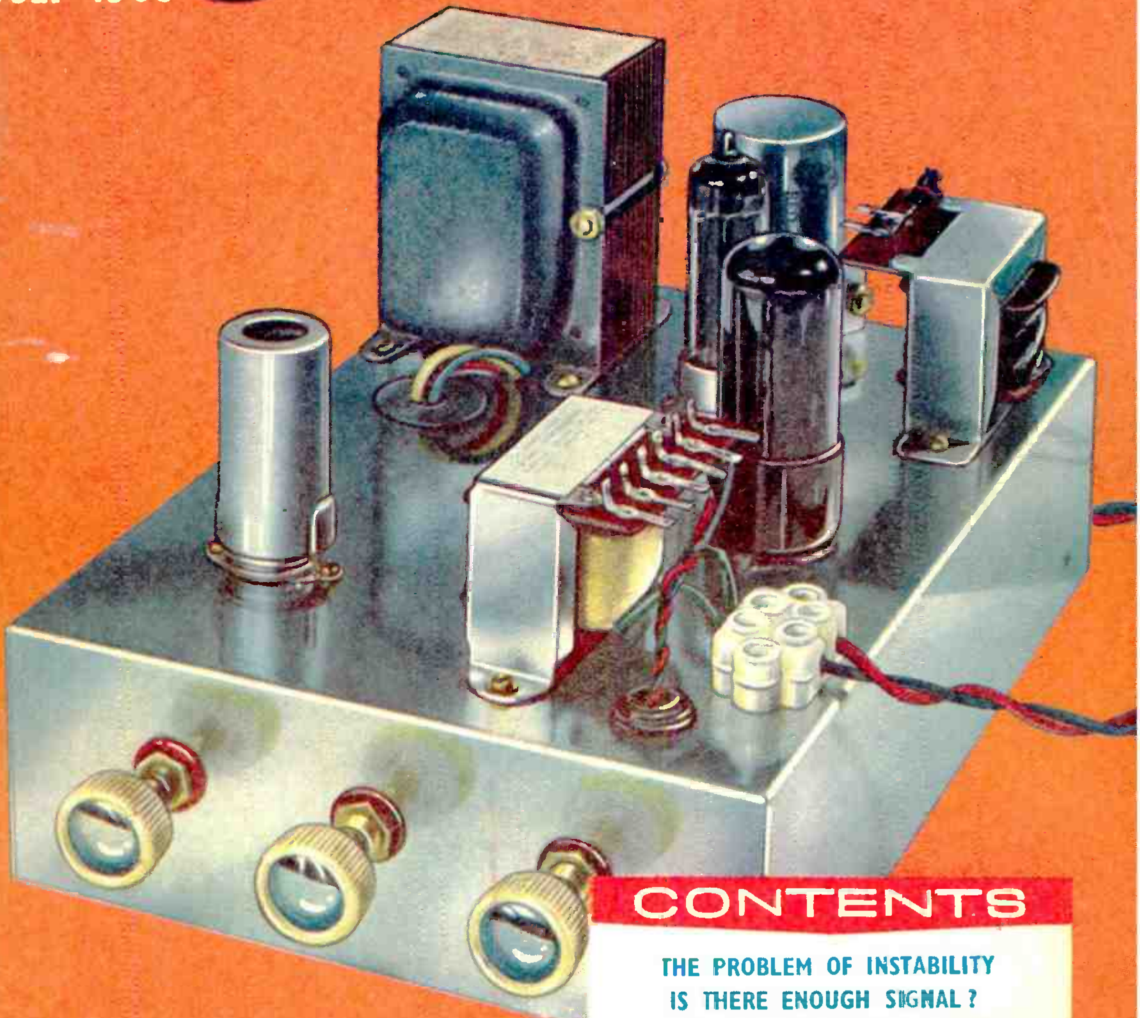
ADD-ON SOUND UNIT

Practical Television

1'6

AND TELEVISION TIMES

JULY 1960

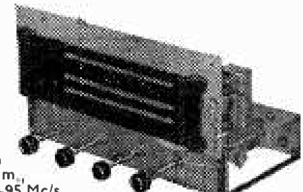


CONTENTS

7-VALVE AM/FM RADIOGRAM CHASSIS

TRS

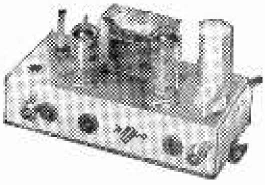
Valve Line up:
ECC85, ECH81, EF89, EABC80, EL84, EM81, EZ80.



3 wave band and switched gram positions. Med. 200 m.-500 m., Long 1,000 m.-2,000 m., VHF/FM 88-95 Mc/s. **4 Controls.** Vol., On-off, Tone, Tuning, Wavechange. P.U., Ae. and E., and speaker sockets. Magic eye tuning. Philips continental tuning insert with permability tuning on FM, and combined AM/FM IF transformers, 460 Kc/s and 10.7 Mc/s. Dust core tuning all coils. Latest circuitry, including AVC and Neg. Feedback. 3 watt output. Sensitivity and reproduction of a very high standard. Chassis size 13½in. x 6½in. Height 7½in. Edge illuminated glass dial 11½in. x 3½in. Vertical pointer, Horizontal station names, gold on brown background. A.C. 200/250 v. operation.

£13.10.0 *Carr. and Ins. 5/-. Complete with 4 knobs walnut or ivory to choice*

As previously announced fresh supplies are now being received, but we regret some slight delay may be experienced in fulfilling orders for this popular item.



BAND 3 TV CONVERTER

All channels 7-13 (180-205 Mc/s).
Mk. 2 Model. Latest cascode circuit using ECC84 and EF80 valves. 18db gain over standard circuits. Built-in Power Supply 200-250 v. A.C. Size 6½in. x 3in. x 4in. Simple to fit—only external plug-in connections. Wired and aligned ready to use. Only 79/6, P. & P. 2/6.
B1-B3 changeover Sw. and BBC Aerial Socket fitted and wired, 8/- extra.
Band 3 Aerials. Single Dipole with 4 yds. cable, 13/9, 3 Element Beam, 25/-, 5 Element, 32/6, etc. B1-B3 Crossover Units, 7/6.

RE-GUNNED TV TUBES

New Reduced Prices !

And now 12 months' Guarantee!

12in. ....£6 17in. £8.10.0
14in. ....£7 21in. £10.10.0
15in. ....£7.10.0 *Carr. and Insur.* 10/-

All tubes Rebuilt with new Heater Cathode and Gun Assembly—reconditioned virtually as new! Full 6 months' unconditional Guarantee. As used by our own Service Dept. Comprehensive stocks—quick delivery. 10/- part exchange allowance on your old tube.

FULLY GUARANTEED VALVES NEW REDUCED PRICES

1R5, 1T4	7/6	DAF96	9/-	EF80	9/6	PCF82	10/6
1S5	7/6	DF96	9/-	EF86	13/6	PCL83	12/6
3S4, 3V4	8/-	DK96	9/-	EF91	8/6	PL81	12/6
5Z4	9/6	DL96	9/-	EL41	10/6	PL82	9/6
6K7	5/6	EABC80	9/6	EL84	9/6	PL83	11/6
6K8	8/6	EBC41	9/6	EM81	9/6	PY80	7/6
6Q7	8/6	ECC83	9/6	EY51	10/-	PY81	9/6
6SN7	8/6	ECC84	10/6	EY86	10/-	PY82	7/6
6V6	7/6	ECF80	11/6	EZ80	7/6	PY83	10/6
6X4	7/6	ECF82	11/6	EZ81	7/6	U25	12/6
7C5	9/-	ECH81	10/6	MU14	9/6	U191	12/6
7Y4	8/6	ECL80	10/6	PCC84	10/6	UCH42	10/6
35L6	9/6	ECL82	11/6	PCF80	10/6	UF41	10/-

Send for List of more Valve Bargains.

SPECIAL PRICE PER SET
1R5, 1T4, 1S5, 3S4 or 3V4 .. .. .. 27/6
DK96, DF96, DAF96, DL96 .. .. .. 35/-
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 .. .. 35/-

RECORD PLAYER BARGAINS

NEW RELEASE by E.M.I.—4-speed Single Player Unit fitted with latest stereo and monaural Xtal cartridge and dual sapphire stylii. Auto stop and start. A fidelity unit and bargain buy at only £6.19.6.
BSR—UA8 Model.—4-speed autochanger with crystal turnover cartridge, etc., wired for stereo. Bargain £6.19.6.
Garrard—Latest RC121/D/Mk. 2—fitted with GC8 Xtal cartridge, plug-in monaural head. Auto/manual selector, etc. The connoisseur's choice for audio perfection. Bargain 10 gns.
Plug-in stereo head GC8/10, £2 extra.
All above are *brand new, fully guaranteed* models. Carr. and Ins. 4/6.
Comprehensive bargain range of Collaro, BSR and Garrard Units in stock. Send for comprehensive bargain lists.

RECORD PLAYER CABINETS

Contemporary styled, rexine covered cabinet in two-tone fawn and brown, or mottled red with white polka dot. Size 18¼ x 13¼ x ht. 8½in., fitted with all accessories, including baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers etc. Uncut record player mounting board 14 x 13in. supplied.

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

COAX 80 OHM CABLE. Stand

¼in. dam. Low Loss Semi-Air Spaced Aeraxial. Top grade cable—not to be confused with in/air types.

SPECIAL REDUCED PRICES

20 yds. 12/6, p. & p. 1/6; 60 yds. 32/6, p. & p. 3/-; 40 yds. 22/6, p. & p. 2/6; All other lengths 8d. per yard.
Coax Plugs 1/-, Sockets 1/-, Couplers 1/3. Cable End Sockets 1/6. Outlet Boxes 4/6.

C.R.T. Heater Isolation Transformers

New Improved types—mains prim. 200/250 v. tapped.

All isolation Transformers now supplied with alternative *no boost plus* 25%, and *plus* 50% boost taps, at no extra charge.

2 v. .2A type 12/6 (P. & P. 1/6)
6.3 v. .6A „ 12/6 „
10.5 v. .3A „ 12/6 „
13 v. .3A „ 12/6 „

Other voltages available at same prices.
Small size and tag terminated for easy fitting.

2-valve AMPLIFER Mk.2

Latest developed circuit giving a higher fidelity response and greater output (2-3 watts) using twin stage valves ECL82 and neg. feedback Tone Control. Complete with knobs etc., wired and tested ready to fit in above cabinet.
ONLY £2.17.6. P. & P. 1/-.
6in. speaker and matching transformer, 22/-. P. & P. 1/6.

SENTERCEL RECTIFIERS. E.H.T. Type Flyback Voltages, K3/2/5 2 kV., 5/-; K3/40 3.2 kV., 6/9; K3/45 3.6 kV., 7/3; K3/50 4 kV., 7/9; K3/100 8 kV., 13/6. **MAINS TYPES**—RM1, 125 v. 60 mA, 4/9; RM2, 125 v. 100 mA, 5/6; RM3, 125 v. 120 mA, 7/6; RM4, 250v. 250 mA, 16/-; RM4B type 270 mA, 17/6; RM5, 250 v. 300 mA, 21/-.

SPEAKER FRET.—Expanded Bronze anodised metal 8 x 8in., 2/3; 12 x 8in., 3/-; 12 x 12in., 4/6; 12 x 15in., 6/-; 24 x 12in., 9/-, etc.
Listed above are only a few items from our very large stock. Send 3d. stamp today for Complete Bargain List.

TRANSISTOR 'ONE-WATT' AMPLIFIER

6 v. Battery operated

Latest Push-Pull, 4 Transistor circuit giving full 1 watt Output into standard 3 ohms speaker. Good sensitivity and improved freq. response. Neg. feedback. Var. Tone and Volume Controls. Chassis Size 6½in. x 3½in. x 1½in. Current consumption 10 mA quiescent—250 mA at 1 watt.
2 matched GEC GET15 Transistors...42/- pr.
2 GEC GET3 Transistors..............21/- pr.
Driver Trans.............................8/6
Output Trans (to 3 ohms)...............10/6
Complete Kit of Parts incl. circuit etc. less speaker.
ONLY 99/6 P. & P. 2/6.
Circuit and instruction booklet 1/6 post free.

JASON FM TUNER UNITS

(87-105 Mc/s)

Designer-approved kits of parts for these quality and highly popular tuners available as follows:

STANDARD MODEL (FMT)—as previously extensively advertised. COMPLETE KIT, 5 gns., post free. Set of 4 spec. valves, 30/-, post free.

LATEST MODEL (FMT2)—attractively presented shelf mounting unit to enclosed Metal Cabinet with Built-in Power Supply. COMPLETE KIT, £7, p. & p. 3/6. Set of 5 spec. valves, 39/6.

NEW JASON COMPREHENSIVE F.M. HANDBOOK, 2/6 post free. 48 hr. Alignment Service, 7/6, p. & p. 3/6.

VOLUME CONTROLS

10,000 ohms—2 Megohms. All long spindles. Morganite Midget type, 1½in. diameter. Guar. 1 year. Log or Lin. Ratios. Less Sw. 3/-. D.P. Sw. 4/9. Twin Ganged controls, ½ meg., ½ meg., 1 meg., less Sw. 8/9 ea.

TYGAN FRET (Murphy pattern) 12 x 12in., 2/-; 12 x 18in., 3/-; 12 x 24in., 4/-, etc.

SPEAKERS P.M. 3 ohm 2½in. Elac, 16/6. 3½in. Goodmans, 18/6. 5in. R. & A., 17/6. 6in. Celestion 18/6. 7 x 4in. Goodmans, 18/6. 8in. Rola, 20/-. 8in. Special Cone G'mans, 21/6. 10in. R. & A., 25/-

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

Hours: 9 a.m.–6 p.m. 1 p.m. Wed. Open all day Saturday.

TRS

RADIO COMPONENT SPECIALISTS (Est 1946)

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

50 yards Thornton Heath Station. **Buses: 130A, 133, 159, 166 and 190**

SPECIALIST IN THE SUPPLY OF NEW VALVES, TRANSISTORS, AND GERMANIUM DIODES

BENTLEY ACOUSTIC CORPORATION LTD.

38 CHALCOT ROAD, CHALK FARM, LONDON, N.W.1. Telephone: PRIMROSE 9090

EXPRESS POSTAL SERVICE! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED. FOR ONLY 2/6 EXTRA TELEPHONE FOR THAT URGENT ORDER TO BE DESPATCHED IMMEDIATELY BY OUR SPECIAL C.O.D. SERVICE.

