITIONED Television Tubes with 3 months' guarantee. Up to 17in. £5, 21in. £7/10/-, incl. carriage. Trade prices on application to: TELETUBE SERVICES, 5 Lawrence Hill, Bristol, 5

5-CHANNEL TELEVISIONS: 12in. screen Ferguson 988, Ekco 161, etc. £22 each. A good selection of 12in. T.V.s. (London). 100% condition, from £12; 9in. from £7, also 12in. T.V.s. slight faults, from £5; 9in. from £3. TYLER TELEVISION, 63, Lee High Rd., Lewisham, S.E.13. (LEE 5979.)

TELEVISIONS, 9in. models, £7/10/-; 12in. models, £13/10/-; 12in. 5-Channel models, £19/10/- each; all working; carriage paid. Send for list. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

T.V. TUBES, 14in., £3/10/-; 17in., £5; 15in. CRM153, £4; picture-tested and guaranteed 3 months. A few 12in. and 14in., suitable for testing or boosting. 25/- ea.; all carriage paid. BRADLEY, 6, Beadon Ave., Waterloo, Huddersfield.

RF27 or 26, 18/-; 25 or 24, 11/-, brand new, post 3/6. E.W.S. CO., 69, Church Rd., Moseley, Birmingham.

ASSIST-U-AERIAL KITS, containing insulator and cap for lin. boom in elements, 20 in. plugs, 2 1in. end plugs, 2 1in. grommets, suitable for construction of Band II or Band III Aerials, 6/6 complete. Send P.O. with order. ROBERT MOSS, LTD., 35, Banbury Rd., Kidlington, Oxford. Trade inquiries invited.

CATHODE RAY TUBES, ex-chassis, picture-tested, 3 months' guarantee. Mullard, Mazda, Brimar, etc. 9in., 12in., 14in., 15in., £3/10/-; 17in., £4 carriage and insurance, 15/-. Miniature Valves, 10/- dozen. S.C.L., 77, Cranleigh Rd., Bournemouth.

Save 30% on all outdoor aerials and fittings. Example: Double Five Array costs only 70/-. Self-contained Band III Pre-amplifiers only 60/-. Convertors 80/- complete. Fringe Area Super Low-Loss Co-axial, 1/4 yard. Reconditioned T.V. Tubes, 6 months' guarantee. 12" & 14" 110/-, 17" 150/-, 21" 210/-. C.W.O. carriage 10/- extra. S.A.E. FOR FULL LISTS.

G. A. STRANGE

North Wexham, Nr. Chippington, Wilts.
Tel.: Marshfield 236.

WANTED

VALVES WANTED, ECL80, EY51, EY86, PL81, PCF80, and all Miniature Types. U25, 10C1, 10C2, 10F1, etc. 52G, 6K8G, 6V6G, brand new only; prompt cash by return. R.H.S., 155, Swan Arcade, Bradford, 1.

IMPORTANT.—Valves wanted, new, loose or boxed; same day payment. ROBERT, 414, Whitefoot Lane, Bromley, Kent.

ALL TYPES OF VALVES WANTED. FL81, ECL80, EY51, U25, PCF80, PZ30, U801, etc. etc. Best cash price by return. STAN WILLETTS, 43, Spion Lane, West Bromwich, Staffs. (Tel.: WES 2392.)

SALE

Satisfaction or Money Back Guarantee
If returned unused within 7 days

13 CHANNEL CONVERTERS

For T.R.F. or Superhets. Famous make, fine tuner, 9 quick-set trimmers giving any 3 channels, output to aerial socket. Beautiful case, with PC84, PCF80. Full instructions. £3.15.0 (Post 3/-).
Focus Magnets w.a., centring, mounted, 9/8; ditto, double magnets, 12/6. 10X TRAPS, 4/-; D.F.L. COILS, 35 mm., 7/6. Super 38 mm... 15.-. 100-200 Mfd. 27v v.v. Conds., 5/8. T.V. CABINETS, 14 inch. attractive, mask, glass, front sprk., 25/-.

GUARANTEED T.V. TUBES!

(EX EQUIPMENT)

12in. (MW31-74, 3 31, etc.) £5. 5.0
14in. (MW35-21, CRM141, etc.) £4. 10.0
17in. (MW40-64, 415, etc.) £4. 10.0
17in. (CRM17 only) £6. 0.0
(All guaranteed 6 months.) (Carr. & Ins. 12/6.)
Also available limited number of T.V. Tubes giving very good picture when filament volts boosted. All types 30/- each. (Carr. & Ins. 12/6.)

STAAR GALAXY PICK-UPS

Lightweight all speeds, one hole mounting, complete with Power Point dual sapphire turnover cartridge, 19/6.
Ditto with Steig and Reuter or Sonotone dual sapphire turnover heads, 22/6.
Ditto latest Acos GP65 dual sapphire head, 25/-.



Above Autochanger mounted on streamlined high-finish case, as shown, to make complete add-on Player, which will play any 10 Records through your Radio or Amplifier for all mains voltages. (Post 4/-).

£5-15-0

COMPLETE PLAYER in 13 Gns.

covered two-tone quality portable Case, with above Autochanger, excellent 3-valve Amplifier, 7-inch Speaker, beautiful reproduction (worth over £20). (Post 5/-).

STAAR GALAXY SPARKS. 100s available, low prices, including motors, rubber idler pulleys, tone-arms, o.n. cartridges (Acos, Power Point, Sonotone), etc.