OA2	17/6
OB2	17/6
OZ4	5/-
1A3	3/-
1A5	6/-
1A7GT	12/-
1C5	12/6
1D5	9/-
1D6	10/6
1H5GT	10/6
1L4	4/6
1LD5	5/-
1LN5	5/-
1N5GT	10/6
1R5	6/6
1S4	9/-
1S5	6/-
1T4	4/6
1U5	6/-
2A3	26/6
2A7	10/6
2P	26/6
2X2	4/6
3A4	6/-
3A5	10/6
3B7	12/6
3D6	5/-
3Q4	7/6
3Q5GT	9/6
3S4	7/-
3V4	7/6
5R4GY	17/6
5U4G	6/6
5V4G	10/-
5Y3G	8/-
5Y3GT	6/6
5Z3	12/6
5Z4G	9/-
5Z4GT	10/-
6A7	26/6
6A8G	9/-
6AB7	9/-
6AB8	9/-
6AC7	4/-
6AG5	5/6
6AK5	8/-
6AL5	4/-
6AM6	4/6
6AQ5	7/6
6AT6	7/-
6AU6	10/-
6AV6	12/8
6B7	10/6
6B8G	4/6
6B8GT	5/-
6BA6	7/6
6BE6	6/-
6BG6G	23/3
6BH6	8/-
6BJ6	6/-
6BQ7A	15/-
6BR7	15/-
6BS7	25/-
6BW6	8/6
6BW7	7/-
6BX6	7/-
6C4	5/-
6C5G	6/6
6C6	6/6
6C8	12/6
6C9	12/6
6C10	9/-
6CD6G	36/6
6CH6	9/-
6D3	19/11
6D6	6/6
6E5	12/6
6F1	26/6
6F6G	7/-
6F6GTM	8/-
6F11	17/3
6F12	4/6
6F13	11/6
6F14	26/6
6F15	15/3
6F16	9/6
6F17	12/6
6F23	10/6
6F32	10/6
6F33	7/6
6G6	6/6
6H6GT	3/-
6J5G	5/-
6J5GTG	5/6
6J5GTM	6/-
6J6	5/6
6J7G	6/-
6J7GT	10/6
6K7G	5/-
6K7GT	6/-
6K8GT	10/6
6K8G	6/6
6K25	19/11
6L1	23/3
6L6G	8/-
6L6M	9/6
6L7GT	7/6
6L18	13/-
6L19	23/3
6LD3	8/6
6LD20	15/11
6N7	8/-
6P1	19/3
6P25	12/6
6P28	26/6
6Q7G	6/6
6Q7GT	11/-
6R7G	10/-
6SA7GT	8/6
6SC7	7/6
6SG7GT	8/-
6SH7GT	8/-
6SJ7GT	8/-
6SK7GT	6/-
6SL7GT	6/6
6SN7GT	5/6
6SQ7GT	9/-
6SS7GT	8/-
6U4GT	12/6
6U5G	7/6
6U7G	8/6
6V6G	7/-
6V6GTG	8/-
6X4	5/-
6X5GT	6/-
6/30L2	10/-
7A7	12/6
7B6	21/3
7B7	8/6
7C5	8/-
7C6	8/-
7D6	10/6
7D8	23/3
7H7	8/-
7R7	12/6
7S7	9/6
7V7	8/6
7Y4	7/6
7Z4	18/7
8D2	3/6
8D3	4/6
9BW6	15/3
9D2	4/-
10C1	12/-
10C2	26/6
10D2	12/-
10F1	26/6
10F9	10/6
10LD3	8/6
10LD11	15/11
10P13	15/-
10P14	19/3
11D3	24/7
12A6	5/-
12AC6	15/3
12AD6	17/3
12AE6	13/11
12AH7	8/-
12AH8	12/6
12AT6	7/6
12AT7	6/-
12AU6	23/3
12AU7	6/6
12AV6	12/8
12AX7	7/6
12BA6	8/-
12BE6	9/-
12BH7	21/3
12E1	30/-
12J5GT	4/6
12J7GT	9/6
12K5	17/11
12K7GT	5/6
12K8GT	14/-
12Q7GT	5/-
12SA7	8/6
12SC7	8/6
12SG7	7/-
12SH7	8/6
12SJ7	8/6
12SK7	6/-
12SQ7	11/6
12SR7	8/6
12Y4	10/6
14S7	27/10
18	23/3
19AQ5	10/6
19BG6G	23/3
19H1	10/-
20D1	15/3
20F2	26/6
20L1	26/6
20P1	26/6
20P3	23/3
20P5	23/3
25A6G	10/6
25L6GT	10/-
25U4GT	16/7
25Y5	10/-
25Y5G	10/-
25Z4G	9/6
25Z5	9/6
25Z6G	10/-
27SU	19/11
28D7	7/-
30C1	8/-
30F5	7/-
30FL1	10/-
30L1	8/-
30L15	11/6
30P12	7/6
30P16	7/6
30PL1	11/6
30PL13	12/6
33A/158M	30/-
35A5	21/3
35L6GT	9/6
35W4	7/6
35Z3	10/6
35Z4GT	6/-
35Z5GT	9/-
42	23/3
43	10/-
50C5	12/6
50CD6G	36/6
50L6GT	9/6
53KU	19/11
72	4/6
75	24/7
77	8/-
78	6/6
80	9/-
83	15/-
83V	12/6
85A2	15/-
150B2	15/-
161	10/6
185BT	33/2
185BTA	33/2
304	10/6
305	10/6
807	7/6
956	3/-
1821	16/7
5763	12/6
7475	7/6
9002	5/6
AC/PEN 5-pin	23/3
AC/PEN 7-pin	15/-
AC2PEN/DD	12/6
AC5PEN	23/3
AC6PEN	7/6
AC/SG	23/3
AC/TP	33/2
ATP4	5/-
AZ1	18/7
AZ31	10/-
AZ41	13/11
B36	15/-
BL63	7/6
C1	12/6
C1C	12/6
CBL1	26/6
CBL31	23/3
CCH35	23/3
CK506	6/6
CL33	19/3
CV63	10/6
CY1	18/7
CY31	16/7
D1	3/-
D15	10/6
D63	5/-
D77	4/-
DAC32	10/6
DAF91	6/-
DAF96	8/6
DD41	13/11
DF33	10/6
DF66	15/-
DF70	15/-
DF91	4/6
DF96	8/6
DF97	9/-
DH63	6/6
DH76	5/-
DH77	7/-
DH81	46/5
DH101	28/6
DH107	13/11
DK32	12/-
DK40	21/3
DK91	6/6
DK92	9/-
DK96	8/6
DL33	9/6
DL66	17/6
DL68	15/-
DL82	46/5
DL92	7/-
DL94	7/6
DL96	8/6
DM70	7/6
EA50	2/-
EABC80	9/-
EAC91	4/6
EAF42	9/-
EB34	2/6
EB41	8/6
EB91	4/-
EBC3	23/3
EBC33	5/-
EBC41	8/6
EBC81	8/-
EBF80	9/-
EBF83	13/11
EBF89	9/6
EBL21	23/3
EBL31	23/3
EC52	5/6
EC54	6/-
EC70	12/6
EC92	13/3
ECC32	5/6
ECC33	8/6
ECC34	24/7
ECC35	8/6
ECC40	23/3
ECC81	6/-
ECC82	6/6
ECC83	7/6
ECC84	9/-
ECC85	8/6
ECC88	23/11
ECC91	5/6
ECF80	10/6
ECF82	10/6
ECH3	26/6
ECH21	23/3
ECH35	9/6
ECH42	9/-
ECH81	9/-
ECH83	13/11
ECL80	9/-
ECL82	10/6
ECL83	19/3
EF9	23/3
EF22	14/-
EF36	6/-
EF37A	8/-
EF39	5/6
EF40	15/-
EF41	9/-
EF42	10/6
EF50(A)	7/-
EF50(E)	5/-
EF54	5/-
EF73	10/6
EF80	7/-
EF85	7/-
EF86	10/6
EF89	9/-
EF91	4/6
EF92	4/6
EF97	13/3
EF98	13/3
EF183	18/7
EK32	8/6
EL32	5/-
EL33	12/6
EL34	15/-
EL38	26/6
EL41	9/-
EL42	10/6
EL81	12/6
EL84	7/6
EL85	13/11
EL91	5/-
EL95	10/6
EM34	9/6
EM71	23/3
EM80	9/-
EM81	9/-
EM84	10/6
EN31	37/-
EY51	9/-
EY83	16/7
EY84	14/-
EY86	9/-
EZ35	6/-
EZ40	7/-
EZ41	7/-
EZ80	7/-
EZ81	7/-
FC2A	24/7
FC4	15/-
FC13	26/6
FC13C	26/6
FW4/500	8/6
FW4/800	8/6
GZ30	9/-
GZ32	10/-
GZ34	14/-
H63	12/6
HABC80	13/6
HL23DD	17/3
HL41	12/6
HL41DD	19/3
HL42DD	19/3
HN309	24/7
HVR2	20/-
HVR2A	6/-
KF35	8/6
KK32	21/11
KL35	8/6
KLL32	24/7
KT2	5/-
KT33C	10/-
KT36	29/10
KT41	12/6
KT44	12/6
KT61	12/6
KT63	7/-
KT66	15/-
KT81	46/5
KT88	22/6
KTW61	6/6
KTW62	7/6
KTW63	6/6
KTZ41	8/-
KTZ63	7/6
L63	6/-
MH4(C)	7/-
MHL4	7/6
MHLD6	12/6
ML4	8/6
MU12/14	8/-
MX40	15/-
N37	19/11
N78	19/11
N108	19/11
N308	20/7
N339	15/-
P61	3/6
PABC80	13/11
PCC84	8/-
PCC85	9/6
PCC88	23/11
PCC89	11/6
PCF80	8/-
PCF82	10/6
PCL82	10/-
PCL83	11/6
PCL84	12/6
PENA4	12/6
PENB4	26/6
PEN4DD	26/6
PEN25	19/11
PEN40DD	25/-
PEN44	26/6
PEN45	19/6
PEN45DD	26/6
PEN46	7/6
PEN383	23/3
PEN453DD	33/2
PEN/DD 4020	33/2
PL33	19/3
PL36	12/-
PL38	26/6
PL81	10/6
PL82	7/6
PL83	9/-
PL84	12/8
PL820	18/7
PM2B	12/6
PM12	6/6
PM12M	6/6
PM24M	21/3
PX4	10/6
PX25	59/8
PY31	16/7
PY32	11/6
PY80	7/6
PY81	8/6
PY82	7/-
PY83	8/6
PZ30	19/11
QP21	7/-
QP25	14/6
QS150/15	10/6
R12	9/-
R18	14/-
R19	19/11
S130	15/-
SD6	12/-
SP4(7)	14/6
SP41	3/6
SP42	12/6
SP61	3/6
SU25	26/6
SU61	9/-
T41	23/3
TDD4	12/6
TH4B	15/-
TH41	26/6
TH233	33/2
TH2321	20/-
TP22	15/-
TP25	15/-
TP2620	33/2
TY86F	13/3
U12/14	8/6
U16	10/-
U18/20	8/6
U22	8/-
U24	29/10
U25	17/11
U26	10/-
U31	9/6
U33	26/6
U35	26/6
U37	26/6
U43	9/-
U45	9/-
U50	6/6
U52	6/6
U54	19/11
U76	6/-
U78	5/-
U107	16/7
U191	16/7
U201	16/7
U251	14/-
U281	19/11
U282	22/7
U301	23/3
U329	14/-
U339	16/7
U403	16/7
U404	8/6
U801	29/10
U4020	16/7
UABC80	9/-
UAF42	9/6
UB41	12/-
UBC41	8/6
UBC81	11/4
UBF80	9/-
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URIC	9/-
UU6	19/11
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UU8	26/6
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UY41	7/6
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VT501	5/-
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W76	5/6
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W107	15/3
W729	18/7
X24M	24/7
X31	26/6
X41	15/-
X61(C)	12/6
X61M	26/6
X63	9/-
X65	12/6
X66	12/6
X76M	14/-
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X79	21/3
X81	46/5
X101	33/2
X109	17/3
XD(1.5)	6/6
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XFY34	17/6
XH(1.5)	6/6
XSG(1.5)	6/6
Y63	7/6
Z63	7/6
Z66	17/6
Z77	4/6
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CG6E	4/-
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CG12E	4/-
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GEX36	10/-
GEX45/1	6/6
GEX64	11/6
GEX66	13/-
OA2	4/-
OA5	4/-
OA70	4/-
OA79	4/-
OA81	4/-
OA91	5/-
OA95	5/-
OA210	25/-
OA211	40/-
OC16	54/-
OC19	54/-
OC26	44/-
OC28	20/-
OC35	20/-
OC44	26/-
OC45	23/-
OC65	22/6
OC66	25/-
OC70	14/-
OC71	14/-
OC72	17/-
OC73	20/-
OC75	20/-
OC77	20/-
OC78	17/-
OC81	18/-
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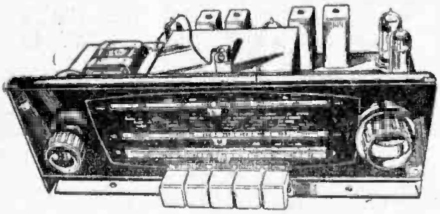

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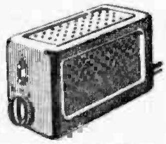

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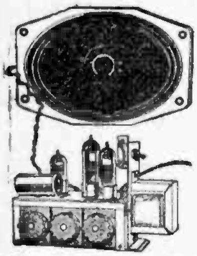

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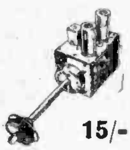

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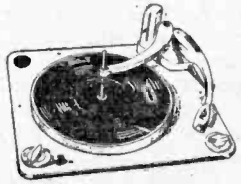

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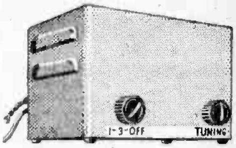

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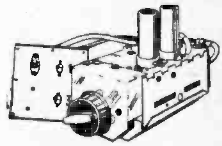

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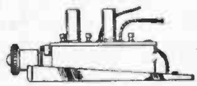

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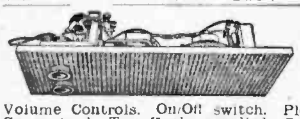

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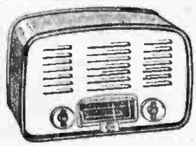

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Practical Television

& TELEVISION TIMES

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CONTENTS

Trends in Viewing

IT seems that, until a third service begins, the development of television in Great Britain is limited. Several years ago the intelligent observer could have forecast that, once the initial novelty of ITV had disappeared, then tastes in viewing would alter progressively as viewers became more familiar with the programmes transmitted. When ITV first began, as was expected, many viewers watched the programmes in preference to those of the BBC; the novelty of the programmes and the generally more popular style both contributed to this trend. For the BBC, the worst period occurred in late 1957 when, according to the BBC's own figures, their share of the nightly audience dropped below 30 per cent of the total for the first and only time. During the next few months, the viewing figures remained relatively static although periodically the BBC showed slight gains over ITV. However, ITV always regained its position soon after the decline. In recent months, though, a change in these trends has been evident; according to figures produced by TAM (Television Audience Measurement Ltd.) there has been a gradual decline in the popularity of ITV. The proportion of the total audience with multi-channel sets watching the commercial network has fallen from 72 per cent to 66 per cent since September last although, naturally, there are differences from region to region. As might be surmised, those areas in which ITV is a recent introduction still remain, for the most part, loyal to ITV: a particular instance is Ulster TV where the proportion of ITV viewers very soon after the opening reached over 70 per cent although this was not so with Anglia TV where the initial ITV share of the viewing was no more than 55 per cent. Another factor upon which viewing figures partly hinge is the preponderance of industrial areas in the north of England where available leisure hours tend to differ from those in the south of England.

Generally speaking, and leaving aside minor regional differences, the BBC is lately gaining an increasing proportion of the viewing audience. All this has occurred without any evident or specific change of policy and therefore it seems that the slight decline in ITV figures depends to some extent on the standards of their programmes. There have been many complaints that advertisements occupy too much of the programme time and it is interesting to note that the ITA has recently announced that while the daily maximum of 10 per cent will continue, from 12th September, spot advertising will not exceed 7½ minutes in the clock hour, and from 24th December, 7 minutes. The ITV programme policy is being based more and more on regular weekly series: "episoded" serials. Perhaps it is believed that when a regular diet is offered, then viewing becomes a matter of habit rather than choice.

It seems that the BBC's long-established policy of providing well-balanced programmes is now achieving success in areas where ITV is no longer a novelty.

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

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of April 1960, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,822,965
Home Counties	1.427.406
Midland	1,599,203
North Eastern	1.716.602
North Western	1.413.175
South Western	884.213
Wales and Border Counties ..	635,040
Total England and Wales ..	9.498.604
Scotland	925.322
Northern Ireland	144.759
Grand Total	10,568,685

Southern Area ITV

FINDINGS of the first complete survey covering the whole of the newly-defined Southern ITV area have been released by TAM. They reveal that there were, at mid-March, 589,000 homes—half the number of homes in the enlarged Southern area—receiving independent television from either the Chillerton Down or the Church Hougham transmitter.

An analysis of ITV homes reveals that the Southern area still has a consistently higher percentage of ITV homes in the ABC socio-econimic group than any other ITV area. TAM survey figures for mid-March reveal that 45 per cent of its homes are occupied by people in this class compared with 33 per cent for the whole network.

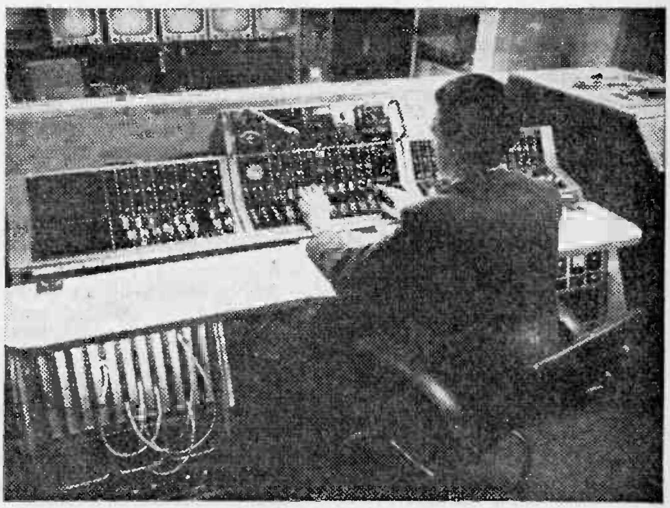
Results of the survey are published by TAM along with those for London, Midlands, Northern, Scottish, South Wales and the West, and North Eastern ITV areas. In common with the trend in five of these areas, findings for the Southern area show a slight drop in the average size of ITV homes compared with figures for last October. The average size of ITV homes in the South Wales and the West area, however, remains stationary. TAM adds that these comparisons tend to indicate that ITV ownership is now penetrating further into the smaller families which constitute the bulk of the non-TV population.

Research Chair

THE University College of North Staffordshire accepted last July an offer from Granada TV Network to found a Research Chair in Communication. Dr. Donald Mackay has been appointed to the Chair and took up his appointment in June. He will appoint a team including two medical scientists, one or two psychologists, several physicists and electronics engineers, and eventually some sociologists. His work will include a study of the way in which the brain deals with the information sent to it by the eyes and ears. Dr. Mackay hopes to discover whether the brain can translate a system of electronic sounds into words or letters of the alphabet. This might open the way to the development of a machine to enable blind people to "read" printed words "by ear". The Granada Chair is tenable in the first instance for seven years at a total cost of £45,000.

Westward TV Studios

WORK on the Plymouth site for Westward TV's studios was scheduled to begin on June 1st and completion is expected about



Nine television sound control desks of an entirely new design have been ordered from Marconi's by various programme contractors to the Independent Television Authority. The illustration above shows the "Major", one of the three versions of the control desk, in use at the Teddington studios of Iris Productions Ltd. (ABC Television Ltd.)

March 1961. Preliminary drawings have been prepared by the architects and in planning the lay-out, great care has been taken to preserve as many as possible of the existing trees on the site, which includes the present Crescent Gardens. A number of firms in Devon and Cornwall were interviewed before the contract was awarded to Garrett's of Plymouth, who built the North Hessary Tor Transmitting station for the BBC.

ITV in the Borders

THE application of a group formed under the Chairmanship of Mr. John L. Burgess, Managing Director of Cumberland Newspapers Ltd., to provide the programmes for transmission from the Authority's proposed two stations in the Border area has been accepted, subject to contract, by the ITA. The group, which will be known as Border Television, will have its headquarters and studios in Carlisle.

The Authority plans to build two transmitting stations in the Borders and to bring them both into operation next year. The first station to open will be at Caldbeck near Carlisle and it is hoped that this station will be on the air early in 1961. The other station will be near Selkirk, and it is hoped to open it around the end of 1961. The service areas of these two stations, taken together, will include over half a million people.

Australian TV Station

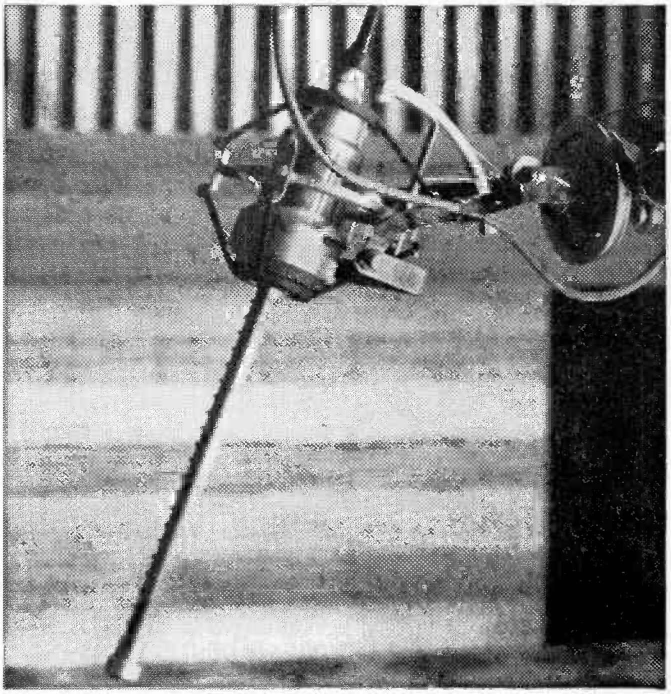
A NEW Australian television station was officially opened by the Australian Postmaster-General, Mr. C. W. Davidson, at Adelaide recently. Situated at Mount Lofty, at a height of 1,130ft above sea level, and about 13m east of Alelaide, the station was equipped by Marconi's of Chelmsford.

The order, placed by the Australian government with Amalgamated Wireless (Australasia) Ltd., was part of a larger order for the supply and installation of transmitting stations and studio equipment worth approximately £400,000.

The equipment supplied for the national transmitting station at Adelaide included two 10kW television transmitters with associated 2kW FM sound transmitters, combining equipment and an eight-stack high gain aerial, a control desk, programme input equipment (vision and sound), transmitter studio link and extensive monitoring facilities and spares.