GUARANTEED RADIO VALVES, BOXED, SAME DAY SERVICE

5E46	6-18574T	6-18581	6-18584	6-18587	6-18590
5Z46	6-18587T	6-18592	6-18595	6-18598	6-18601
6A17	6-6V6G	6-6V6G	6-6V6G	6-6V6G	6-6V6G
6AL5	6-6V6M	6-6V6M	10-6V6T	10-6V6T	10-6V6T
6AM6	7-6X4	6-18V5	9-1P81	9-1P81	13-6
6BA6	6-6U4	12-6E780	12-1P82	9-6	11-6
6BE6	6-6U6	10-1P82	12-1P83	11-6	11-6
6C4	4-610L11	12-6E784	9-6P80	6-6	6-6
6C16	11-10P14	15-1E280	12-6P81	8-6	8-6
6C14	14-12A7	8-1E28	4-1P82	8-6	8-6
6C15	13-12A7	6-6E78	5-1P83	8-6	8-6
6C51	3-12AX7	8-6E780A	3-6E781	2-6	2-6
6C72	5-12X7	6-6E780B	4-8P81	2-6	2-6
6K7G	4-612Q74T	7-1E280	8-6U6	9-6	9-6
6K8G	7-62516G1	8-6E785	7-1E22	7-6	7-6
6L19	15-3524G1	7-6E780	9-6124	12-6	12-6
6L129	15-3071BR	3-6E781	7-1C85	12-6	12-6
6N72	9-607AXM	5-6E785	8-6U2	6-6	6-6
6N7M	7-1E281	5-6E784	6-1C82	6-6	6-6
6S7M	5-6E783	7-1E280	7-1C84	9-6	9-6
6S7M	7-1E281	9-6E782A	5-1C81	8-6	8-6
6SK7GT	6-1E282	9-1M14	9-206	12-6	12-6

S.A.E. FOR FREE LIST OF 500 SUPER SNIPS

All items less 5% and post free for a dozen. Postage 1/3 in £1. Min. 6d. No C.O.D.

TECHNICAL TRADING Co.
350/352 Fratton Rd., Portsmouth

FOR SALE

TELEVISION BARGAINS: 9in., seen working, £7/10/-; 17in., £37/10/-; new 17in. Sets, 59 Gns. Aerials and Co-ax. cheap. CLAYTON'S, of Church St., Chalvey, Slough.

SUPERTONIC SUNLAMPS, listed £7/10/-, 80/-. S.A.E. SCIENTIFIC PRODUCTS CO., Cleveleys, Lancs.

VALVE CARTONS.—We can supply from 12 to 100,000 off the shelf. Plain white or printed. Miniatures, 10/-; "G.T.s.", 12/-; "Gs.", 14/- per 100, plus 2/- postage. Also printing done to your special requirements; quotations gladly given. J. & A. BOXMAKERS, 75a, Goodwin St., Bradford, 1.

SCOUT MK.II Ex-W.D. TELESCOPES, 25 x 50, practically new, with case and sling, £7/15/- ea.; ditto, second-hand condition, £6/10/-; High-power Eyepieces to fit above scopes, 50x or 75x, state which, 50/- ea.; Triple Power Conversion Kits for the above scopes, giving 25x and 40x terrestrial and 60 astro, 50/- extra; 6 Power Kits, giving 25, 40, 50 and 80x terr. and 60 and 120x astro, at £5 extra. If scope already purchased elsewhere send us the erector (centre lens system) from your scope when ordering triple or 6 power kits. Returned intact. Ex-Gov. Telescopes terrestrial, all brass, in case 30x, 24in x 2in., weight 7lbs., near new, £4/5/- ea.; Telescopic Sights, 13in. long, weight 20oz., 17/6. No. 42 Rifle Sight, 3x, 50/-, near new. Tank Periscopes, boxed, unused, 7/6, post. 2/-; Directors, with 4x optical sight, ideal for builders, etc., will lay out any angle with precision of theodolite; sound detector, 45/- ea., cost over £80; ditto, in near new condition in leather case, £4/10/- ea.; ditto, minus case, £3/15/- ea.; H. W. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

"MAINS" FROM 12v. BATTERY.—Brand new American Dynamotor Unit in beautiful black crackle case. Weighs about 3 1/2 lbs., but neat and compact. Thousands of uses, no conversion required. In seconds makes marvelous, powerful 200/250 A.C./D.C. electric motor electric fan dynamotor gives 250 volts at about 100 watts from 12-volt car battery, runs mains radio, bulbs, etc. Makes ideal rotary transformer, battery charger, etc. Continuous duty, quiet running, doesn't overheat; worth £25—our price 80/-, with instructions; carriage paid; Satisfaction guaranteed. Send remittance with order. Dept. 8. SCIENTIFIC PRODUCTS, Manor Works, Cleveleys, Blackpool.

T.V. ON PARAFFIN without mains, by means of the famous Briggs & Stratton engine-driven generator; 230 volt A.C. 250 watts. Ideal for radio, television, portable tools and drills and floodlighting. Price only £40 each, carriage paid. GREEN ACE MOTORS LTD., 301/5, Norwich Rd., Ipswich.

AMAZING OFFER.—Originally £40/£100 each. Ekco. Pye, H.M.V., Marconi, Philips, Murphy, etc., 9/10in. Televisions, complete, now working, 50/- each; carriage paid; immediate dispatch. 12in., £5/5/-; 15in., £9; Philips 17in. Projection Televisions, £9/15/-. TOMLINS, 127, Brockley Rise, London, S.E.23.

FOR SALE continued

100 BAYS of brand new adjustable steel Shelving, 72in. high x 34in. wide x 12in. deep, stove enamelled, dark green; sent unassembled; 6-shelf bay, £3/15/-; sample delivered free; quantity discounts. N. C. BROWN, LTD., Eagle Steelworks, Heywood, Lancs. (Tel.: 69018.)

BRAND NEW Taylor 45C Valve Tester with CRT adapter; instructions and maker's guarantee. List price £35, our price £21 cash. REDMOND'S, 689, Little Horton Lane, Bradford, 5.

SECONDHAND TELEVISIONS, 9in. to 21in.; all makes; faulty and working. WILKINSON'S, 146a, Goldhawk Rd., Shepherds Bush, 4379.

EVERYTHING FOR THE AMATEUR.—Write for our new List catering for Home Engineers, H.F. Fans, Tape Recording Fans, etc., etc. Probably the most comprehensive in the trade. Price 1/-, R.H.S., 155, Swan Arcade, Bradford, 1.

CO-AXIAL CABLE, unbeatable offer. 8d. a yard air spaced.

TELEVISION TABLES cancelled order. 20" x 20", 18" legs, 4-quartered veneering, veneered both sides, in medium oak, walnut and supe. Unrepeatable offer while stocks last. 39/-, carriage 3/6.

MARSHALLS FOR TELEVISION

131, ST. ANN'S ROAD
TOTTENHAM, N.15
Phone: STAmford Hill 3267.

SERVICE SHEETS

SERVICE SHEETS for sale and hire. Radio T.V.; s.a.e. enquiries. J. PALMER, 32, Neasden Lane, N.W.10.

SERVICE MANUALS/SHEETS Tel. Radio for hire. Sale and wanted. Mixed Manuals and Sheets, 12 for 10/-; s.a.e. enquiries. W. J. GILBERT (P.T.), 21, Frithville Gdns., London, W.12.

WANTED, Loan of Service Sheet for T.V. Columbia C505. Box 13, c/o PRACTICAL TELEVISION.

ENGINEER has complete range Radio/T.V. Service Sheets, 4/- each; s.a.e. State Model No. required; c.w.o. L. BRENNER, 23, Meadow Close, Barnet, Herts.

PROPERTY

BERRYLANDS (Surbiton). Adjoining station in a fully built-up area, parade of spacious shops with 2 floor upper parts just constructed. To be let or sold. Trades already reserved: Grocer and Provision Merchant, Greengrocer, Ladies' Outer- and Underwear, Shoe Repairer, Tobacconist and Confectioner, Dyers and Cleaners, Retail Builders' Merchant and Pet Shop. Full details: MESSRS. WHIDDINGTON, Chartered Surveyors, 133, High Street, Teddington. (KINGSTON 1216 7/8.)

(Continued overleaf)

EDUCATIONAL

FREE! Brochure giving details of Home Study Training in Radio, Television and all branches of Electronics. Courses for the Hobby Enthusiast or for those aiming at the A.M. Brit. I.R.E., City and Guilds, R.T.E.B. and other Professional examinations. Train with college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. INSTITUTES, Dept. PT28, London, W.4.

STUDY RADIO, TELEVISION AND ELECTRONICS with the world's largest home study organisation—E.I.C.S. Courses for the enthusiast and for those seeking examination qualification. Brit. I.R.E., City and Guilds, R.T.E.B., etc. Build your own equipment with Practical Radio Course. Write to-day for free book: **INTERNATIONAL CORRESPONDENCE SCHOOLS**, 71, Kingsway, (Dept. CL.119), London, W.C.2.

BUILD YOUR OWN T/V and learn about its operation, maintenance and servicing. Qualified engineer-tutor available while you are learning and building. Free Brochure from E.M.I. INSTITUTES, Dept. PT58, London, W.1. (Associated with H.M.V.)

INCORPORATED Practical Radio Engineers home study courses of radio and T.V. engineering are recognised by the trade as outstanding and authoritative. Moderate fees to a limited number of students only. Syllabus of Instructional Text is free. "The Practical Radio Engineer" journal, sample copy 2/-. 6,000 Alignment Peaks for Superhets, 5/5. Membership and Entry Conditions booklet, 1/-. all post free from the SECRETARY, I.P.R.E., 20, Fairfield Road, London, N.8.

MATHEMATICS for T.V. Course. 21/-. **TUTORIAL MATHEMATICS.** 20/-. Buchanan St., Glasgow.

LEARN IT as you do it—we provide practical equipment combined with instruction in Radio, Television, Electricity, Mechanics, Chemistry, Photography etc. Write for full details to E.M.I. INSTITUTES, Dept. PT47, London, W.4.

RADIO AND TELEVISION COMPONENTS

We operate a prompt and efficient MAIL ORDER Service, 3d. stamp (on/ly) for Lists.

JAMES H. MARTIN & CO.
Dept. PT.
FINSTHWAITE, NEWBY-BRIDGE,
ULVERSTON, LANC.

from one source

Denco, Repanco, J.B., T.C.C., Woden, Elac, McMurdo, Radiospares, Eddystone, Elstone, Bulgin, Belling & Lee, Hunts, Sorad, Acos, Brown, Mullard, Irganic, Corsor, Taylor, Avo, Henley, E.M.I., etc.

Orders dealt with day received

55-page illustrated catalogue No. 11, with 103 photographic illustrations, and over 2,000 new guaranteed lines by leading makers. 9d. post free.