TV for Wales

MR. HENRY BROOKE, Minister for Welsh Affairs, Mr. J. R. Bevins, Postmaster General and Lord Brecon, Minister of State for Welsh Affairs, had a discussion recently with members of the Continuation Committee of the National Conference on Television for Wales which met in Cardiff last autumn.



The Sound Section of Tyne Tees Television's Engineering Department has recently brought into service a new type of microphone (illustrated above) for use on sound booms. The microphone is manufactured by the Electrovoice Company of Michigan, U.S.A.

The Committee had sent to the Ministers a detailed memorandum on the practical possibilities of providing a television service, partly in Welsh and partly in English, designed particularly for Wales. The Ministers assured the Committee that they all fully appreciated the desire in Wales for a television service intended primarily for Welsh viewers. The committee indicated that its aspiration was to see television provided in the Welsh language for Welsh-speaking viewers at peak viewing hours, while ensuring for English-speaking viewers the opportunity to watch English-language programmes with a Welsh outlook. The various problems entailed in securing this were discussed, and the technical difficulties seen by the Post Office in the plans suggested in the Committee's memorandum were explained orally. The Committee said that they would like to examine these technical arguments further, and for this purpose the Ministers promised to furnish a technical memorandum which the Committee could consider with its advisers.

ITV in N.E. Scotland

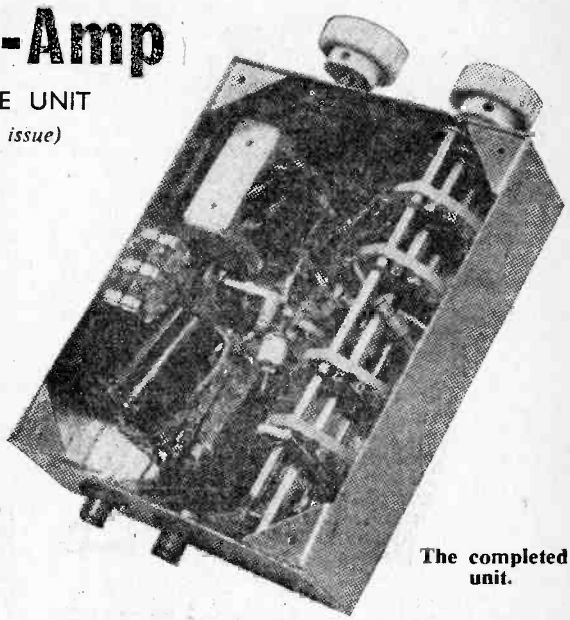
THE Independent Television Authority early last month invited applications from new groups wishing to become the programme contractor for North East Scotland. This area will be served by two transmitting stations, one near Aberdeen and the other close to Inverness, and it is hoped that both stations will be opened around the end of next year. Over 850,000 people live within the two service areas.

Two-Band Pre-Amp

COMPLETING AND TESTING THE UNIT

(Continued from page 475 of the June issue)

By R. E. F. Street



The completed unit.

THE article in the previous issue dealt with the design, layout and construction of this pre-amplifier. The importance of short wiring, particularly in the Band III circuitry was stressed, and it was mentioned that the leads wired to poles on S1B and S1C should consist of two wires in parallel in order to reduce the effective inductance. Those who have started the construction of this unit may have referred to valve manuals and found that the input triode of the PCC89 has two cathode leads. Although in the circuit diagram, pin 8 only was shown as being connected, pin 7 should be wired, at the holder, to pin 8. This reduces the effect of the inductance of the cathode lead of the input triode and results in improved performance. It should be noted that the triode connected to pins 9, 6, 8 and 7 should be used for the input and the one connected to pins 3, 2 and 1 for the output as the valve was designed for this arrangement.

Testing

When the pre-amplifier construction is finished, all wiring should be checked carefully; when using a few tags only on each wafer of the switch it is very easy to make errors. The unit may now be switched on and if possible the H.T. and L.T. should be measured without the valve in position. If all is in order the unit should be switched off, the valve inserted and the unit switched on again. As a check, the H.T. and L.T. voltages may again be measured. Plug the downlead into the input socket and connect the output to the receiver aerial socket. Switch to the Band I position, as owing to the different propagation conditions on Band I and Band III, the Band I signal is usually the stronger of the two and it is easier to check that the pre-amp works satisfactorily by using the Band I signal first.

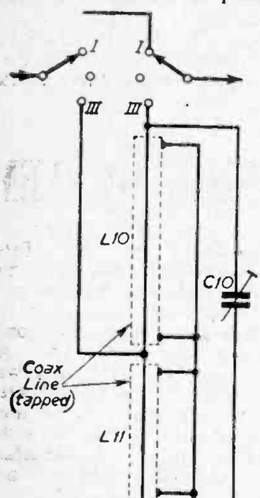
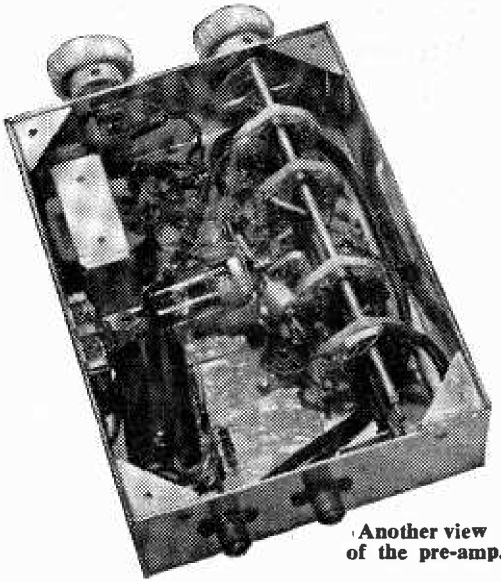


Fig. 4.—An alternative input circuit using coaxial lines with the input circuit tapped down this line for best results.

The dust cores in L2 and L6 should be altered in position for best results and finally the positions of the two coupling coils L2 and L7; movement of these coils may necessitate altering the position of the slugs again. If the slugs are loose in the coil formers they should be removed and a piece of thin elastic inserted down the threads of the former and the slug screwed in again. When the best positions for the slugs and coupling coils have been found, the coupling coils may be lightly cemented in position. (A tool for adjusting the position of the cores can be made from a plastic knitting needle.)

Band III Alignment

The pre-amp may now be switched to Band III and the spacing of the turns on L3 and L8 adjusted with an insulated tool—the knitting needle will serve. If the Band III signal is very weak it may be found that the signal level from the pre-amp is less than the signal level direct from the aerial. Whilst this may be due to L3 and L8 resonating at the wrong frequency, it is more likely that the coupling between the aerial and L3 and the receiver and L8 is not optimum. Various alternative methods of coupling may be tried. Instead of using the coil L4, the wire from S1B can be tapped directly on to L3 and the optimum position be determined by trial. The effect of including a small capacitor—2-10pF—may also be tried. A coaxial line input may be used as indicated in Fig. 4, and the aerial input tapped down this line for best results. Naturally, as the signal level is stronger, matters are easier as far as L8 is concerned. The effect of omitting L9 and employing a small capacitor between the anode and the inner conductor of the output coaxial cable is certainly worth trying. The value of this capacitor may be, again 2-10pF. If good results are obtained with the initial arrangement the number of turns on L4 and L9 may be altered in an endeavour to secure better results.



Another view of the pre-amp.

The condenser C2 which is part of the neutralising network for V1 is best set for optimum results on the Band III channel and is simply adjusted until the best picture quality is obtained—for lowest noise. The turns of the inductance L5 may be opened out or closed up when switched to Band III. If it is desired to avoid the losses which may be associated with change of cable at the input socket this socket may be omitted and the aerial downlead wired directly to S1A.

Instability

Owing to the high gain of the pre-amplifier it is possible and, if construction is not particularly well carried out, likely, that instability in the pre-amplifier will be experienced. This shows up when the screen of the cathode ray tube becomes extremely bright owing to the large signal developed in the oscillating stage. In curing this instability the positions of the output and input leads relative to each other are critical and arrangement will often effect a cure. The decoupling capacitors can likewise have a great effect upon the performance—particularly C6 and C7. In the event of instability, it is worth while to experiment with these condensers by putting others in parallel, perhaps connected to different earth points, until the instability is cured.

Housing

The finished unit may be housed in a wooden box which can be fitted or placed on top of the TV receiver where the knob for the band switching will be within reach and can be operated with the existing channel selector. The two relevant positions of the switch can be marked "BBC" and "ITV" for the non-technical members of the household. Although a great deal of heat is not generated in the unit, adequate ventilation should be assured to avoid frequency drift. During the testing, the unit can be operated direct from the mains supply but finally when it is fitted permanently to the receiver the mains supply should be taken direct from the set (after its mains switch) and then the pre-amplifier cannot be left switched on inadvertently.

Conclusion

It is worth while emphasising again that where signal strengths are low a pre-amplifier such as this must be "tailored" to suit the conditions of the location concerned. To obtain maximum transfer of energy from aerial to first grid and from second anode to receiver will necessitate, in most instances, some experiment, but it will then be certain that the best use is being made of the available signal.

THE HENRI DE FRANCE COLOUR TELEVISION SYSTEM

A UNIQUE demonstration was presented in April at The Institution of Electrical Engineers, when two French authors, MM. R. Chaste and P. Cassagne, described a new system of colour television transmission. Scenes originating in Paris were seen in full colour by a large audience in London, on screens which differed little, if at all, in their external appearance from those of ordinary "black and white" television receivers.

Moreover, the transmitted pictures were "compatible", that is to say, if fed into a colour receiver, they gave a coloured result; if fed into a normal television set, they gave a black and white picture. This "compatibility" is important, because it would provide a means of bridging the gap if a colour service were to be introduced, so that until a user bought a colour receiver his existing set would still give him a black and white result from the colour transmission.

Behind this feat lay a triumph of engineering co-operation. Experts in the French companies responsible for the development of the system, the French Posts and Telegraphs, the Radio Television Française, the British Post Office and the BBC, together set up a complicated radio link comprising sections of the existing Eurovision network, with additional microwave links of the type used by the BBC. As an additional precaution, a video recording was made in London beforehand of the complicated colour signals transmitted from Paris, to be used in the event of there being any breakdown in the radio link between the two capitals. It is satisfactory to report that the recorded version was not in fact required.

"Boosting" C.R. Tubes

MAKING SMALL TRANSFORMERS TO IMPROVE EMISSION

By "Engineer"

THE price of picture tubes makes it necessary to retain these components just as long as possible. However, the emission of C.R. tubes gradually deteriorates and the picture brightness decreases. In many cases this state of affairs can be alleviated and the life of the picture tube prolonged by what is known as "rejuvenation"—treatment by means of which the cathode of the tube is persuaded to increase its emission. It will be clear that such treatment can do nothing to improve tubes which have gone soft, tubes in which the screen has deteriorated, or tubes in which defects such as enlarged gun apertures have arisen, but even so, cathode rejuvenation will give a very distinct improvement in the picture, and extend the life of a tube for a considerable time, in between 50 per cent and 85 per cent of old tubes so treated.

Rejuvenation is nothing new, for patents dealing with rejuvenation principles were being granted in 1926. Two basic methods are available, one a true rejuvenation process and the other a "brightening" process.

Construction

Cathodes are commonly formed of nickel alloy cylinders coated with an electron emitting chemical—barium and strontium oxide coatings are best. The coating is made in the form of barium carbonate or strontium carbonate, the carbonate coating then being activated by the process of heating the coating whilst the cathode has about 150V applied through a resistor. Under these conditions, the carbonates are thermally reduced to oxides and the oxide coating is bombarded by high energy ions. As a result the coating and cathode become highly emissive and normal operation can proceed at lower cathode temperatures. Different manufacturers' processes naturally contain various refinements and additions.

Throughout its life the cathode deteriorates. It may be over-worked or incorrectly energised (by too high or too low a heater voltage) or the oxide coating may be contaminated by occluded gases in the tube—under normal working conditions the outer oxide coating of the cathode evaporates and is replaced by oxide from deeper layers; contamination can occur when evaporation is more rapid than replacement. Electrons are then emitted less freely, the beam current falls and the picture on the face of the tube becomes progressively dimmer.

The Simplest Method

The simplest method of obtaining at least a further measure of life from the tube is to increase the cathode temperature so that electrons can escape more readily; this is obviously achieved by supplying the tube heater with more than its rated voltage, an increase of 25 per cent or so being usual. It might seem that this would lead merely to rapid burning-out of the heater but in practice this rarely happens, heaters being conservatively rated since they are employed in the first instance to raise the cathode temperature for the original activation of the carbonate coating. Many "boosters" now sold consist of a small transformer supported in leads or in a plug-base. The connecting socket of the tube is removed from the base and the transformer assembly is plugged into this socket instead . A socket connected to the transformer assembly is slipped on to the tube pins, and in a surprising number of cases a dim, practically worthless tube is able to give months of extra service.

The advantage of any rejuvenation system is that whatever the result may be, nothing is lost (if the rejuvenator is built up from the spares box). If the tube responds to treatment it may give a further three, six or even nine months service— if it fails to respond or if the heater does burn out (very rarely) a new tube will be required in any case.

A booster may be either an auto-wound transformer, accepting heater power from the receiver from the original tube heater circuit and transforming this up to the higher voltage, or a two-winding transformer may be employed, the primary being fed from the mains and the secondary supplying the new heater voltage. In this case it is sometimes possible to overcome the effects of a cathode-heater insulation breakdown since the use of a two-winding transformer means that the heater and cathode can be strapped.

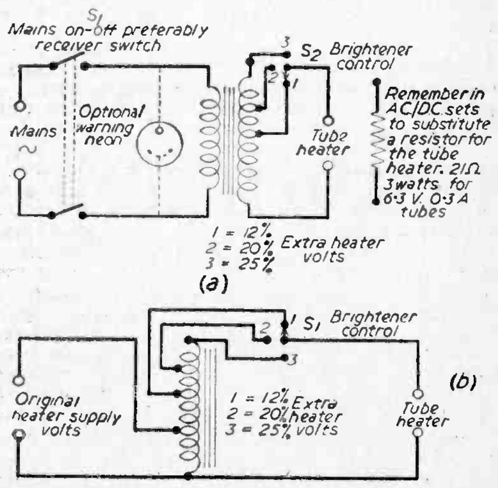


Fig. 1 (a).—A transformer tube booster and (b) an auto-transformer booster. (In A.C./D.C. sets, instead of substituting a resistor for the tube heater, as at (a), the voltage selector may be moved to the next highest position and the tube heater leads shorted together.)

One deciding factor on the system to be used is whether the receiver is an A.C. only or an A.C./D.C.

model—in the latter case an auto-transformer may not be used and a two-winding transformer can be employed only when the receiver is supplied from A.C. mains. If the set is fed with D.C. it is impracticable to build a brightener, and a rejuvenation process proper must be tried. When the picture tube forms part of the heater chain in an A.C./D.C. receiver an equivalent resistance must be wired in as a substitute for the tube heater, and some form of switching for two-winding transformers must be devised. In the majority of cases it will be possible to wire the transformer primary to the mains switch in the receiver.

Circuits

The circuit of a transformer booster is shown in Fig. 1, and it will be seen that in each case three heater taps are made available. This is in order that brightening may be progressive—when the tube first loses brilliance to a marked degree the booster is put into circuit and the heater supplied from the first tap, which applies approximately 12 per cent extra voltage over the heater rating. The second tap can be used when the tube again dims, and applies 20 per cent approximately higher voltage. The third tap supplies the full 25 per cent extra voltage to the heater—still higher percentages might be tried but by that time it is probable that the cathode would fail to respond to further brightening.

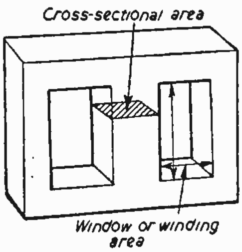


Fig. 2.—A typical transformer core, showing the cross-sectional and window areas.

Two-winding transformers may be constructed most easily and cheaply from the small-sized heater transformers at present in wide supply, rated to give an output of 6·3V at 1·5A. For the majority of tubes the basic heater rating is 6·3V at 0·3 or 0·6A, so that the existing secondary winding on a small heater transformer can be stripped off and a winding of thinner wire put on. (Choose for this purpose a heater transformer with the secondary winding on top of the primary, and ensure that there is perfect insulation between the windings when the secondary is remade.) Count the turns taken off the secondary and to find the number of turns per volt divide by 6·3 or, if this fails, to give a round number or at least a simple fraction, divide by 6·5. (The majority of small transformers have an extra turn or two to allow for a voltage drop on load.) If any doubt exists, a test winding can be put on, loaded by about 10Ω and the voltage across the winding measured by an A.C. voltmeter.

Using thinner wire than that removed, carefully wind on the new winding to give the three suggested heater voltages (basic rating plus 12 per cent., 20 per cent and 25 per cent.) For 6·3V tubes the final voltages should be 7·0, 7·5 and 8·0V. Suitable wire is chosen by reference to wire tables —for 0·3A tubes 24s.w.g. wire, and for 0·6A tubes 22s.w.g. wire will serve at current density ratings of 1,000A sq. in. If the winding space appears too small for these gauges it may be presumed that the transformer was designed to operate at current density ratings of 2,000A sq. in. when gauges of 28s.w.g. and 24s.w.g. may be used for 0·3 and 0·6A heaters respectively.

Enamelled wire should be employed and tappings must be made with care. Good rubber-covered flex of thin diameter should be chosen for the tapping leads and the soldered joints where the taps contact the windings must be made neat and smooth, with no more enamel removed than is necessary. The joints must be perfectly insulated.

Winding Data

If it is desired to employ the auto-transformer type of brightener this may be wound up on any small core such as the stampings from an output transformer, since only between 2 and 5W approximately have to be handled. A former may be constructed from card or fibre, if one is not to hand with the transformer core, and the windings may be calculated from the simplified formula

$$N = \frac{5{\cdot}6}{A}$$

where N is the number of turns per volt and A is the cross-section area of the centre leg of the transformer core (i.e. the leg round which the windings are to be placed). Thus if a core with a cross-sectional area of 1 sq. in. is used it will require 5·6 turns per volt (A is measured in square inches), and cores of lesser dimensions will require more turns per volt.

For 6·3V tubes the previously mentioned voltages of 7, 7·5 and 8V will be required, so that the whole winding will give 8V, the lower voltages being taken from taps. Remember that there must also be a 6·3V tap into which the original heater supply of the tube is fed.

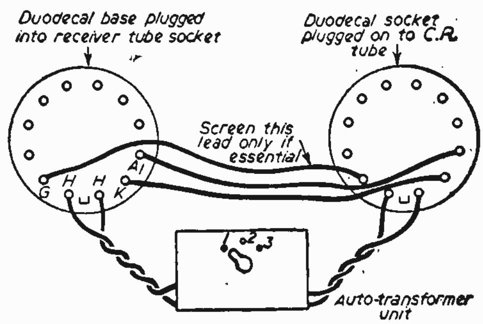


Fig. 3.—Typical arrangement of booster unit.