SOUTHERN RADIO and ELECTRICAL SUPPLIES

SORAD WORKS . REDLYNCH
SALISBURY . WILTS

P. P. COMPONENTS LTD.
219, ILFORD LANE, ILFORD, ESSEX.
Phone: ILF 0295

4D1	6.0	12K7	8.0	EP37	4.0	PL83	8.0
5Y3	8.0	12T4	8.0	EP39	3.0	PM22	1.0
6AM5	3.0	15L6	8.0	EP42	8.0	PP25	3.0
6AM6	7.0	63SPT	2.0	EP50 (reid)	PG1		6.0
6B7	1.0	7T7	3.0		5.0	RL37	1.0
6B8G	3.0	210VPT	5.0	EP80	8.0	SA61	6.0
6F12	7.0	7103	3.0	EP85	8.0	TT11	6.0
6F14	8.0	ARG2V		EP91	7.0	U22	10.0
6HM8	1.0		1.0	EP92	3.0	UF41	8.0
6J5M	2.0	ARP35	3.0	EL84	10.0	UV6	7.0
6K7M	3.0	V1083	3.0	EZ40	8.0	U32	8.0
6S7M	8.0	1D1	1.0	EZ60	8.0	VRS5	6.0
6V6M	8.0	1D176	8.0	FW4,500		VT32	6.0
6P28	12.0	DK96	8.0		10.0	VT301	6.0
6S47M	3.0	EP66	5.0	KTW61	5.0	VW36	1.0
6H47	3.0	EA50	1.0	KTW63	8.0	VW76	8.0
6H47M	2.0	EAB'80	9.0	L410	1.0	W30	3.0
812	3.0	EAF'42	8.0	NR41	1.0	Z77	7.0
813	7.0	EB34	2.0	PER43	6.0		
9D2	6.0	EW33	3.0	PEN46	6.0	UK	
11E3	5.0	EC81	8.0	PEN290A		TYPES	
12A6	8.0	ECH42	8.0		3.0	78	3.0
12A7	6.0	EP36	5.0	PL82	8.0	25RE	3.0

T.V. AERIALS, 25 6. For all I.T.A. channels. Outdoor or loft; 3-element. Half normal cost. P. & P. 2/6.

CA. AERIALS, 6 3. Whip antennae. 50in. long, collapsing to 11in.; 1-hole fixing. Post 1/-.

GANGED CONDENSERS, 1 8. 2- or 3-gang. Salvage, guaranteed; .0005. Post 1 3.

I.F. TRANSFORMERS, 1 - pair. 465 kc/s. Tested, guaranteed. Post 1 -.

RESISTANCE LINKS, 4d. each. "Bulgin." Super type wirewound resistance links. All NEW and boxed. 240 and 1,500 ohms, 2 6 doz. Post on 1 doz. bid.

12-VOLT CONVERTER, 5 9. Ex-W.D. 275 volt in, 500 volt out. Usabl. Needs cleaning but believed to be in perfect working order. Carriage 3 6 (owing to weight).

T.V. SLIDER CONTROLS, 9d. 10k and 2K only. Salvaged. Post 6d. 4 for 2 8.

SH. P.M. SPEAKERS, 8 9. Ideal gift if fitted in small cabinet. "Treat the lady at home." Fit one in kitchen or cupboard door. With O.P. trans., 10 -.

RECTIFIERS, 2 9. 250 volt 100 ma. Full- or half-wave. Salvage. Guar. Post 1 3.

ION TRAPS, 5 -. For all and any type of tube requiring a trap. Post 6d.

RESISTORS, 6d. doz. 270 ohms, 1 watt ceramic. Post on 1 doz. bid., on 4 doz. 1 -, on 10 doz. 2 6.

INSULATING TAPE, 1 6. 730i. x 3/4 in. wide. Post on 1 9d., on 5 only, 2 -.

SOLDER REELS, 1 6. 60-40, 5-core 12-in. 20ft. on plastic spool. Post 6d.

O.P. TRANSFORMERS, 1 3. Salvage, guaranteed. 2-5 ohms. Matching Pentode or Tetrode. Post 1 1 -, 20 for 2 1. Post 5 6.

HEADPHONES, 1 8. Single earphone and band, C-LR type. Grand bargain. Ideal for crystal sets, extension on T.V. or radio. Post 1 6.

CO-AXIAL CABLE, 6 1. yards. Cut to any length. 100 yards, post 3 6.

DROPPERS, 8d. e-h. 750 ohms, 2 amp. Post 6d. 5 - dozen, post 2 6.

CHASSIS, 1 - e-h. 6- or 8-valve, latest type midgeet valve design, for A.M. or F.M. New. Cadmium plated on s.w.g. steel. 12 1/2 in. x 7 1/2 in. x 2 1/2 in. Post 1 9. 4 for 4 -, post 3 -; 12 for 10 -, carr. 5 -.

CLOCKWORK MECHANISM, 1 9. A perfectly engineered clockwork unit, with a fully equipped clocktype spring, gear train and escapement. Ex-W.D. (type ROP(B)40SL). Can be modified for use as a darkroom timer. For the amateur with ideas. Drawings free. Post 1 -.

VOLUME CONTROLS, 1 8. 1 me-zolum. Long shodde. New, boxed. Post 1 6.

CONDENSERS, 9d. 32 mf., 450 volt working. Card-board. New. Post 1 -; 12 for 7 -, post 3 6.

R.F. FILTER UNITS, 1 9. G.P.O. specifications. Beautifully made in solid brass case. Fitted with in-out switch, simply fitted in the aerial. Has 2-stage tuning. Limited stock. Post 1 3.

VALVE SCREENING CANS, 1 - doz. Latest midgeet type. Aluminium. 2 1/2 in. x 1 1/2 in. dia. Post 6d.

NICKEL-CHROME WIRE, 1 -. .014 dia., on 50-yard spool; .002 dia., on 25-yard spool. Packed in nickel-plastic fins, with run-out mechanism, special luffed finish. Rustproof. Ideal for gardeners and outdoor use. Post 9d. 25 for 2 1, post 2 6.

SPRING STEEL WIRE, 6d. .014 dia., on 50-yard wood spool. Post 9d. 25 for 10 -, post 2 6.

CHOKES

250 ma, 4 9. Salvage, guaranteed. P. & P. 2 6.

10 to 30 - P. & P. 7 6.

80 ma, 2 9. Salvage, guaranteed. P. & P. 2 6.

10 for 20 - P. & P. 7 6.

60 ma, 1 8. Salvage, guaranteed. P. & P. 2 6.

10 to 10 - P. & P. 6 6.

TORCH LANTERNS, 6d. each. Ex-W.D. Including 2 bulbs. Uses 800 battery. Post 1 6. 5 - doz., post 3 -.

Crate of 48, 22 -, carr. 10 -.

PIANO HINGES, 1 6 pair. Chrome. New. 7 in. long. Post 3 3.

Send 3d. stamp for FREE catalogue.

OPPORTUNITIES IN TELEVISION



148 pages

Free!