For the best possible efficiency and regulation the winding space of the transformer core should be full of wire—this will also mean that the thickest possible wire is used. The wire gauge should therefore be chosen from wire tables with reference to the size of the "window" (Fig. 2) and the number of turns of wire per sq. in. Allowance must be made for the dimensions of the former.

As mentioned the core of a miniature output transformer is suitable, and it may be of help to the constructor to run through the calculations which show how this might be used for an auto-transformer for 6·3V tubes. The cross-sectional area of the core is

$$\frac{3}{8} \times \frac{7}{16} = \frac{42}{256} \text{ sq. in.}$$

Therefore the turns per volt may be taken as

$$N = \frac{5{\cdot}6}{\frac{42}{256}}$$

which simplifies to

$$N = \frac{5{\cdot}6 \times 256}{42} = 35 \text{ turns per volt.}$$

The area of the window is $\frac{3}{8} \times \frac{5}{8}$ sq. in., and allowing for a thin-walled former this must be reduced to

$$\frac{5}{16} \times \frac{9}{16} = \frac{45}{256} \text{ sq. in.}$$

Thus the full winding, which is 35 × 8 turns, or 280 turns must be contained within this area and the wire chosen must be of a size such that in 1sq. in.

$$280 \times \frac{1}{\frac{45}{256}} \text{ turns turns are contained.}$$

This simplifies to

$$280 \times \frac{256}{45} \text{ turns per sq. in.}$$

$$= 1{,}593, \text{ say } 1{,}600 \text{ turns per sq. in.}$$

Reference to wire tables shows that 24s.w.g. enamelled wire can be wound with 1,794 turns per inch. This gives some small margin for bad winding, the affixing of tapping leads, etc. and with very careful winding this wire gauge could be employed—using 25 or 26s.w.g. enamelled wire would enable the 280 turns to be wound on with little difficulty. No allowance has been made for copper and iron losses, however, so that this transformer could handle only small currents—it should serve for an 0·3A tube. Larger cores would be preferable — with an increase in window space and a reduction in the number of turns per volt it would be possible to employ rubber-covered flex for the winding.

An ordinary output transformer has all the E and all the I laminations grouped together to give the effect of a gapped core. For use as an auto-transformer core the E's and I's should be interleaved, preferably one by one and at least in several groups.

Position

If a small auto-transformer is made it may be suspended in the wiring or assembled as a very small unit—two winding or other, larger transformers should be supported inside the receiver cabinet. It is important to keep the video signal lead as short as possible, and to achieve this it is worth while to unsolder the heater leads from the picture tube socket, leaving the rest of the leads untouched, should it not be possible to support the transformer in the leads. If a supported unit is employed it should be fitted and wired as shown in Fig. 3, using an old tube base as a plug which fits into the present receiver tube socket. The socket fitted to the brightener unit then plugs on to the tube. As already explained, commence the brightening process by employing the lowest of the three input voltages.

When the picture tube is finally replaced remove the booster unit and store it until such time as it is again required. Do not touch the tube socket, base, or other circuits, until the receiver is switched off and the mains plug removed from the wall socket.

Rejuvenation

In rejuvenation proper, as distinct from brightening, the generally accepted method would appear to be the application of one and one-half times the normal heater voltage to the heater for one minute or so, with low voltages applied to the tube electrodes, the tube then being aged for two or three hours at normal heater voltage with no electrode voltages applied. Probably more satisfactory from the constructor's point of view is a method whereby the heater voltage is increased by 33 per cent and the tube "cooked" for a time with approximately 100V applied between the cathode and the control grid. The cathode temperature is thus raised both by the increased heater voltage and current and also by a relatively heavy current between it and the grid, the net result being the boiling off of the old oxide surface and the exposure of a new surface (or the bringing of fresh oxides up to the surface). Visual control by meter is obtained.

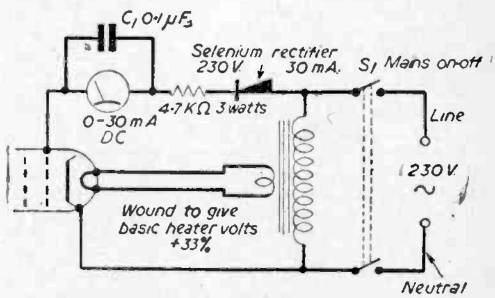


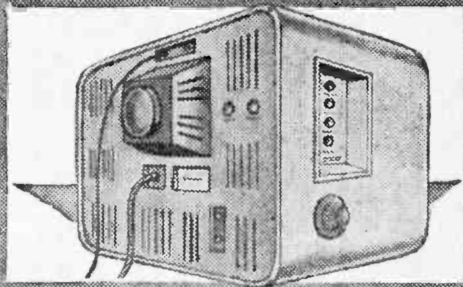
Fig. 4.—"Rejuvenator" for AC supplies.

The circuit for this type of rejuvenation is shown in Fig. 4, for A.C. supplies. In Fig. 4, a heater transformer is rewound to give 33 per cent extra heater voltage—in the case of 6·3 tubes the transformer must give 8·5 at 0·4 or 0·8A, for 0·3 and 0·6A heaters, respectively. The ordinary heater transformer already mentioned can easily be rewound for this purpose, a slightly thinner secondary wire being wound on so that the extra turns can be accommodated. Count the number of turns removed from the 6·3V secondary and multiply by 1·35 to obtain the number of turns required in the new winding.

Half-wave rectification direct from the mains side of the heater transformer is employed so that the circuit must be handled with care. It must not be directly earthed, or wired so that it can be touched accidentally. The use of a rectifier with no reservoir capacitor drops the D.C. output to

(Continued on page 516)

Servicing Television Receivers



No. 57—THE H.M.V. 1824 SERIES

By L. Lawry-Johns

(Continued from page 459 of the June issue)

HAVING discussed, perhaps not in great detail, the tube circuit and timebase faults we should now turn to the vision signal circuits and from the diagram of the vision strip (Fig. 7) it will be seen that V5 is the video amplifier, this being an N153. R20, 4·7k is the anode load with a small metal rectifier as a cathode bias element. The grid leak is R19 which also functions as a load resistor for the crystal diode demodulator or detector.

Pale Picture

Although a weak picture is most often the sign of a failing tube, where it is necessary to advance the contrast and sensitivity fully, the video amplifier and detector stages should be checked. For example, the anode resistor R20 may have decreased in value thereby reducing the voltage drop and the level of the signal passed to the tube. In this case, the excessive signal passed on to the control grid by the advanced controls may overload the N153 and produce negative pictures similar to those produced when the tube is low. An ohmmeter check across R20 when the receiver is off or a voltage check when it is on will quickly reveal the presence of a faulty resistor. A voltage of about 150 should be recorded under no signal conditions if the resistor is approximately correct but if it is low this reading will rise nearer to 200. Note however that the cathode voltage should not

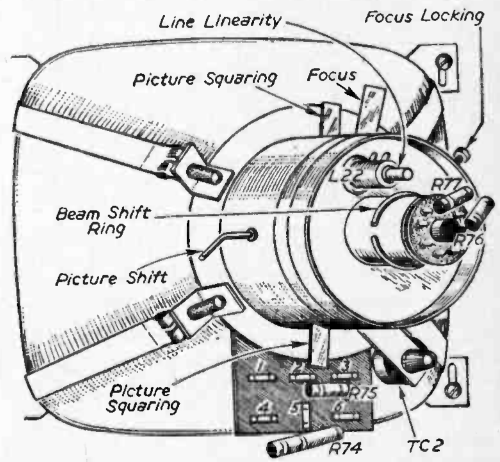


Fig. 5.—The tube unit (position of shift and L22 are different on some models).

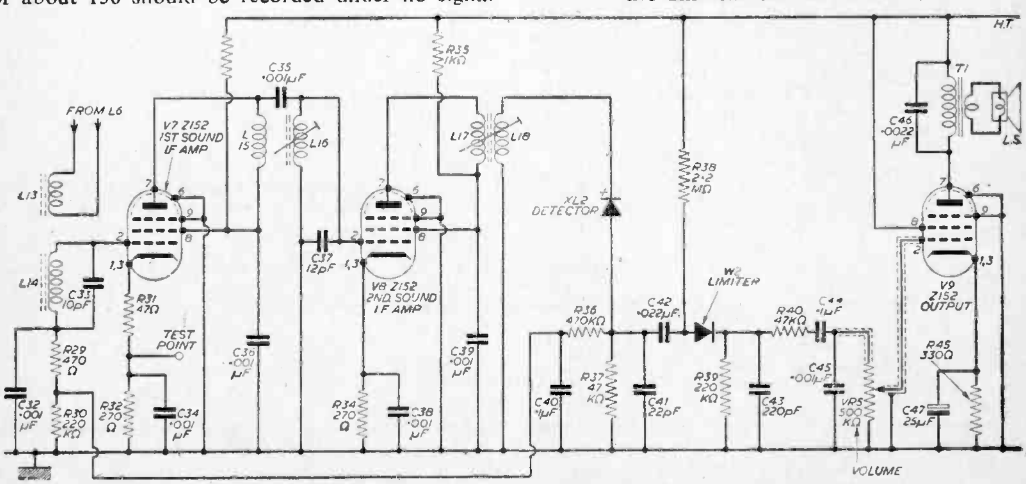


Fig. 6.—Circuit of the sound strip.

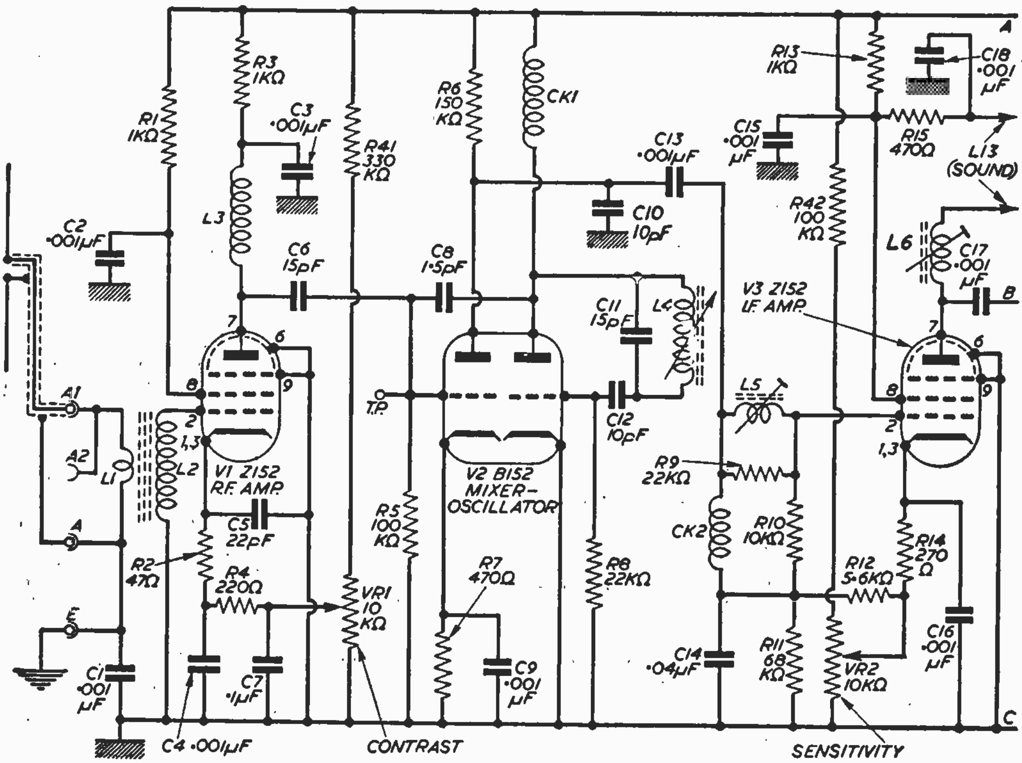


Fig. 7 (a) and, opposite, (b)—Circuit of the vision strip.

vary much from its correct value of 6. If it is much higher, the bias rectifier may have developed a high resistance causing the cathode voltage to rise, biasing back the valve resulting in reduced anode current which will again cause the anode reading to be nearer 200V. If, however, the 5V readings are reasonably correct, check the grid leak R19 as this could have fallen in value. Also check the crystal diode. Generally speaking, if the crystal diode is disconnected at one end, a resistance reading should show a high reading one way (say over 100k) and a low reading the other i.e. when the test prods are reversed. If the same reading is obtained in either direction or even approximately the same, be this low or high, the crystal is at fault and should be replaced. The OA70 is a suitable replacement crystal (GD3, GEX35, CG12E etc.). If these stages are in order the operating conditions of V3 and V4 should be checked. It is somewhat surprising to find that a weak signal still manages to break through even when R13 or R18 have failed, although this results

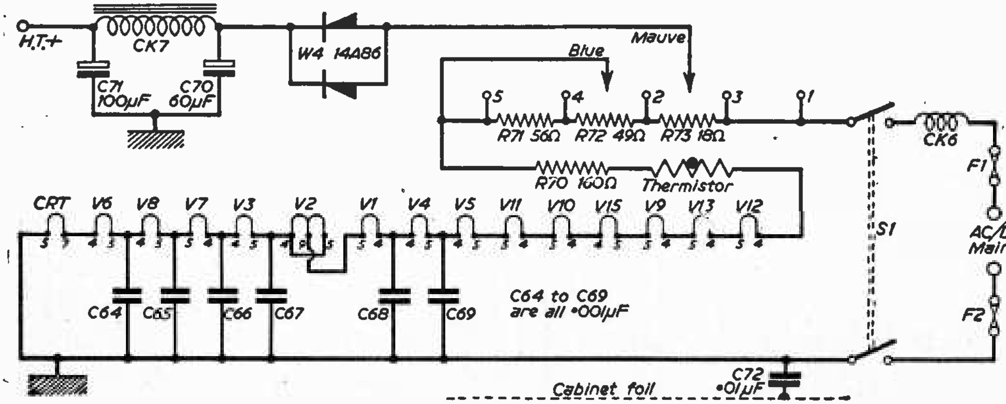
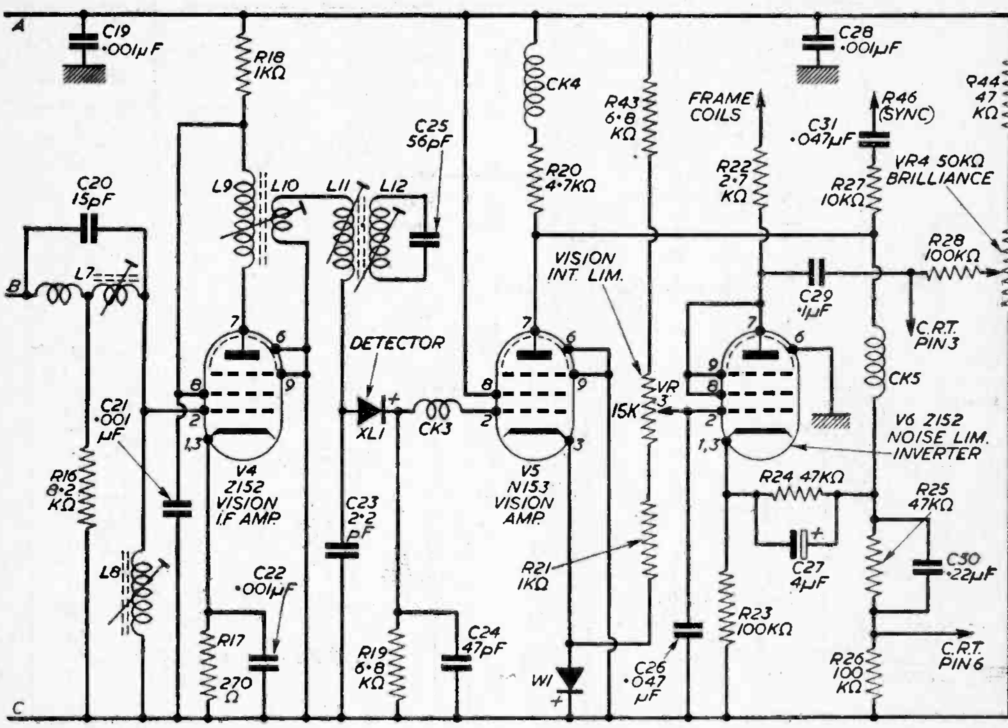


Fig. 8.—Power supply and heater chain.



in a lack of voltage at the screen or anode and of course in the case of R13 the sound will also be almost entirely absent. These resistors often burn out as a result of a shorted 0·001µF decoupling capacitor or an internal short in a Z152 valve. Thus when a short is recorded at pin 8, before disconnecting the 0·001µF, always remove the Z152 to see if this is responsible after all.

Hum Bars

When the picture is heavily shaded so that the centre, top or bottom is lighter or darker than the rest, check V4 and V5 for heater to cathode leakage. When this accompanied by a hum on the sound, check V3, V2 and V1.

Oscillation

When the screen is brightly (but blankly) illuminated and V5 glows red hot inside, check the V4 stage 0·001µF (C21), which may well be open circuited. If the sound is also affected, being distorted or harsh, if present at all, check the V3 stage decouplers.

No Signals

If the raster is present but unmodulated and no sound signals are received, first see that the aerial plug is in and correctly wired. See that the tuner knob (clear plastic) has not been disturbed and then check V2 the B152 (12AT7—ECC81). If this does not produce any positive results, check V1 and V3 and the voltage supplies to all three stages.

Poor and Ragged Picture

Check as above and include C2 and the other decoupling capacitors.

Low and Distorted Sound (Fig. 6)

Check R38, the sound detector crystal diode and the limiter rectifier, then check C44 and C47, V7, V8 and V9.

Dual Band Versions

The 1824A and other models with the Suffix A have an incremental inductance tuner using a PCC84 and PCF80 to replace the V1 and V2 stages of the single band models.

After a period of use it may be found that the Band III signals deteriorate even though the tuner valves are up to standard. This can usually be overcome by careful tuning of the studs on the top of the tuner when switched to Band III.

No Signals

Check PCF80 and PCC84 making sure that these are replaced in their correct positions, and then check the resistors under the tuner unit as it is often the case that a shorted decoupling capacitor has burned out the feed resistor.

Conversion

When it is desired to fit a tuner unit to a single band model, several methods present themselves. The first and simplest method is to remove **V1,**

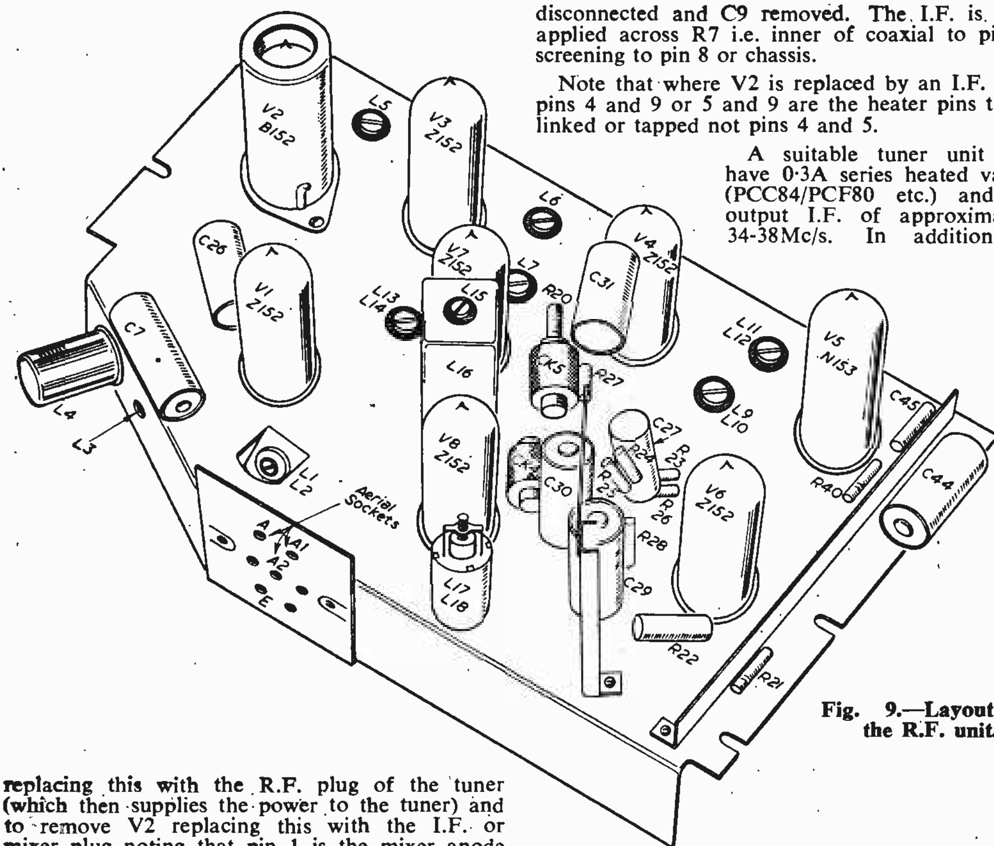


Fig. 9.—Layout of the R.F. unit.

replacing this with the R.F. plug of the tuner (which then supplies the power to the tuner) and to remove V2 replacing this with the I.F. or mixer plug noting that pin 1 is the mixer anode (not pin 6). This method is quite satisfactory in areas of reasonable signal strength but when extra gain is required, V2 can be left fitted, pins 6 and 7 disconnected and C9 removed. The I.F. is then applied across R7 i.e. inner of coaxial to pin 3, screening to pin 8 or chassis.

Note that where V2 is replaced by an I.F. plug pins 4 and 9 or 5 and 9 are the heater pins to be linked or tapped not pins 4 and 5.

A suitable tuner unit will have 0·3A series heated valves (PCC84/PCF80 etc.) and an output I.F. of approximately 34-38Mc/s. In addition to the Cyldon P38H and Brayhead 35s, several surplus tuners are suitable such as the G.E.C. BT204 and some of the Pye tuners.

BOOSTING CR TUBES

(Continued from page 512)

roughly half the A.C. input, and no elaborate smoothing is required. C1 is necessary to prevent meter flicker and the value of 0·5μF may need some variation with different meters—it will be sufficient with moving iron instruments which are quite satisfactory for this application, but it may have to be increased where moving-coil instruments are employed.

For greatest convenience the rejuvenator may have its output leads taken to a suitable picture tube socket so that tubes may be treated without being removed from the receiver cabinet. Switch off the receiver and remove the mains plug from the wall socket, then remove the wired socket from the base of the tube and plug in the rejuvenator socket instead. Connect the rejuvenator to the appropriate mains supply and switch on, watching the meter as the tube comes up to operating temperature. If the instrument pointer rises up the scale to a fair reading—10mA or more—within a minute or so of switching on then the tube condition is one which rejuvenation cannot help—the screen has deteriorated, or the tube is, perhaps, gassy. If the meter reading is low, or if the pointer stays at zero, leave the rejuvenator switched on and keep a watch on the meter. A gradual rise in the current indicated shows that the cathode is responding to treatment, and rejuvenation should continue until the indicated current has risen to a final level and remained at that reading for a short time. With some tubes the treatment may be completed within minutes, with other tubes it may be worth while to continue the rejuvenation for an hour or so. The tube could then be run for an hour with normal heater voltage applied and with no voltage on the cathode, grid and anode; but usually the tube is put straight back into service. This type of rejuvenation is not always successful, or, if successful, the extra tube life gained may not be great before a further treatment is required, but every extra hour's run is worth having.

Instability

METHODS OF LOCATING AND REMOVING THIS FAULT

By K. Royal

THE term instability usually signifies that a stage in the receiver is either on the point of oscillation or that it is, in fact, vigorously oscillating. Generally, oscillation can only occur when there is some coupling between the output and input circuits of an amplifier, and when this coupling is such that the output signal fed back is in step, or almost in step, with the input signal.

In step, or in phase, feedback from output to input is known as positive feedback, and tends to increase the gain of the stage to a small degree before oscillation sets in. Oscillation will not occur if the phase of the signal fed back differs too much from the phase of the applied signal, and neither will it occur if the coupling is insufficient. When the feedback signal is exactly in phase with the applied signal, less coupling is required to promote oscillation, but progressively greater coupling is necessary as the feedback signal falls away from the phase of the input signal, until the phase difference is so great that even the tightest of coupling will not cause oscillation. The feedback signal then approaches the anti-phase condition: i.e., when the phase of the feedback signal is opposite to that of the input signal. This is known as negative feedback and results in degeneration of stage gain.

Frequency

The reference to input and output signals given above was primarily to illustrate phase- and signal-wise the conditions that must exist in order for feedback to occur. An amplifier will, in fact, oscillate without the presence of a signal given sufficient encouragement. This, of course, happens in all oscillators. The frequency of oscillation is governed by the tuned circuit elements, for it is at the tuned frequency that conditions for feedback usually occur, provided there is sufficient feedback coupling. With an oscillator, coupling is purposely introduced, but with an amplifier, positive feedback coupling is very much avoided, and various decoupling and screening artifices are adopted in order to preserve stability.

An I.F. amplifier in a TV receiver, for example, is suitably screened and decoupled so that it works only as an amplifier and not as an oscillator. However, in the event of a fault developing in one of the decoupling components or of a screen becoming disconnected from the chassis, sufficient coupling may then exist to cause oscillation, which, like a true oscillator, will generate a signal close to the tuned frequency of the I.F. transformers. If the coupling is not quite tight enough or if the phase is not quite right, the stage may only just approach the point of oscillation. In this case, oscillation may occur intermittently with applied signal or the signal may undergo distortion owing to its passage through a somewhat unstable stage.

Symptoms of Instability

There are various ways in which instability may reveal itself in a television receiver, and it may affect one or a number of stages, and not only those concerned with the signal proper. In the vision channel, instability to the extent of oscillation may result in the spurious oscillatory signal beating with the real signal, and as the two signals are not too far removed in frequency a beat frequency will be produced which gives rise to pattern interference on the picture. Since the spurious signal is somewhat unstable in frequency, the pattern effect usually drifts across the screen and alters considerably in formation (see Fig. 1). In the sound channel, the beat frequency often produces whistles on sound which alter in pitch in a random manner.

However, the spurious signal is usually of large amplitude, and in this case completely overrides the real signal. When this happens, the video detector produces a large D.C. voltage from the spurious signal which makes the control grid of the video amplifier valve positive. This causes abnormal conduction in the valve, which results in

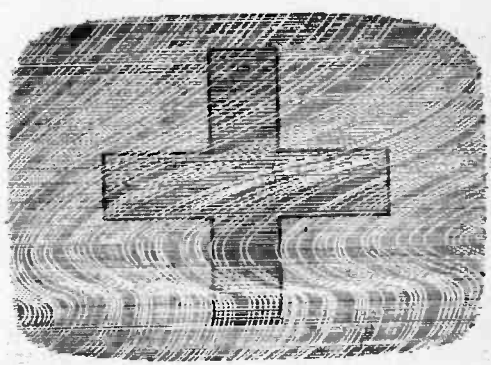


Fig. 1.—Moderate instability usually causes patterns to drift across the screen in a random manner, as shown.

a fall in potential at the anode, and since the anode is coupled to the picture tube cathode, a like reduction in potential also occurs here. This means that the tube grid is likely to be more positive than the cathode, and owing to this, a bright raster, which is often uncontrollable, appears on the tube screen. This symptom is invariably accompanied by overheating of the resistor in the anode circuit of the video amplifier valve as the result of the current rise. It should be pointed out that very similar symptoms may be caused by a heater to cathode short in the tube itself, but instability can be proved as will be explained later.

Altered Bias Conditions

There are times, however, when the spurious signal produced by instability falls outside the passband of the tuned stages. A fault in an I.F. amplifier valve, for example, may cause a form of electron oscillation which is rectified by the vision detector, but owing to its difference in frequency from that of the real signal does not cause patterning. However, the D.C. voltage produced by the detector owing to the spurious signal could result in disturbance of the biasing of the video amplifier valve. When this happens, either an unmodulated raster may occur on the screen or, if a picture is present, this may appear somewhat weak and watery looking, and it may be difficult to hold it in lock.

Heavy oscillation in the vision channel could cause failure of the vision detector diode, especially if of the germanium type. Also, the D.C. applied to the video amplifier may overload this valve, and result in the screen grid becoming red hot.

In the sound channel, instability may cause a beat note, as mentioned earlier, but if the instability is heavy and the spurious signal much stronger than the real signal, the sound will not be heard, but the sound channel will seem extra lively and several valves may seem to have developed microphony, and give a ringing sound from the loudspeaker when they are tapped.

Instability in the Timebases

Instability sometimes occurs in the timebase circuits, but in this case it is usually a low-frequency oscillation that results. In the frame timebase, this could cause the picture to judder vertically either at a speed that is visible or so fast that the effect is essentially that of impaired interlace. In the line timebase, the vertical parts of a picture may have the appearance of a sine wave or saw-tooth wave, depending on the kind of signal produced by the instability.

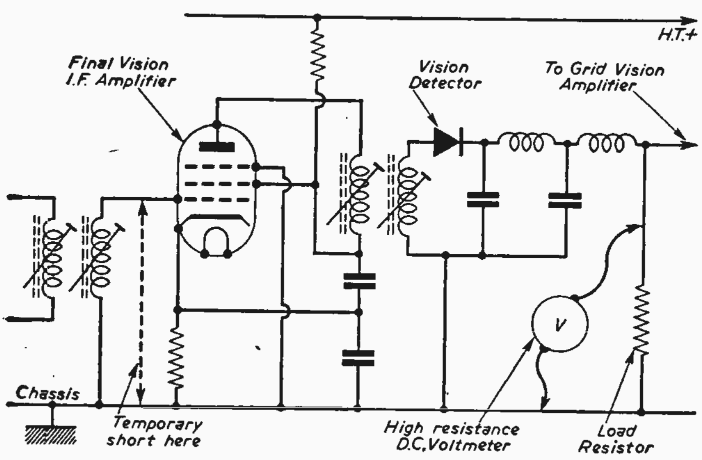


Fig. 2.—Instability may show as a constant voltage across the vision detector load resistor with the aerial disconnected from the set. This is proved by the voltage collapsing when a short is applied to the control grid of the final vision I.F. valve.

Checking for Instability

If a high resistance voltmeter is connected across the vision-detector load resistor with the aerial connected and the receiver working normally, a D.C. voltage will be recorded whose value alters with change in picture content. This is the normal action of the circuit. However, on removing the aerial from the set, the voltage should collapse to zero. A set which is unstable in the vision channel will give a constant voltage at this point (see Fig. 2) even with the aerial removed. If this voltage falls to zero when the control grid of the final vision I.F. amplifier valve is shorted to chassis, then one can be absolutely certain that instability is present. On sound, a similar test can be applied if it is not obvious that the sound channel is in a state of oscillation, as revealed from the symptoms given earlier.

If uncontrollable brightness leads one to suspect instability or a possible tube fault, the tube can be cleared from blame if the normal control of raster brightness is restored on shorting the control grid of the final vision I.F. amplifier valve, as before (see Fig. 2).

Cause and Remedy

In the majority of cases of sudden instability, open-circuit of one or more of the small decoupling capacitors associated with an I.F. amplifier valve is responsible, but it is often difficult to pinpoint the stage responsible since other stages may oscillate in sympathy, and the feedback loop may exist over two or more stages. One of the best ways of bringing the culprit to light is to shunt each decoupling capacitor in turn with a test component of a similar type while observing the instability symptom on the screen or on a meter (see Fig. 3).

The test component should have very short leads and can often be held in position without soldering by pressing the lead to chassis in good connection with a screwdriver and arranging for the other lead to make connection with the appropriate tag on valveholder or tag strip, etc. The actual component should not be touched when this test is made. If the instability is cleared on shunting a capacitor in this way, the original capacitor should be replaced, for it is almost certainly faulty. Alternatively, each capacitor can be replaced temporarily in turn until the faulty one is located.

Valves sometimes cause the trouble, and in some sets EF80's have been known to produce a spurious signal removed from the real signal's frequency.

(Continued on page 532)

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Is There Enough Signal?

INVESTIGATING SIGNAL STRENGTH

By G. J. King

ONE of the major problems facing television experimenters and, indeed, service technicians lies in determining whether a poor picture is due to a set fault or weak aerial signal. After considerable experience of a particular type of set, using a specific make and type of aerial in an area of known signal conditions, the service technician is usually able to decide with reasonable accuracy whether it is the set or aerial at fault. Unfortunately, the original signal conditions are not always known. The area may be new to the technician or experimenter, or a poor picture after a Band III conversion may well pose the question —is there enough signal?

The strength of signal at the end of a downlead can be measured fairly easily in microvolts or millivolts on a signal strength or field strength meter, but as these are rather expensive instruments it is unlikely that the experimenter will have one at hand, and it may happen that the technician is similarly placed. There are several things that can be done to avoid making the answer to the question a total guess, but before considering these, let us examine the symptoms of insufficient signal.

Noise Effect

Noise on a television picture is the background grain and ragged vertical edges of a picture component when the contrast and gain controls are turned up in an endeavour to secure a desirable black/white ratio. In severe cases, the effect is much like random, closely-spaced, small white spots, giving the picture a grey, snow-storm appearance. This happens in many areas on ITA programmes owing to the Band III signals being weaker than the Band I signals, the latter giving a BBC picture mostly free from the noise effect.

Service Areas

It should be made clear that the signal strength on Band III is invariably below that on Band I due to the higher frequencies and other factors. This means that in the outer service area of co-sited BBC/ITA transmitters a change from BBC to ITA will result in a distinct increase in noise effect. This may be overcome to some extent by the use on Band III of an aerial which is of more elaborate design than that used on Band I, but the problem may not be fully resolved by this artifice.

The noise effect is caused by very small spurious signals being generated in the valves and components of the early stages of the set. Random movement of electrons in resistors and the electron flow in valves contribute to the overall noise signal. In order to prevent the spurious noise signal from revealing itself in the form described earlier, the aerial signal must be far stronger so that the noise effect is masked by the required signal. The noise signal in a well designed set is often below 5μV. Virtually no noise is displayed when the aerial signal is some 100 times stronger than the noise signal, but when the signal noise ratio drops to about 10:1, slight picture noise is noticeable, and the noise effect progressively increases as the signal noise ratio decreases.

The noise signal not only modulates the picture tube in such a way as to cause spots on the picture but it also appears at the sync separator and thus enters the timebase circuits, resulting in irregular triggering of the timebases. This gives the ragged vertical edges to parts of the picture, and in severe cases causes vertical judder and intermittent rolling of the frame. On sound the effect is that a definite hiss forms a background accompaniment to the sound.

Increase in Receiver Noise Factor

It is now apparent that the ratio between the aerial signal and the noise signal generated by the set itself governs the extent of the noise effect on the picture. Unfortunately, there are various faults

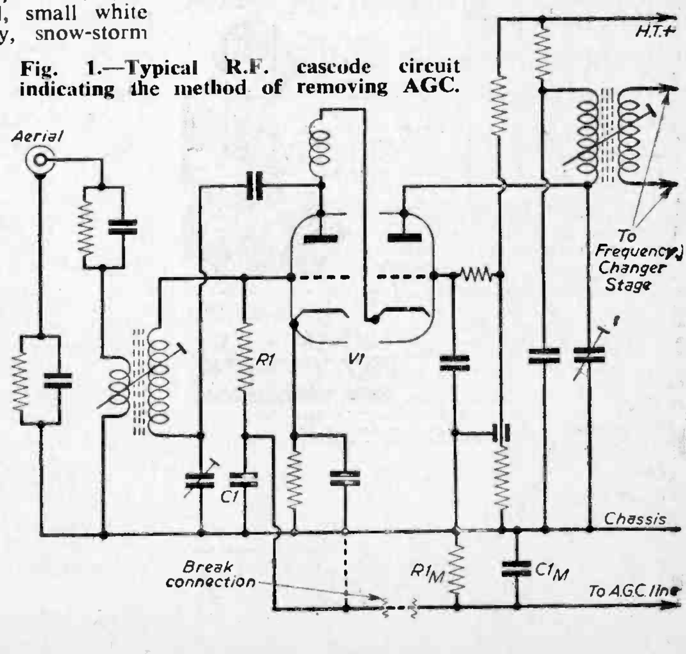

Fig. 1.—Typical R.F. cascode circuit indicating the method of removing AGC.

that can occur in the set to increase the generated noise signal. Thus, noise may show up on a picture even though the aerial signal remains unchanged. This is the reason why it is often difficult to decide without a signal strength test whether the set or aerial is at fault.

The receiver noise factor may increase due to a low emission R.F. or frequency changer valve, or as the result of an increase in value of a resistor, alteration in value of a capacitor or even misalignment. With sets using a multi-channel tuner a substantial increase in noise factor would be likely to be seen on both BBC and ITA pictures, though to a greater extent on ITA pictures for the reason given earlier. On the other hand, a small increase in noise factor may leave the BBC picture virtually unaffected and yet produce noise on the ITA picture. This is because the BBC signals are sufficiently strong to outweigh the increased noise factor, while the weaker ITA signals cannot do this.

Signal Strength Test

However, one cannot be certain that the increase in noise on ITA pictures is definitely caused by an increase in noise in the set, as the same symptom would result from a fault in the Band III aerial, downlead or both. A signal strength test would prove this without doubt, of course. Moreover, even if both pictures are suddenly affected by noise one still cannot be certain that the set is at fault, since if a diplexer is used to combine the two signals at the aerials, the downlead again may be defective, or a fault may have developed in the diplexer or aerial plug or socket at the set.