Television offers unlimited scope to the technically qualified. Details of the easiest way to study for A.M. Brit. I.R.E., R.T.E.B. Cert., City and Guilds, "Television, Television Servicing, Sound Film Projection, Radio Diploma Courses, etc.", are given in our 148-page Handbook "ENGINEERING OPPORTUNITIES" which also explains the benefits of our Appointments Dept.

We Guarantee "NO PASS—NO FEE"
If you are earning less than £20 a week you must read this enlightening book.

Send for your copy NOW—FREE and without obligation.

WRITE TO-DAY!

British Institute of Engineering Technology
237, College House,
29-31, Wright's Lane, **BIET**
Kensington, W.8.

AN ELECTRONIC ORGAN FOR THE HOME CONSTRUCTOR

Simple and straightforward instructions for building an inexpensive musical instrument specially designed for amateur use in church, hall or home. Valuable features of its construction are the small dimensions. No electrical measuring instruments are required in order to set up this organ. If you can use a soldering iron, drill and screw-driver you can build it at home.

15/- by A. Douglas. Postage 1/-

- TELEVISION ENGINEERS' POCKET BOOK, by E. Molloy. J. P. Hawker. 10/6. Postage 6d.
- TV FAULT FINDING, a Data Pub. 5/-, Postage 6d.
- A BEGINNER'S GUIDE TO RADIO, by F. J. Camm. 7/6. Postage 6d.
- ELECTRONIC HOBBYISTS' HANDBOOK, by R. P. Turner. 20/-. Postage 8d.
- RADIO VALVE DATA, compiled by "W.W." 5/-. Postage 8d.

THE MODERN BOOK CO.

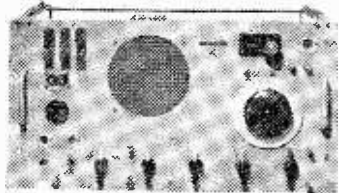
BRITAIN'S LARGEST STOCKISTS of British and American Technical Books
19-23 PRAED STREET, LONDON, W.2.

Complete Catalogue 6d.
Phone: PADdington 4185.
Open 6 days 9-6 p.m.

SHORT-WAVE RECEIVER

10-60 Mc/s (5-30 Metres)

RECEPTION SET TYPE 203



Complete with 6 valves, 2-6K8C, 2-EP39, 6Q7G and 6V6G. Internal mains power pack and 6 v. vibrator pack. Built-in 6" speaker. Muirhead slow-motion drive. B.F.O. and R.F. stage. Provision for 'Phones and Muting and 600 ohms. Combined Input 100/250 v. A.C. or 6 v. D.C. All sets in new condition and air tested. I.F. Frequency 2 Mc/s.

£6/19/6 Carr. 15/6.

BE PREPARED TO LISTEN TO THE SATELLITES

TRANSISTORS (PNP)

GREEN/YELLOW Audio Frequency. Amp. 7.6
WHITE-SPOT 2.5 Mc/s R.F. and I.F. Amp. 15.-
RED/YELLOW 1.5 to 8 Mc/s R.F. and I.F. Amp. 15.-

NEW BOXED VALVES!

EQUIVALENT TO FOLLOWING TYPES

AC/SC	GU50	MX40	VP45-pin
AC/SCVM	H30	PEN4VA	VP47-pin
AC/PEN	MSPEN 5-pin	PEN30C	VP4B
AC/VP15-pin	MSPEN 7-pin	PP36	VMS4
AC/VP17-pin	MVSPEN 5-pin	PP36	VMP4G
AC/VP2	MVSPEN 7-pin	SP45-pin	W42
AC/HLDD	MVSPENB	SP47-pin	ID5
CYIC	MHD4	S4VB	TD5
DDT4	MKT4	TD4	TD6
FC4	MS4B	URIC	41MPG

10/- each

A SELECTION FROM OUR LARGE RANGE:

ATP4	4/-	HL2	3/6	IT4	8/-	8SJ7	7/6
AZ31	12/6	KT2	5/-	IR5	8/-	6Q7	10/-
D42	5/-	MU14	8/6	IS5	8/-	6J6	6/-
DM70	9/-	OZ4	7/-	IS4	8/-	6BX6	7/6
DK40	10/-	PX25	12/6	3S4	8/-	6SK7	9/-
EA50	2/-	PX25A	12/6	3V4	9/-	6V6G	7/6
EB34	3/6	TD2A	8/6	5U4	8/6	7S7	9/-
EB91	7/6	VR105/30	8/6	SZ4	10/-	12A6	7/6
EP50	4/-	VR65	4/-	6AM6	7/6	12AT7	7/6
ECC81	9/-	XH(1.5 v.)	4/-	6AL5	7/6	25A6	10/-
ECL80	12/8	XP (2 v.)	4/-	6SN7	7/6	43	10/-
EP32	8/-	Y83	8/6	6SK7	7/6	50L6GT	10/-
EP18	17/6	Z77	7/6	6J5M	5/-	607	7/6

SEND FOR OUR FREE COMPLETE VALVE LIST

PYE 45 Mc/s STRIP TYPE 3583

Complete with 10-EP30's, EB34 and EA50 valves. Unit is in new condition.

ABSOLUTE BARGAIN! 39/6

Including modification data.

R.F. UNITS

Type 25 Switched Tuning 20 to 30 Mc/s. Unit includes 35P31's, 10"- carriage 2/6.
Type 26. Variable Tuning from 50 to 65 Mc/s. Including 2-EP34's and EC52. 25/-, carriage 2/6.

QUARTZ CRYSTAL UNITS IN STOCK

Frequency ranges from 100 kc/s to 36.7 Mc/s. SEND FOR FREE LIST.

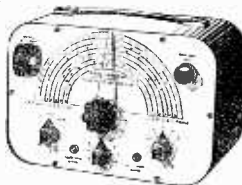
T/V Pre-Amp.. 45 Mc/s Pre-amp unit with 2-VR91 (slight modification necessary). 12/6.

OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock.

HENRY'S RADIO LTD.

5 HARROW ROAD, EDGWARE ROAD, LONDON, W.2
TEL.: PADDDINGTON 1003-9

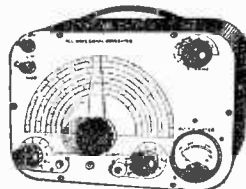
SIGNAL GENERATORS



£6.19.6 or 25- deposit and 6 monthly payments of 21/6. P. & P. 5- extra. Coverage 100 Kc/s-100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6in. x 5 1/2in. Grey case 10in. x 6in. x 5 1/2in. Incorporating hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250. Internal Modulation of 400 c.p.s. to a depth of 30%. modulated or unmodulated R.F. output continuously variable. 100 milli-volts. C.W. and mod. switch, variable A.F. output. Incorporating magic-eye as output indicator. Accuracy plus or minus 2%.

£4.19.6 or 25- deposit and 4 monthly payments of 21/6.

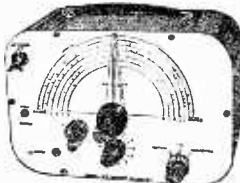
P. & P. 5- extra. Coverage 120 Kc/s-84 Mc/s. Metal case 10in. x 6in. x 4 1/2in. Size of scale. 6in. x 3 1/2in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30%, modulated or unmodulated R.F. output continuously variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%.



SIGNAL & PATTERN GENERATOR

25- deposit plus P. & P. 5- and 6 monthly payments of 21/6. Cash £6.19.6 plus P. & P. 5-.

Coverage 7.6 Mc/s-210 Mc/s in five bands, all on fundamentals, slow-motion tuning, audio output, 8 vertical and horizontal bars, logging scale. In grey hammer finished case with carrying handle. Accuracy 1%. A.C. mains 200-250 v.



COMPLETELY BUILT

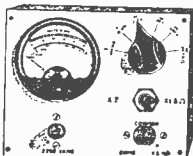
8 WATT AMPLIFIER

A.C. Mains 110/250 v. Size 10 1/2in. x 6 1/2in. x 2 1/2in. Incorporating 4 valves, H.F. pen., 2 triodes, 2 output pens., and rectifier. For use with all makes and types of pick-up and mike. Negative feed back. Two inputs, mike and gram, and controls for same. Separate controls for Bass and Treble lift. For use with Std. or I.P. records, insinual instruments such as Guitars, etc. Complete with 8in. speaker and ready for use.

£4.9.6

Plus P. & P. 5/-.

AC/DC POCKET MULTI-METER KIT



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

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

Built and tested 7/6 extra.

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

PORTABLE AMPLIFIER.—Size 6 1/2in. long, 5in. high, 2 1/2in. deep. Will suit any type of crystal pick-up. Output approx. 2 watts. Incorporating ECC83 double triode, Cossor 142BT output pentode and contact cooled rectifier. Fully isolated mains transformer for 230-250 v. A.C. mains. Bass, Treble and volume controls. 49/6 plus P. & P. 3/6. 5in. Speaker and O.P. Transformer. If purchased with above, 18/6, plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER Model 457 (suitable for use with above amplifier). Type 'O' pick-up. Size 12in. x 13 1/2in. Min. clearance above board 5in., below 2 1/2in. 10 records. A.C. mains. 200-250 v., turnover crystal head. Brand new, fully guaranteed. £8.19.5, plus P. & P. 5/- Or 25/- deposit plus P. & P. 5/- and 7 monthly payments of £15.0.

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

23, HIGH STREET, ACTON, LONDON, W.3
All enquiries S.A.E. GOODS NOT DESPATCHED OUTSIDE U.K.

RADIO SUPPLY CO. (LEEDS) LTD., Dept. N, MAUDE ST. parish church school, LEEDS 2.

Post Terms C.W.O. or C.O.D. NO C.O.D. under £1. Postage 1/9 extra under £2. 2/9 under £5. Open to callers 9 a.m. to 5.30 p.m. Sats. until 1 p.m. S.A.E. with enquiries, please. Full list 6d.; Trade list 5d.

R.S.C. TRANSFORMERS

Fully Guaranteed

Interleaved and Impregnated.

Primaries 200-230-250 v. 50 c.s. screened

TOP SHROUDED DROP THROUGH

260-0-260 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

250-0-250 v 100 ma. 6.3 v 4 a. 5 v 3 a ... 23/9

350-0-350 v 100 ma. 6.3 v 4 a. 5 v 3 a ... 23/9

350-0-350 v 150 ma. 6.3 v 4 a. 5 v 3 a ... 29/9

FULLY SHROUDED UPRIGHT

250-0-250 v 60 ma. 6.3 v 2 a. 5 v 2 a ... 17/9

Midjet type 21-3-31in. ... 26/9

250-0-250 v 100 ma. 6.3 v 4 a. 5 v 3 a ... 26/9

for R1356 Conversion ... 31/9

300-0-300 v 100 ma. 6.3 v 4 a. 5 v 3 a ... 31/9

350-0-350 v 100 ma. 6.3 v 4 a. 5 v 3 a ... 23/9

350-0-350 v 150 ma. 6.3 v 4 a. 5 v 3 a ... 33/9

425-0-425 v 200 ma. 6.3 v 4 a. C.T. 6.3 v ... 49/9

4 a. C.T. 5 v 3 a ... 49/9

FILAMENT TRANSFORMERS

All with 200-250 v 50 c.s Primaries: 6.3 v

1.5 a. 5.9; 6.3 v 2 a. 7.6; 0-4-6.3 v 2 a. 7.9;

12 v 1 a. 7.11; 6.3 v 3 a. 8.11; 6.3 v 6 a. 17.9

CHARGER TRANSFORMERS

200-250 v 0-9-15 v 11 a. 11.9; 0-9-15 v 3 a. 16.9;