The query department of PRACTICAL TELEVISION is often asked to advise on how to eliminate noise on the ITA picture after a converter or tuner has been fitted, the BBC pictures being received without noise. It is almost impossible to answer this

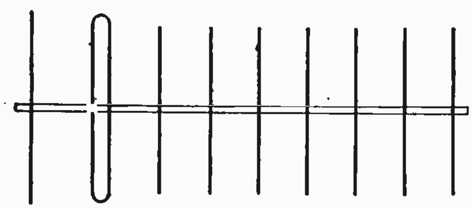

Fig. 2.— Typical multi-element aerial array. These arrays are often used indiscriminately in areas of poor signal strength; the most complicated array is not necessarily the optimum for a given location as much depends on the effects of reflections.

question as there is no relative signal factor which can be considered. This query usually comes from fringe areas where the Band I signal is only just about strong enough to mask noise while the Band III signal is nowhere near strong enough to outweigh the receiver noise, converter noise or both. The solution, in this case, lies in obtaining a stronger Band III signal by improving the aerial.

Combination

However, with simple add-on converters used with superhet receivers the overall noise factor is greater with the combination than when the set alone is used on Band I. This is because there are two frequency changer stages, one in the converter and the other in the set. In addition, the front end noise factor of this type of converter is often less favourable than that of a multi-channel tuner used to replace the front end of the set. This means that even if a Band III aerial considerably more elaborate than the Band I aerial is connected to the converter, noise may be present on the ITA pictures. When the Band I aerial signal is just about strong enough to hold back the noise effect, a comparable picture can be obtained on Band III when the ITA signals are approximately twice as strong. This applies to a multi-channel set, but with a Band I-only set coupled to a Band III converter the ITA signals may have to be even stronger to secure a noise-free picture comparable with that of the BBC.

The best noise performance of an add-on converter can be obtained with the converter's gain control at maximum and the receiver's contrast control turned down to give the correct contrast ratio. If the converter's gain control is retarded to give the correct contrast ratio, then noise will appear on the ITA pictures.

Improving Noise Performance

In order to obtain the best noise performance in fringe areas the first R.F. stage to which the aerial signal is applied must be operating at maximum gain. When this condition exists, the following stage receives a strong enough signal to outweigh the noise that it is generating, and the noise of the first stage only need to be considered. Some sets feature a sensitivity control which adjusts the gain of the first stage. In fringe areas this should always be set at maximum. Other sets have AGC applied to the R.F. stage. Where the aerial signal is weak, this AGC can be removed with considerable advantage. Such AGC is often applied to multi-channel tuners—to the cascode R.F. stage, as shown in Fig. 1. Here the AGC is applied to the "bottom" of the grid resistor R1, decoupled by C1. AGC can be removed from the cascode stage V1 simply by shorting the "bottom" end of R1 to chassis. However, as this may upset the AGC applied to the I.F. valves, it is best to break the AGC line as shown in Fig. 1, short the bottom of R1 to chassis and then load the open-circuit AGC line with components R1M and C1M, the values of which should match R1 and C1.

It is surprising how this improves the noise performance, especially on Band III, in poor signal areas, since with the AGC line connected, a control voltage is usually present for even the smallest of signals. It should be noted, however, that on some sets a delay is given to the AGC applied to the cascode stage, in which case the alteration may not be so advantageous as on sets with the cascode coupled directly to the vision AGC line.

Diplexer Losses

The removal of a diplexer on Band III may also assist in obtaining an improved noise performance. Although the through loss of a diplexer is not usually excessive (one or two decibels), the extra signal thus obtained is well warranted in poor signal strength areas. This, of course, means changing over the aerial downleads when changing bands, unless a low-loss changeover switch is incorporated, which is a fairly easy matter.

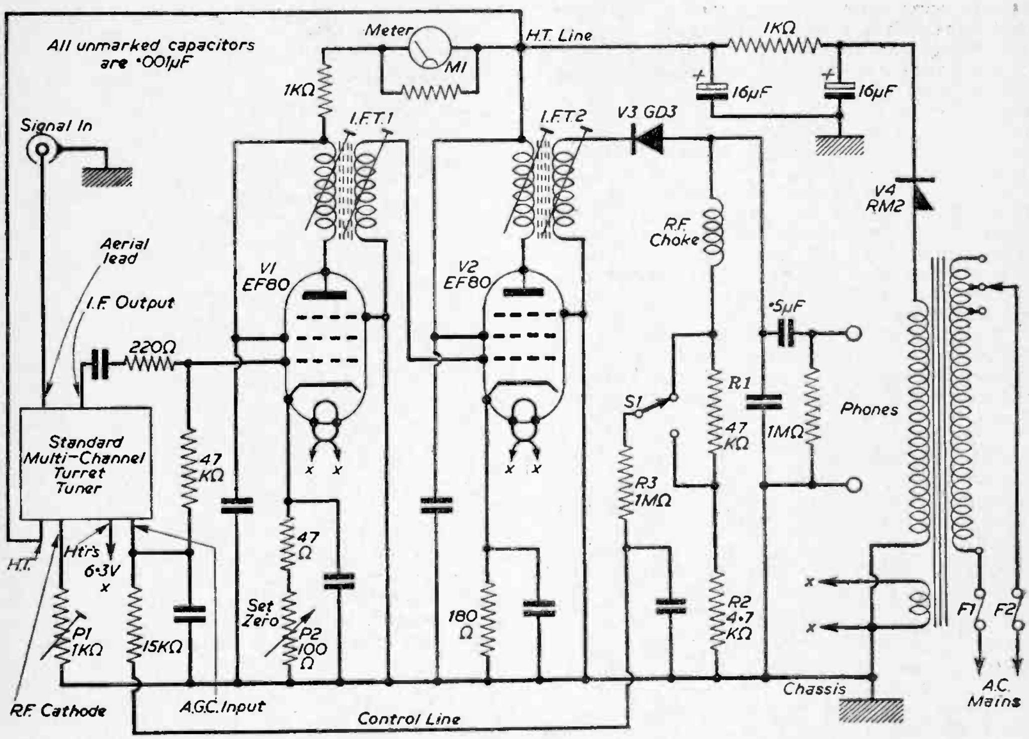

Fig. 3.—Circuit diagram of the signal strength meter for comparative tests.

Low-loss coaxial should always be used to connect the Band III aerial to the set when the signal is low. This pays dividends, as also does careful orientation of the aerial to get the best possible signal pickup. In very bad areas a reasonably noise-free picture can sometimes be obtained when the fine tuning control on the turret is adjusted away from sound, thus resulting in an improved picture and very poor sound. The sound in this case can be restored by adjusting very carefully the sound I.F. transformers for maximum sound output after first setting the fine tuner to the best position for picture. This should be done only as a last resort when it is absolutely impossible to improve the performance by other means.

Is there enough Signal?

We now get back to the original question. If in doubt about the signal conditions in the area, a relative idea can be gleaned by making inquiries of neighbours' reception. Most people are keen to talk about TV and the interference.

Arrays of complex aerials would indicate a weak signal area, and the use of a lesser aerial would be unlikely to give noise-free performance in such an area.

A sudden increase in noise on one channel only should lead to a check of the affected channel's aerial, while the same trouble on both channels should cast suspicion on the set, the downlead connections at the set and diplexer and the connections at the signal outlet socket. Check for a short in the coaxial plugs, as a small, almost invisible, piece of braiding wire partially shorting between the inner and outer conductors can result in a loss of nearly all the aerial signal, leaving just enough to give a very noisy picture and sound.

In cases of doubt it often pays either to check the set on a friend's aerial or the suspect aerial on a friend's set. Alternatively, the local radio dealer may be prepared to measure the aerial signal for a small fee.

It is interesting to note that an increase in noise may be caused by a neighbour having his aerials co-sited on a shared chimney stack. The proximity of other aerials does not usually take the signal away from the affected aerial unless they are acting as some sort of screen, which is unlikely, but an impedance change occurs, and it is this which detracts from the signal transfer from the aerial to the set.

Design for Signal Strength Meter

In Fig. 3 is given a circuit diagram of a signal strength meter. The circuit consists of a standard multi-channel turret tuner feeding into two I.F. amplifiers, V1 and V2, the output of which is rectified by the germanium diode, V3. The resulting D.C. component of the I.F. signal is developed across R1 and R2 in series, and being negative in polarity with respect to chassis is fed as a control bias, via S1 and R3 to V1 and the turret R.F. stage.

(Continued on page 540)

Add-on Sound Unit

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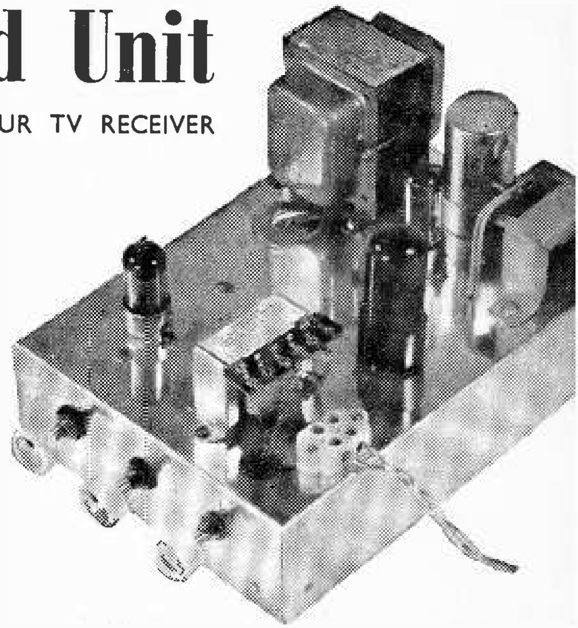


The completed amplifier.

IN the Editorial of the April issue it was mentioned that most of the modern developments in the design of TV receivers seem to be concentrated on improvements to the reproduced picture. The quality of the sound, far from being improved with the advent of new models, seems to be deteriorating. Many factors have given rise to this state of affairs, not the least of which is the increasing demand for so-called "slim" receivers where deflection angles of 110deg are used. Whilst it can be seen that the use of large diameter speakers should not be a deterrent to reduction of cabinet size, it seems absurd to obtain a small receiver with an excellent picture and very poor sound reproduction. Many older receivers, too, do not give the sound quality which can be obtained from the high fidelity TV sound signal which is transmitted. In many receivers the sound output stage is fed direct from the detector circuit and to secure an adequate volume of sound it is very often necessary to advance the volume control of the receiver to near the limit of its travel with the result that the signal-to-noise ratio is poor.

Noise Levels

Two forms of hum are encountered in the sound circuit of TV receivers; one is caused by "vision on sound" and takes the form of a 50c/s buzz which tends to be most wearing on the listener. Generally this is the result of misalignment in the R.F. circuits of the receiver or occasionally of

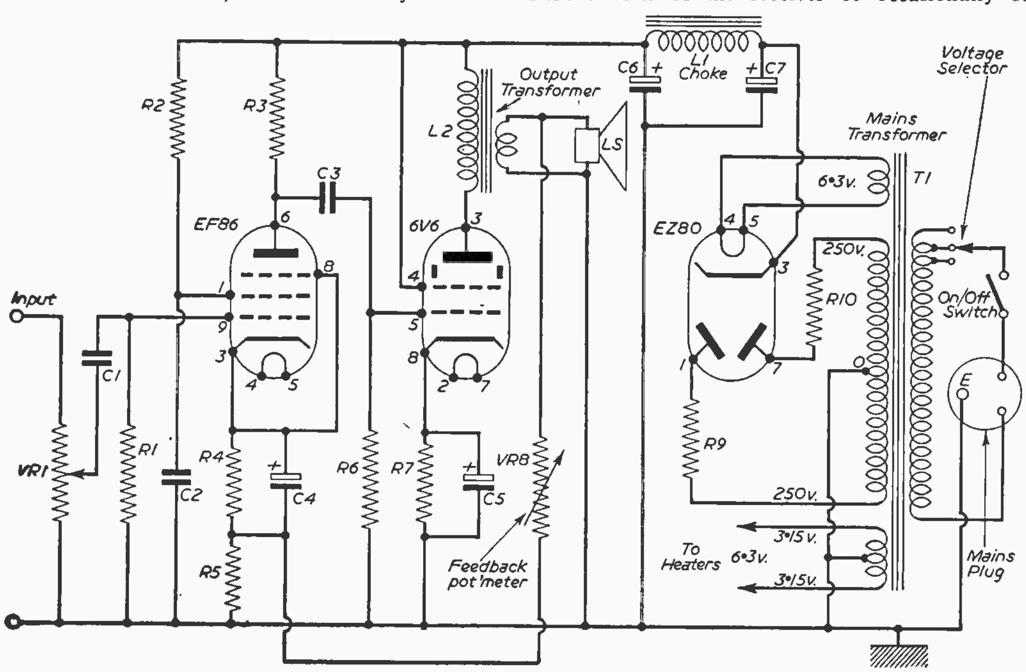
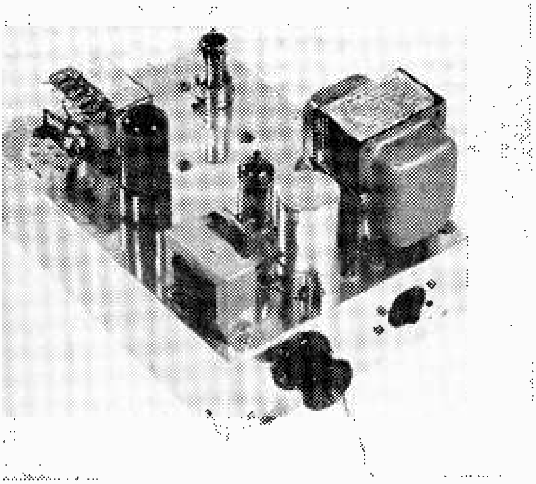


Fig. 1.—Circuit diagram (omitting tone controls).

standing waves on the aerial feeder which, in areas of high signal strength, may give rise to overloading of the vision circuits. The most common cause of hum in the sound output is poor smoothing in the H.T. circuits. Generally, smoothing is achieved by the use of high value electrolytic capacitors so that low resistance smoothing circuits may be employed. These electrolytic condensers may age and decrease in value and efficiency.

Fidelity

Therefore, only rarely is the sound quality from TV receivers an approach to the fidelity of the signal transmitted. Apart from modifying the receiver itself—renewing components and employing new circuits—the only easy way of improving the sound reproduction is to employ a separate sound amplifier and such an amplifier is the subject of this article.



Another view of the amplifier.

Circuit Design

Many constructors advocate the use of a very high quality amplifying and loudspeaker system with television receivers. Some use amplifiers having rated outputs of 20W or more with comprehensive tone control circuits in the pre-amplifier including steep cut-off bass and treble filters. To my mind, it is unnecessary to go to great lengths in the design of a separate amplifier for TV sound. An output of say, 4W maximum should be more than adequate for most rooms especially when it is borne in mind that when watching television the attention of the viewer is concentrated for the most part on the picture and minor defects in sound quality will be evident only to the most critical constructor. The main requirement so far as I am concerned is that the level of mains hum and other noise in the output should be negligible and preferably inaudible. This requirement is not so difficult to meet as is so often suggested; careful circuit design and, more particularly, very careful thought in the layout of the amplifier can give eminently satisfactory results.

Operation

The circuit diagram of the amplifier is given in Fig. 1 and it will be seen to be quite straightforward. Three valves are employed; V1 is an EF86 in a voltage amplifying stage and V2 is a well known and well tried 6V6 in a conventional output circuit. The rectifier valve is a modern type, an EZ80, the smoothing circuit for which is normal except for the large values of electrolytic condenser employed. These condensers, C6 and C7, with the choke L1 ensure adequate smoothing and no hum is audible from the loudspeaker except by extremely careful listening near to it. No tone controls are shown in the circuit diagram but suitable circuits can be connected before the amplifier if required.

The signal input passes to VR1, a 500k pot, which functions as the volume control. The signal then passes via C1 to the grid of V1 where an amplified signal is developed across R3. This is then passed via C3 to the grid of V2 and the output from V2 is transferred via L2 to the loudspeaker.

COMPONENTS LIST

Resistors:
VR1—500k log pot with double pole switch.
R1—1M.
R2—1M.
R3—220k.
R4—1·5k.
R5—100Ω.
R6—270k.
R7—270Ω.
VR8—10k wire wound pre-set pot.
R9—150Ω.
R10—150Ω.
(All ½W types of 10 per cent tolerance).

Capacitors:
C1—0·1μF 150VW.
C2—0·1μF 350VW.
C3—0·25μF 350VW.
C4—25μF 12VW (electrolytic).
C5—50μF 25VW (electrolytic).
C6, C7—32+32μF 350VW (electrolytic).

Valves:
V1—EF86.
V2—6V6 (G or GT).
V3—EZ80.

Miscellaneous:
L1 choke 10H 50mA.
L2 multi-ratio output transformer to give 45:1.
(Wharfedale type P).
T1 mains transformer with tapped primary. 250V-0-250V 60mA, 6.3V-5V 2A, 6·3V 2A centre tapped.
(Ellison MT161).
Coaxial input socket; mains voltage selector panel; mains input socket; two B9A and one internations octal valveholders; terminal block for output to speaker; eight way group board aluminium chassis approximately 10in. x 7in.; tag strips; nuts and bolts, etc.

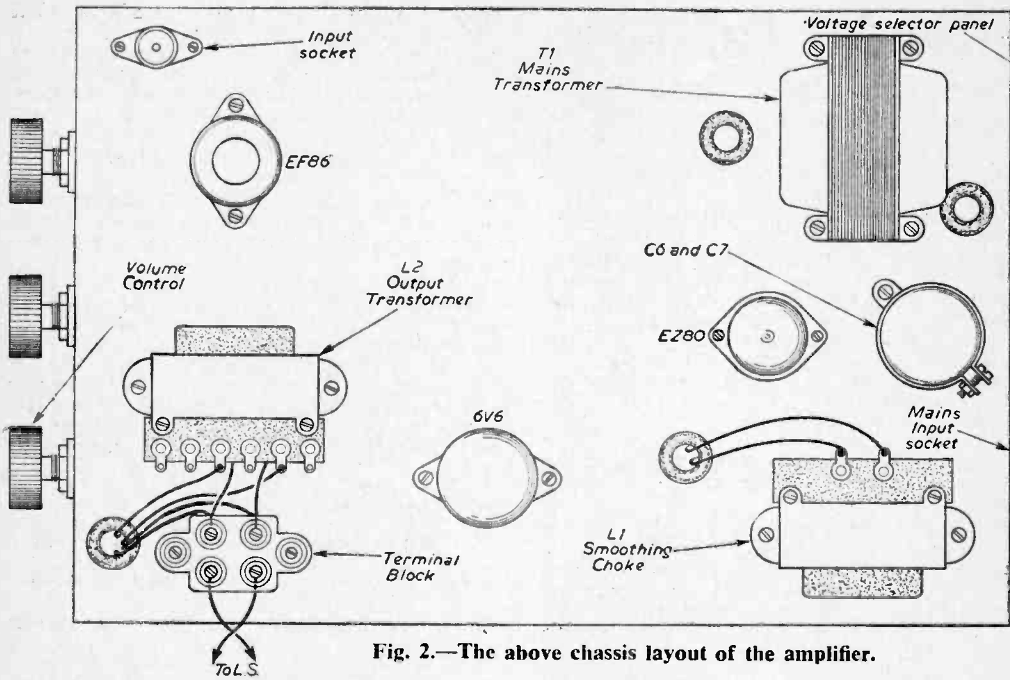


Fig. 2.—The above chassis layout of the amplifier.