0-9-15 v 5 a. 18.9; 0-9-15 v 6 a. 22.9

OUTPUT TRANSFORMERS

Standard Pentode 5,000 to 3 ohms ... 4/9

Small Pentode 5,000 to 3 ohms ... 3/9

SMOOTHING CHOKES

100 ma 10 h 250 ohms ... 8/9

80 ma 10 h 350 ohms ... 5/6

60 ma 10 h 400 ohms ... 4/11

SELENIUM METAL RECTIFIERS

250 v 250 ma. 11.9; 120 v 40 ma. 3.9;

6.12 v 1 a F.W. 4.11; 240 v 50 ma. 4.11;

6.12 v 2 a F.W. 8.9; 6.12 v 4 a. 14.9; 250 v

80 ma. 7.9; 6.12 v 6 a F.W. 19.9; 6.12 v

10 a. 25.9; 6.12 v 15 a. 35.9; 24 v 2 a. 14.9

CO-AXIAL CABLE (in.)

75 ohms 14 3/8 ... 8d. yd.

Twin-screened Feeder ... 11d. yd.

BATTERY SET CONVERTER KIT

All parts for converting any normal type of Battery Receiver to A.C. mains 200-250 v

Fully smoothed and fully smoothed L.T.

of 2v at 0.4 a to 1 a. Price including circuit

49/9. Or ready for use. 9/9 extra.

ALL DRY RECEIVER BATTERY ELIMINATOR KIT

All parts for the construction of a unit (metal-case

5 1/4-2 1/2 in.) to supply Battery Portable

receivers requiring 90 v and 1.5 v. Fully

smoothed. From 200-250 v 50 c.s mains.

Price, inc. point-to-point wiring diagrams, 39/9. Or ready for use. 46/9.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS

10-0-100-200-220-240 v to 5-0-75-115-135 v

plus 2/9 post. 10-0-100-200-220-240 v to

9-0-110-122-136-148 v or Reverse. 200

watts, 35/9, plus 7/6 carr. Both 50 c.p.s.

EX-GOVT. CASES. Well ventilated.

black crackle finished. undrilled cover.

Size 14 x 10 x 8 1/2 in. high. IDEAL FOR

BATTERY CHARGER OR INSTRUMENT

AMPLIFIER. Only 9/9, plus 2/9 postage.

Size 13 1/2 x 8 1/2 x 6 1/2 in. with undrilled perforated

cover finished stoved grey enamel.

7/9, plus 2/9 post

EX-GOVT. VALVES (NEW)

1R5 7/9 6K7C 3/9 DF96 6/9

1T4 7/9 6Q7G 9/11 EBO83 8/9

1S5 7/9 6X5GT 7/9 EB91 8/9

3S4 8/9 6SN7GT 8/9 ECC91 4/6

5Y3C 7/9 6L6G 11/9 EF91 8/9

5U4G 8/9 807 7/9 EL32 3/9

6J5C 4/9 12AG 7/9 EL91 5/9

6K8C 9/9 12A6 7/9 FW4500 9/9

6S7GT 6/9 35Z4 6/9 KT61 7/9

6V8C 7/9 3MH 4/9 KT95 11/9

8U5G 3/9 MH4 4/9 SP61 2/9

616 4/9 6AT6 7/9

EX-GOVT. MAINS TRANSF.

Removed from New ex-Govt. units.

Primary 0-200-130-250 v. Secs 275-0-275

v 100 ma. 6.3 v 7 a 5 v 3 a 21/9

All 200-250 v 50 c.s input.

230-0-230 v 80 ma. 12.6 v 1.5 a. 5 v 2 a ... 11/9

250-0-250 v 150 ma. 5 v 3 a ... 16/9

350-0-350 v 160 ma. 6.3 v 5 a. 5 v 3 a ... 27/9

400-0-400 v 250 ma. 5 v 2 a. 5 v 2 a ... 18/9

450-0-450 v 150 ma. 6.3 v 5 a. 6.3 v 1 a.

5 v 3 a ... 29/9

450-0-450 v 250 ma. 6.3 v 3 a. 6.3 v 1 a.

5 v 6 a ... 49/9

12.5 v 3 a. 5 v 3 a ... 12/9

EX-GOVT. SMOOTHING CHOKES

80 ma 10 h 150 ohms ... 3/11

100 ma 5 h 100 ohms Tropicalised ... 3/11

100 ma 8-10 h 100 ohms Parmeko ... 6/-

120 ma 12 h 100 ohms ... 9/9

150 ma 6-10 h 150 ohms. Trop. ... 6/9

150 ma 10 h 150 ohms ... 11/9

250 ma 20 h 200 ohms ... 13/9

200 ma 3 h 100 ohms ... 9/9

ELECTROLYTICS (NEW)

Tabular Can Type

8 mfd 450 v 1/9 8-8 mfd 450 v. 2.11

16 mfd 450 v 2/9 8-16 mfd 450 v 3/11

8-16 mfd 500 v 4/11 16-16 mfd 450 v 4.11

25 mfd 25 v 1/3 32-32 mfd 350 v 4/9

50 mfd 12 v 1/3 32-32 mfd 450 v 5/9

50 mfd 50 v 1/9 150 mfd 450 v 5/9

100 mfd 25 v 2/3 100-100 mfd 350 v 5/9

3,000 mfd 6 v 3/9 100-200 mfd 275 v

6,000 mfd 6 v 3.11 6.11

BATTERY CHARGERS.—For mains

200-250 v 50 c.s. Output for charging 6 v or

12 v at 1 amp. In strong metal case 10/9

25/9. Above can also be used for electric

train power supply.

D.C. SUPPLY KIT.—Suitable for Electric

Trans. Consists of mains trans.

200-250 v 50 c.p.s. A.C. 12 v 1 a Selenium

F.W. Bridge Rectifier, 2 Fuses, 2 Fuses, 2

Fuses, Change Direction Switch, Variable

Speed Regulator. Partially 29/9

drilled Steel Case, and Circuit.

LINE OUTPUT TRANSFORMERS

replacement or rewind. Send us your faulty one and we will be pleased to quote and save you money.

AUDIO LTD.

162 Gray's Inn Rd., London, W.C.1

COVENTRY RADIO

Audio & Component Specialists Est. 1925 189-191, Dunstable Rd., Luton, Beds.

HI-FI EQUIPMENT CABINETS IN STOCK

Record Housing: Nordisk Range in Oak, Walnut, Mahogany.

Speaker Enclosure ... £5.17.6

Equipment Cabinet ... £5.19.6

Record Cabinet (150 records) ... £4.17.6

Continental Bench ... £4.17.6

Polenaise Hi-Fi Cabinet ... £19.19.0

W.B. Prelude Speaker Cabinet ... £11.11.0

W.B. Prelude Equipment Cabinet ... £13.13.0

W.B. Prelude Corner Speaker Cabinet ... £10.10.0

W.B. Table Equipment Cabinet ... £9.19.6

W.B. Senior Hi-Fi Console ... £16.16.0

W.B. Junior Hi-Fi Console ... £12.12.0

W.B. Junior Base Reflex ... £9. 9.0

W.B. Standard Base Reflex ... £10.10.0

W.B. Senior Base Reflex Corner ... £11.11.0

B.K. AUDIO PLAN

B.K. Speaker Cabinet ... £16.19.6

B.K. Equipment Cabinet ... £17.19.6

B.K. Record Cabinet ... £16.16.0

B.K. Continental Bench 48in. ... £7. 7.0

B.K. Continental Bench 72in. ... £13.13.0

B.K. Set 4 Legs tilt & glide feet ... £2. 2.0

B.K. Set 4 Legs Plain Ebonised ... 19.6

SOUTHDOWN Hi-Fi Cabinet

R.C.A. Lowboy Cabinet ... £29.10.0

HEALS Chairside for Quad ... £18.10.0

HEALS Chairside ... £29.15.0

BREARCLIFFE Equip. Cab. ... £37. 0.0

BREARCLIFFE Equip. Cab. ... £30. 9.0

BREARCLIFFE Equip. Cab. ... £22. 1.0

ARMSTRONG Equipment Cabinet ... £34.19.0

Leaflets available on request.

FIRST-CLASS TELEVISION and RADIO COURSES . . .

GET A CERTIFICATE!

After brief, intensely interesting study —undertaken at home in your spare time—YOU can secure your professional qualification or learn Servicing and Theory. Let us show you how!

FREE GUIDE

- The New Free Guide contains 132 pages of information of the greatest importance to those seeking such success compelling qualifications as A.M.Brit.I.R.E., City and Guilds Final Radio, P.M.C. Radio Amateurs' Exams, Gen. Cert. of Educ., London B.Sc. (Eng), A.M.I.P.E., A.M.I.Mech., Draughtsmanship (all branches), etc., together with particulars of our remarkable Guarantee of SUCCESS OR NO FEE
- Write now for your copy of this invaluable publication. It may well prove to be the turning point in your career.

FOUNDED 1885—OVER 150,000 SUCCESSES

NATIONAL INSTITUTE OF ENGINEERING (Dept. 462), 148, HOLBORN, LONDON, E.C.1.

YOUR OWN TELEVISION TUBE RE-BUILT

THE FOLLOWING TYPES AND SIZES ONLY.

MULLARD ..	12in. £7-10-0.	14in. £8-10-0.
OR EQUIVALENTS COSSOR-EMITRON-CATHODEON	17in. £10-10-0.	21in. £12-10-0.
MAZDA ..	14in. £8-10-0.	17in. £10-10-0.

All Tubes plus 15/- carriage and insurance.

SIX MONTHS' GUARANTEE

Terms to the Trade.

Tubes can be sent to us by British Road Services (Parcels) Ltd. Carriage forward.

TERMS, CASH WITH ORDER or C.O.D.

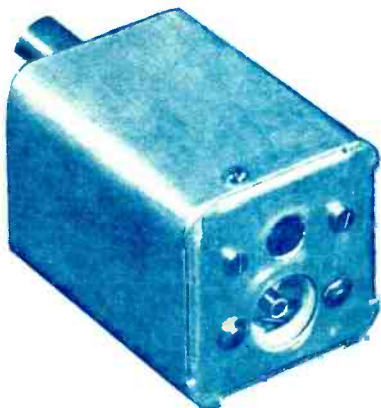
RE-VIEW (LONDON) LTD.

81, HIGH STREET . . . MERTON S.W.19

Telephone : CHERRYWOOD 3255

THE LABGEAR T.V. PICTURE EQUALISER FOR BALANCING B.B.C. AND I.T.V. SIGNALS

No More Fiddling When Changing Programmes !



In many areas, fairly close to B.B.C. stations, it is necessary to adjust contrast and sensitivity controls when switching from B.B.C. to I.T.V. (or vice versa) due to the far greater strength of the B.B.C. signal. The Labgear Picture Equaliser completely eliminates this inconvenience by reducing the Band I signal to the level of the Band III signal. Moreover, as the equaliser is a tunable filter, certain types of interference can also be eliminated. The Unit is fitted with a standard co-ax plug and socket so that it is a matter of seconds to insert it in between the receiver and aerial feeder lead. Preset adjustment is by means of a screw core for equalising the signals. Once set, programmes can be changed instantly by a flick of the channel switch.

RETAIL PRICE 10/6.

STOCKED BY LEADING T/V RETAILERS or in case of difficulty write to the sole manufacturers :

Labgear Ltd. WILLOW PLACE, CAMBRIDGE
Tel. 2494.