It will be noted that the cathode circuit of V1 consists of two resistors in series R4 (1·5k) and R5 (100Ω). Only the resistance R4 is bypassed. This is achieved by C4. One side of the secondary of the loudspeaker transformer is earthed and the other side is connected via a 10k pot (VR8) to the junction of R4 and R5. Provided the correct side of the loudspeaker output is earthed, negative feedback occurs and the distortion introduced by V1 and V2 is reduced. If incorrect connections are made to the speaker output, then the amplifier will oscillate as feedback is positive. When the amplifier is constructed, it is a simple matter to make the necessary connections temporarily and when the correct phase has been determined the wiring may be made permanent.

Power Circuit

As previously stated, the power supply circuit is not unusual, but although the EZ80 rectifier valve can have its heater wired in parallel with those of the remaining valves, in this circuit it is operated from a separate winding. The H.T. secondary of the transformer gives 250V-0-250V and the centre tap is connected to the chassis. Resistors R9 and R10 are of low value (150Ω) and limit the peak currents which the rectifier must pass. The primary of the mains transformer is tapped so that the circuit can be used on varying mains voltages.

Construction

The layout of the principal components which are large in size is given in Fig. 2. It will be noted that three controls are shown; these are for volume, bass and treble although it is quite in order to omit the tone controls if required. Layout is straightforward but no detailed dimensions are given as much depends on the parts employed.

(*To be continued*)

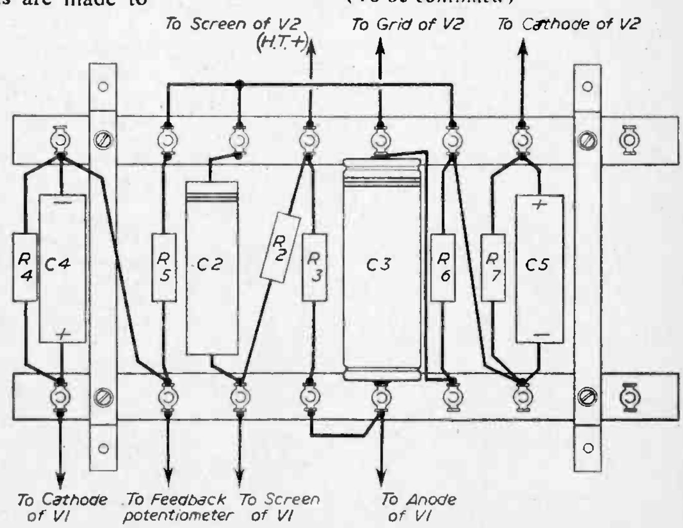


Fig. 3.— Wiring of the group board upon which the smaller parts are mounted.

Feeder Cables

TRANSMISSION LINE THEORY AS IT AFFECTS THE CONSTRUCTOR

By F. A. Palmer

An expensive television receiver can have its performance ruined by incorrect choice and installation of the transmission line connecting the aerial to it; this part of the installation is too often taken for granted, yet the quality of the received picture is very dependent upon it and every constructor should make himself acquainted with its theoretical and practical characteristics.

Transmission lines used for television work fall into two categories:

(a) Balanced twin cable.

(b) Coaxial cable.

Whatever its type, the fundamental principles underlying its functions are the same.

Characteristic Resistance

It will be appreciated that every line has a certain amount of resistance; it also has a certain amount of "leakance" between the conductors. If we have a long line between two points "X" and "Y" (Fig. 1a), the total current at "Y" will be restricted by the series resistance of the line R1 and the leakance R2, and this can be represented in the equivalent circuit in Fig. 1b. (The series resistance is shown in one side of the line merely for convenience.)

Suppose we had a line which was similar in every respect but which was twice as long, then we could represent it as in Fig. 2a, because the series and shunt resistances are progressive along the line. A line three times as long could be represented as in Fig. 2b. Continuing this reasoning, a line extended to infinity could be represented as a number of series and shunt resistances R1R2—R3R4—R5R6—R7R8 . . . RnRn+1.

Coming back to Fig. 1b, let us assume that R1 is 10Ω and R2 is 100Ω. If a battery of 50V is applied to the line we shall have a certain amount of current flowing from the battery (Fig. 3). This current will be

$$I=\frac{E}{R}=\frac{50}{R1+R2}=\frac{50}{110}=454\text{mA}$$

and the overall resistance looking at it from "X" end (i.e., across TU is 110Ω).

If the line is doubled in length then we shall have the condition shown in Fig. 4. To find the current flowing we must first find the *effective* resistance across TU. An easy method of doing this is to take point PQ on the line. From this point looking towards "Y" we have a resistance of R3+R4=10+100=110Ω. This resistance is directly across R2 (i.e. across RS) therefore, across RS we shall have a resistance of

$$\frac{110\times 100}{110+100}=\frac{11000}{210}=52\Omega\text{ (approx.)}$$

The resistance across TU will therefore be R1+52=62Ω. (Note: we shall take all calculations to the nearest whole number for ease of illustration.)

Let us now take a line three times as long. This is shown in Fig. 5. By working out the resistances across XY, VW, PQ and back to TU we shall find that the effective resistance across TU is 48Ω.

A line four times as long will give us an effective resistance of 42Ω. Do you notice how the *difference* in values across TU is becoming less? The stages have been 110, 62, 48, 42, the jumps between successive calculations being continually reduced.

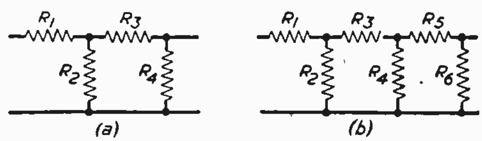


Fig. 2.—Rearrangement of line characteristic resistances.

Let us pursue this point a little further. Another section of line will give us an effective resistance of 38Ω, the next addition will give us 37·5Ω, and a further stage gives us 37Ω across TU. Adding yet another stage gives us 37Ω again.

At this point we could add on stages without making any difference to the resistance across TU. Furthermore we could short-circuit the "Y" end and still the resistance across TU would remain 37Ω. You can prove this yourself by continuing the calculations.

Characteristic Impedance

We have now arrived at a point where short-circuiting or disconnecting the far end of the very long line makes no difference to the effective resistance across TU or the input end. This resistance value we have obtained is termed the characteristic resistance of the line.

In the particular line which we have under discussion the characteristic resistance is 37Ω.

Now have a look at Fig. 6. Here we have disconnected the line at "XY", and inserted a load resistance of the same value as the characteristic resistance. Let us now calculate the value of the resistance which will appear across TU.

Across "VW" (ignoring the rest of the circuit back to the battery), we shall have a value of

$$\frac{R4\times 37}{R4+37}=\frac{100\times 37}{100+37}=27\Omega.$$

Therefore, across PQ we have a resistance of

$$R3+27=10+27=37\Omega.$$

Therefore, across RS we shall have a resistance of

$$\frac{R2\times 37}{R2+37}=\frac{100\times 37}{100+37}=27\Omega.$$

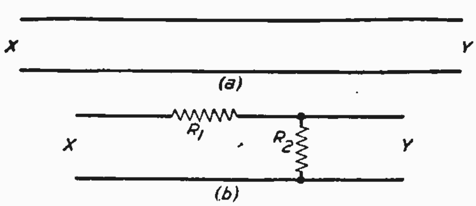
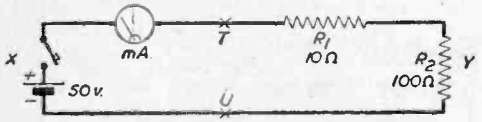


Fig. 1.—Diagram illustrating characteristic resistance of lines.

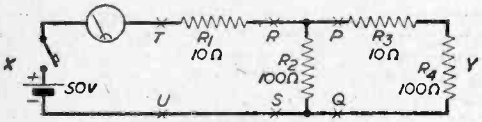
Therefore, across TU we have a resistance of

$$R1+27=10+27=37\Omega.$$

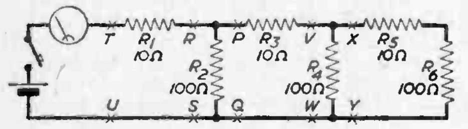
This means that if we disconnect the line at any point and insert across it at that point its characteristic resistance, the characteristic resistance will appear at the input end.

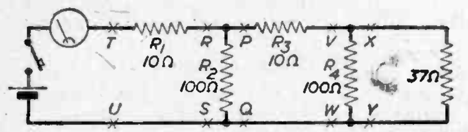


Effective Resistance $R_E = 110\ \Omega$



Effective Resistance across TU = 62 Ω





Figs. 3, 4, 5 and 6.—Circuits showing the effect of various resistances, and the voltage and current distribution round the network.

Critical Length

It will be remembered that an infinitely long line will produce its characteristic resistance at the input terminals, and it does not matter if the far end of the line is short circuited or left open, the input resistance across the line remains unchanged. In other words if a line is extended towards infinity there will be a certain critical length beyond which no additional lengthening will alter the input resistance.

There is, therefore, a certain maximum amount of current which will flow in the line, and as power is the product of resistance times current squared ($W=R\times I^2$), there is a limit to the maximum amount of power which the line can handle.

Now maximum power is transferred from one circuit to another when the resistances of the two circuits are equal; for example, the maximum power is obtained from a battery when the load resistance is equal to the internal resistance of the battery. The same principle holds good for a D.C. generator.

If it is desired to transfer the maximum amount of power from a D.C. generator to a line, then the characteristic resistance of the line should equal the internal resistance of the generator. If the line is not infinitely long it should be made to appear so by making the load across the output terminals equal to the characteristic resistance of the line, and this, as we have seen, makes the characteristic resistance appear across the input terminals of the line.

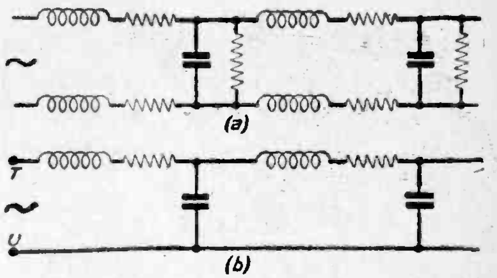


Fig. 7.—Circuits illustrating the characteristic impedance of lines.

Characteristic Impedance

When dealing with A.C., several other factors have to be considered. The line contains series inductance and resistance, with parallel capacitance and leakance. Fig. 7a shows the effect.

In practice the leakance is so small that it can be neglected and to simplify the diagram the constants (inductance, series resistance and capacitance) are shown in one side of the line (Fig. 7b).

It will be observed that at the input end we have A.C. resistance (or impedance), instead of pure resistance. However, the same principles obtain in this case and a line extended to infinity will have a certain *characteristic impedance.*

It must be remembered that the constants which determine the characteristic impedance, are themselves determined by the physical make-up of the line.

A line which is not infinitely long can be made to simulate infinity conditions by terminating it with its characteristic impedance, as in the D.C. case.

Fig. 8 shows the scheme where we have an A.C. generator (A) with its internal impedance (Zi), feeding into a line which is terminated with its characteristic impedance (Zo). Under these conditions, maximum power will be transferred from the generator into the load.

If the load is any other value than Zo maximum, transference of power will not take place. Zo can take any form such as a pure resistance, or lumped inductance and capacitance.

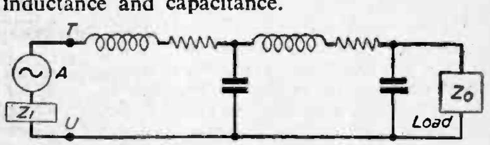
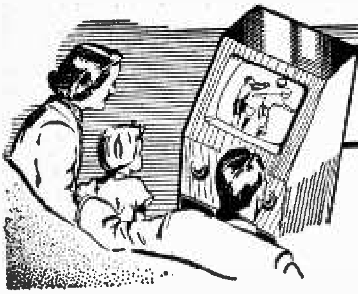


Fig. 8.—Diagram illustrating the effect of the impedance on the load.

Matched Line

In television we make use of a matched transmission line to obtain the transfer of the maximum amount of power from the aerial into the receiver. The aerial has A.C. induced into it by the incoming signal and can, therefore, be likened to a generator.

(To be continued)



UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

By Iconos

"TELEVISION is still in its infancy" is a remark I have heard so many times in the last few years that I have almost come to accept it as a fact. What nonsense! This assertion may have been true in 1936 and 1937, when the BBC were struggling to provide the first public television service in the world, but it is certainly not true now. Improvisation has long given way to careful planning; haywire pioneer experiments have been replaced by well-established production and engineering practices, and premises and equipment have acquired an appearance both functional and stylised. Cameras are no longer ugly square boxes and even the multitude of accessories have acquired a look which is as good as their performance. At British television transmitting stations and at the studios, the electronic equipment is mainly manufactured by E.M.I., Marconi, Pye or Rank-Cintel, and it is all of pleasing appearance, each make with its own characteristic styling.

Videotape and 16mm film

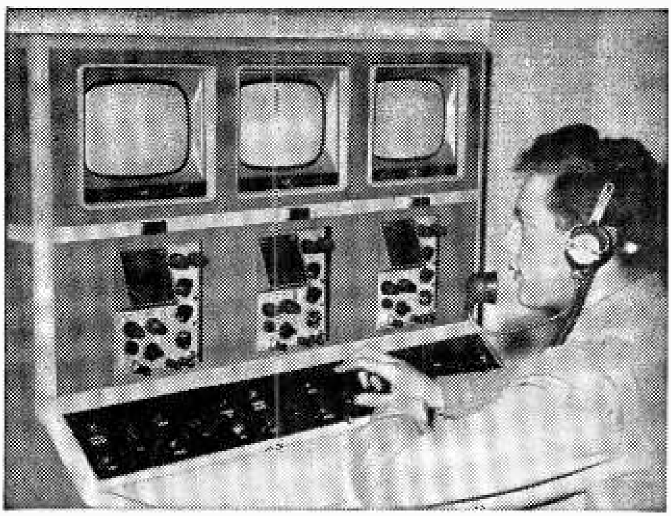
IN the wake of the main electronic equipment come the video tape machines of Ampex and R.C.A., each make well past its teething troubles and now with pleasing appearance as well as performance. Videotape has by no means reduced the amount of film used for outside events and even for telerecording, though the emphasis seems to be shifting from 35mm film to 16mm film. The latest 16mm film camera equipment to be unveiled is the new Debrie "Mixte" combined picture and sound camera, in which a transistorised sound amplifier is an integral part of the camera itself. The cameraman can hear the sound off the recorded magnetic track as it goes through the camera as an alternative to listening to the incoming sound. This well-designed instrument is another brain child of André Debrie, the veteran French camera designer, who is also obviously an artist in the same sense as Bugatti, Telford, Stroudley, Rolls or Brunel—all of them artist-engineers who built bridges, cars or railways. A really good engineering work invariably carries with it the stamp of the originator—almost as much as the work of a great painter.

The Television Society

THE new Director General of the BBC referred at great length to the triumphs of the Corporation's Engineering Departments in a speech at the annual dinner of the Television Society, held on the evening of the Royal Wedding. His eulogies were well deserved, though his "commercial" far outran the statutary natural-break time permitted to his competitors, the ITA programme contractors! As usual, Norman Collins, Deputy Chairman of ATV, outshone all the speakers (even Eamonn Andrews), with a highly topical summary of television people and places, given in the end-of-term manner of a headmaster. "Amongst other matters," he concluded with aplomb, "I have to report that Birkinshaw, D. C., and Bridgwater, T. H., show great promise"—which was his particular way of complimenting these two eminent BBC engineers.

Ulster's Success

ONE of the most pleasing success stories in television has been the rapid rise in popularity of Ulster Television, the ITA's smallest programme contractor. In the short space of six months, the set count for this station has increased



The Remote Control Console for Marconi Broadcast Vidicon cameras which is now installed in Havelock House, Belfast. It was designed and built by Ulster Television engineers.

from 97,000 to 143,000 not including a large number of viewers in Eire. During this time, the proportion of viewers able to receive both BBC and UTV transmissions has risen to 70 per cent in favour of UTV. The very name of the contractor, together with its lively local interview programmes, have contributed to this state of affairs. One regular early evening Ulster programme, "Roundabout", has achieved a rating of 50 per cent, which is considerably higher than similar types of programmes elsewhere. Another regional contractor with a large and loyal following is Tyne-Tees, which produces a relatively high proportion of local programmes, some of which are most ambitious. The BBC's regionals do excellent work, too, but their identity is not always obvious and their programmes are often erroneously presumed to originate in London, at Shepherd's Bush or Lime Grove.

Spoof

I STILL hear remarks about alleged "dishonesty" in the production and presentation of commercials on television. I suppose that such accusations are to some extent founded on fact—but there is just cause for the photographers to indulge in a little "pepping up" of the limited photographic tone range at their disposal, particularly as they do not have the advantage of colour. Even with the best of film or television cameras and systems, it is quite impossible to distinguish between the colours of milk and cream. Similarly the delicate distinction between dark greys and blacks is quite undetectable on home receivers. Therefore the television producers have to resort to a little mild deception to put over their stories. For years, the film people have made the froth on beer look fresher and brighter by adding a pinch of bicarbonate of soda; and cream has had to be darkened by adding a little yellow spice (turmeric). Meat is given a fresher look by painting the lean parts lightly with grape juice, and coffee has to be made very weakly indeed, otherwise it photographs as a black oily liquid. So much for making food look more appetising! For lengthy scenes in a television play, wooden or plaster imitations of foodstuffs are often required. The BBC prop department excel in this mild deception! The white boiled shirts and ties of men's evening dress look far better if they are cream, or yellow coloured, or even pale blue. Sparkling jewellery has to be avoided wherever possible. Mashed potato makes a good substitute for ice cream, under the hot lights, and it is usually wiser for actors to drink glasses of weak tea rather than genuine whisky—especially if they have to take one-over-the-eight in front of the camera! Thick paper or parchment documents have to be damped, or otherwise they sound like dry potato crisps; which, incidentally, sound like a house on fire when crumbled near a microphone. I have lots of other disillusions up my sleeve—but these examples surely indicate their professional necessity in the interests of both the dramatic and advertising arts.

Television Festivals

THE film industry is very prone to festivals. There are film festivals in Cannes, Venice and other glamorous places, at which new films from countries all over the world are shown and prizes are awarded. There are also film festivals much nearer home, mainly in the specialised and classic cinemas in London and the main provincial cities, at which old films of special merit are re-exhibited. Many of these films are grouped together into "festivals." Thus, several Marx Brothers films are shown in rotation on different days of the week. Ealing comedies and Alec Guiness films have also been recognised in this manner as classics. The advent of videotape recording offers the television industry an opportunity of enabling viewers to see again their old favourites, not necessarily by retransmissions on BBC or ITV networks—but in other ways. If the BBC had a small "classic" theatre at Broadcasting House, at which certain especially popular or historic broadcasts could be seen again on closed-circuit, by paying patrons, I feel sure it would be successful. For instance, the wonderful videotape recording of Princess Margaret's Wedding would be sure to attract full audiences. Big sporting events, the Tony Hancock series and some of the top-line dramas would also arouse great interest. On the other hand, ITV programme companies could give their audiences in their "classic" preview theatre a chance of re-seeing some of the fine Armchair Theatres, Goon shows and outside broadcasts. Of course, such a service could be free to viewers who make written application for seats—or the closed-circuit performances might be tacked on to the end of existing audience participation shows, giving an extra half an hour or so's entertainment. It would be a fine public relations service—though I do not think anyone would object to paying for admission.

Trade News

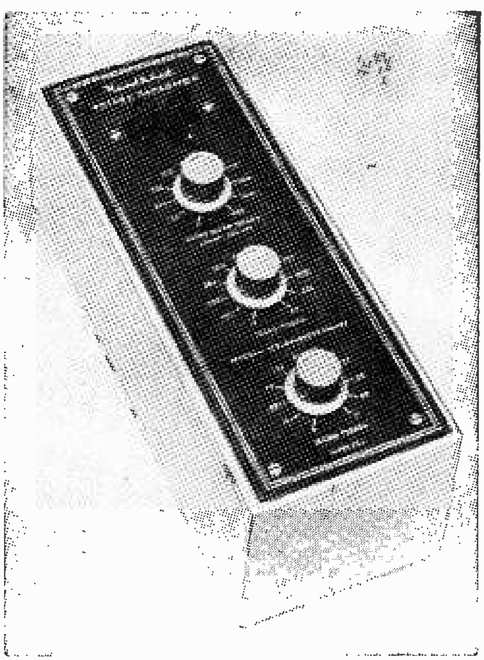
NEW PRODUCTS AND DEVELOPMENTS

Ultra "Bermuda" Range

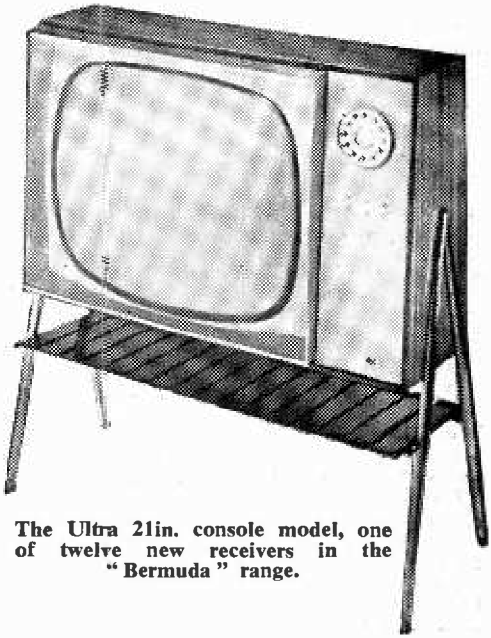
TWELVE new television receivers to be known as the "Bermuda" range have recently been marketed by Ultra Radio and Television Ltd. The new 110 deg tube brings greater cabinet slimness and the use of tinted screens a picture with reduced glare and reflections. High gain valves give better reception, particularly with an indoor aerial and in weak signal areas. All the controls likely to be needed by the viewer are situated at the side on the table sets, and at the front on the luxury models. The luxury models in both 17in. and 21in. sizes have an "Auto-tuner" which automatically rotates at the press of a button to select the desired channel or VHF station. The cabinets are finished in edinam veneers with gold frames, in red fabric also with gold frames, and in blue fabric with white frames. *(Ultra Radio and Television Ltd.. Stonefield Way, South Ruislip, Middlesex.)*

Capacitor Box

THE Heathkit Model DC-1 decade box is an instrument which offers convenience, accuracy and stability. The capacitors are silver mica types with a tolerance of ± 1 per cent. A special crystalline wax finish with an outer coating of wax ensures protection from moisture. Control of the capacitors is carried out by exposure to relative humidity above 95 per cent at a 24 hour cycling between 18 deg C and 35 deg C for a period of 7 days. The heavy duty switches are fitted with ceramic wafers and have a positive action. The Heathkit DC-1 is ideal for general experimental work and retails at £5 18s. 6d. It is manufactured by *Daystrom Ltd., Gloucester.*



The Heathkit Model DC-1 decade capacitor box.



The Ultra 21in. console model, one of twelve new receivers in the "Bermuda" range.

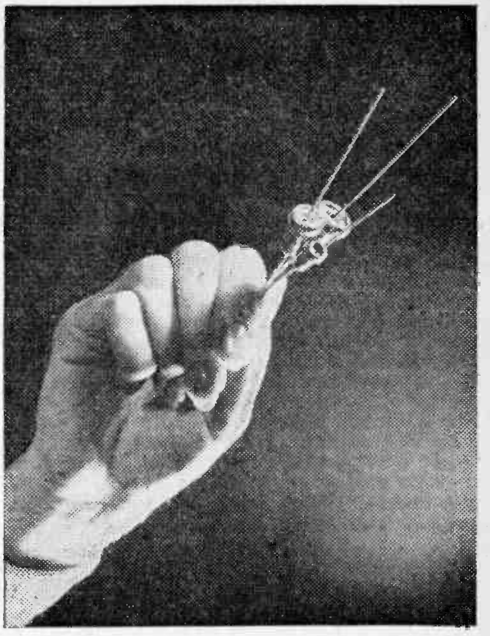
Aeraxial Trunk Cable

WITH the advance of national television relay Aerialite announce a development of interest to all relay companies concerned in the installation of television relay systems using coaxial cable distribution. They now offer a wide range of low radiation cables for trunk lines, with low attenuation in the frequency band used for direct signal television relay. These larger cables open up new possibilities, particularly in systems where extended cable runs are needed, as the number of repeaters can be significantly reduced. Full information may be obtained from *Aerialite Ltd., Cable Works, Stalybridge, Cheshire.*

Fansteel Capacitors

AS a result of an agreement concluded with the Fansteel Metallurgical Corporation of North Chicago, Illinois, the Plessey Company Ltd. now have exclusive selling rights in Great Britain of Fansteel tantalum capacitors. This range of capacitors extends from 325μF at 6V D.C. to 1.75μF at 125V D.C. both at 25 deg C. The range is cased in three standard sizes, the smallest being 15/32 x 5/16in. diameter, and the largest 49/64 x 37/64in.

diameter. The three sizes are available in alternative tolerance grades, grade 1 from −15 to +20 per cent, and grade 2 from −15 to +50 per cent when referred to 120c/s at an ambient temperature of 25 deg C. At reduced working D.C. voltages these capacitors may be used in an ambient temperature up to 125 deg C. *(Plessey Chemical and Metallurgical Division, at Towcester, Northamptonshire.)*



The illustration on the right shows the three sizes available in the "Fansteel" range of capacitors.

Pam "Superslim"

THE new Pam "Superslim" 17in. television receiver, Model 804, is designed on console lines with a "streamlined" cabinet only 3in. in depth. From the normal viewing angle the body of the set is invisible. For servicing purposes the card back is removed and the chassis is laid open for inspection. The cabinet is finished in light natural walnut veneers which have the new polyester non-scratch finish. A polished brass trim surrounds the screen. The set retails at 64 guineas including tax and the fringe equivalent, Model 805F, retails at 71 guineas including tax. Details of this and other Pam receivers are available from *Pam (Radio and Television) Ltd., 295 Regent Street, London W.1.*

INSTABILITY

(Continued from page 518).

This can be checked by replacing each valve in turn with one known to be in good order. Tapping the valves sharply with the handle of a screwdriver may reveal the trouble.

Sockets

Valveholders represent another potential cause of the trouble by developing poor R.F. connections between their sockets and the valve pins. Older sets which use EF50 valves are notorious in this respect. The trouble can often be remedied by closing the contacts on the valve holder with a metal scriber or screwdriver blade. It also helps to clean the valve pins with fine emery cloth, taking care to remove all traces of emery powder after the operation. This trouble can usually be located very easily by gently rocking each valve in turn in its holder while observing the instability symptom.

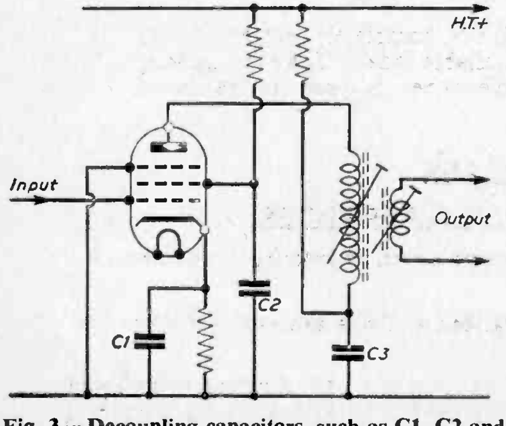


Fig. 3.—Decoupling capacitors, such as C1, C2 and C3, can be checked by shunting each in turn with a similar type of component while observing the instability symptom.

Poorly soldered connections, especially those in R.F. or I.F. stages on the chassis proper or on an earth bus bar, should also be investigated in obstinate cases of the trouble. It is most important that all shields and coil screening cans are making perfect connection to chassis, and that the aerial downlead is connected adequately both at the aerial end and at the set. A mismatch in the aerial due to this or other causes often results in instability occurring when the contrast control is turned towards maximum. Attention should be directed along these lines if it is found that instability can be cured by moving the position of the feeder cable at the back of the set.

Poor Definition

When a set is unstable, but not quite to the point of oscillation, the overall response curve is somewhat modified. and in the vision channel this may well result in very much impaired definition accompanied by a "tadpole" interference effect on the picture with flaring or overshoot. In the sound channel, the sound will be distorted and tend to blur badly at high contrast or sensitivity control settings. Instability in the timebase circuits should first lead to a check of the valves followed by a check of the electrolytic decoupling and smoothing capacitors. In the line timebase, an increase in value of the resistors connected to the control grid of the line amplifier valve may give rise to a symptom that has some resemblance to instability, giving waviness to verticals.

Letters to the Editor

The Editor does not necessarily agree with the opinions expressed by his correspondents.

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.

SERVICING THE BUSH 24C

SIR,—In the May issue Mr. H. Partridge of Bradley, Staffordshire (Your Problems Solved) complained of lack of width on his set. I have serviced several of this type of set for the same fault and would suggest the following cure. If, after replacing the line oscillator, line output, boost diode and H.T. rectifier valves on the left side of the main deck, the fault is not corrected, the cure is replacement of the C22 80pF condenser which is on the right side of the panel containing the EY51. This condenser is a special Bush type and can be replaced with an 80pF 10kV ceramic disc type. If this condenser develops a leak, sometimes the 50k wire-wound control may burn out or give erratic operation. The cure is to replace both the condenser and the 50k pot.—S. WHITTON (Buckingham).

SAFE MODIFICATIONS

SIR,—With reference to Mr. Cobb's letter (May issue), an isolating transformer will not solve the problem because an inductive surge is generated in the secondary at the moment of break which could be lethal. As I see it, the only solution is a completely isolated chassis with a voltage controlled earth leakage circuit breaker between line and chassis (which should be at true earth potential). This breaker would be set to operate at any leakage above a normal 25V and should be subject to I.E.E. and B.S.I. approval. It should be incorporated in the mains switch on the set.—R. E. CLARK (Woolwich, S.E.16).

REMOTE CONTROLLER

SIR,—In view of the present campaign for safety in the home I feel bound to point out the dangers of the circuit published on page 420 of the May issue, in spite of your warning at the end of the article. There is so often the unexpected fault; I quote the instance of the reversible two pin plug which is fed from the solitary socket in the room and removed frequently to make way for other uses. Is it always replaced with the polarity correct? The person using this device may be extremely cautious and check for polarity whenever he employs it, but can he be certain that the neutral fuse will not blow, or the switch not develop a fault on the neutral side. If this should happen when somebody is using the earphones, as suggested, this device can well become an "electric chair ".—G. FELTON (Chelmsford).

[*We think that the warnings given in our articles dealing with circuits using "live chassis" techniques are adequate and we shall continue to stress the dangers caused by careless wiring and handling.—Ed.*]

SOUND REPRODUCTION

SIR,—May I pass to you an outline of my own experiments. Ignoring the 8in. speaker in console (and the amplifier) the extension is a 12in. enclosed in a bass reflex cabinet connected in parallel by jack-plug; also switch to cut out console speaker. The extension is several feet from the TV but ties easily with the picture even when console speaker is " cut ". As there is a slightly better H.F. response from the console speaker, there is no necessity for any H.F. speaker (and crossover) to be added in the extension. Many sounds are greatly improved with the wider frequency response—examples: cymbals cease to sound like dust-bin lids, hoofbeats do not sound like knocking shells, etc.—W. CHESTER (Barnsley).

BARKHAUSEN EFFECT

SIR.—In reply to a reader's inquiry a few issues ago about lines running vertically down his screen, I would like to make one or two suggestions. Although it could be due to the effect mentioned as the heading to the correspondence, it might also be due to direct pick-up of interference from the timebases by the lead to the grid (or cathode) of the tube, in other words, the tube input. It could also be due to interaction between the timebases. I would offer the following suggestions for removing the lines. First, use the finest possible wire for the input lead—not thicker than 28s.w.g. Do not attempt to screen it. If the lines still persist, connect a 0·1μF condenser from input electrode (grid or cathode) to earth. If the lines vanish, then the interference comes from the input lead, or originates in some part of the circuit prior to that point. A clean raster should be left when the condenser is joined, but if the vertical lines still persist, the interference must come from interaction between the timebases, direct pick-up on the scanning coils or even the valves themselves.—H. REVLON (Penge).

SIR,—I was interested to read in your May issue about a reader who had "hum" bars on his screen. I, too, have experienced this fault on the vertical scan. I believe the effect is called the Barkhausen-Kurz effect, and is caused by parasitic oscillations (Barkhausen-Kurz oscillations), usually in the line output stage. In my case a cure was effected by changing the line output valve.— E. J. JONES (Monmouthshire).

Your Problems Solved

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. 540 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

PAM 982

I wish to alter this set to receive local ITV programmes. I do not have a circuit diagram.—W. Baxter (Motherwell).

To convert your receiver to ITA will involve fitting a turret tuner and the easiest one to fit is the Brayhead 35S in the 35BA7 adaptor. Full fitting details are provided with this unit which may be difficult to mount inside your cabinet and may need an external box.

MURPHY V310

I have moved my indoor aerial to several position in the room but I still have very bad ghosting on this set. When I tried it in another room the result was double images. The outdoor aerial is just the same and this only happens on ITV.—W. Fry (South Hackney).

To remove ghosts satisfactorily will require something in the nature of a 7-element ITA aerial erected outside. Several positions may need to be tried before a solution is found and if no alternative chimney is available a cranked arm may be used from the present pole.

ALBA T321

The picture on this set is really good but is split in half. The vertical hold rotates the picture but will not hold on top (only in the centre). I have changed the valves, ECC83's, PL82's (interchanged) but with no result. I put in a new C63 condenser. The vertical form does not appear to have any effect on the picture in its present position. On the bottom half of the picture there are white lines and the flicker on the screen is pronounced.—J. Finch (Wigan).

The lack of sync may be attributed to a resistor or capacitor associated with the frame sync clipper ECC83. First check the 2·2M from H.T. to the junction of the 0·1μF and 470k/220k. Then check the 0·1μF and the 22pF—pin 6 to pin 1. Check 820k to hold control.

PETO SCOTT 1722,

The above set is second-hand and has developed the following faults: the vertical hold is critical, although its best position is still half way. The horizontal hold is the same—also at half way and although it can be held it takes an exceptionally long time to set it. When it is set, it intermittently pulls to the left and there is always a pull to the left about 1½in. from the top. The valves have been checked and proved satisfactory. When I bought the set I found a grid short on the tube (MW43-69) but re-wired the base. When the set is laid on its side with the turret tuner uppermost there are three slider controls on the tag panels and the centre one was sparking slightly.—C. Ashall (Sheffield).

Switch the sync auto direct knob to direct. If both time bases are still "awkward" check rear left side PCF80 sync separator and the resistors associated with this valve base. These are 220k and 150k decoupled from the video amplifier by a 32μF which is also suspect.

PYE FV1

This set (12in.) has a thin white line across the screen. I have checked ECL80 which is in order and I now suspect the frame output transformer is open circuited. (Is it 10A or 11A?).—J. Hugh (Lanarkshire).

T10A is the oscillator transformer and T11A the output transformer. Of the two, T10A is the most likely failure. A check of its operation can be made by measuring the voltage at the ECL80 triode grid, which will be very negative if the transformer is oscillating.

MASTERADIO T917

After a few minutes viewing (ITV only) the frame starts to slip showing diagonal lines across the screen. Frame hold control is in midway position, movement either way makes frame slip upwards and downwards, locking now and again. Otherwise the picture is very good. As I am in a low-lying part of Bristol, would lack of signal strength be the trouble?—E. Caines (Bristol 5).

The use of a pre-amplifier would result in an increase of noise as well as signal and the net result would then be very little. It is the aerial which must receive attention; try to site it in a more receptive position. Also check the 10C2 sync separator and the resistors associated with this and the 20L1, coupling capacitors, etc.

DEFIANT T1410

The picture went very dim but focussed well. Suspecting a low emission tube, I bought a booster transformer marked 25 per cent, substituted a 45Ω 3 W resistor in the heater chain and installed the booster, connecting one side of primary to fuse 2 and the other to chassis. This restored the picture brightness but it is unstable and the slightest change in aerial input causes the picture to vary in size and brightness and occasionally disappear. Altering the contrast will bring it back and the picture has several ghosts. I checked the voltage across the tube heater (15), across substituted resistor (15) and across some other valves and all seem to be about right. There is a steady raster

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with no aerial but shadows seem to drift up and down.—G. Curnick (London S.E.13).

You should replace the U25 EHT rectifier wired on the right side line output transformer. The mains dropper is spring fitted and can be removed to enable the U25 to be reached a little easier.

BEETHOVEN 14in. CONSOLE

Is a Cyldon turret tuner E38H the correct one to use for the above set? I wish to take away the converter and replace with a turret tuner. This set is 5½ years old.—F. Morley (North Cray).

The Beethoven requires a P38H turret tuner for plug in conversion. The E38H could be used if separately supplied with a source of 6·3V for the parallel heaters. The reason being that the Beethoven has series heaters (0·3A) whilst the E38H has parallel heaters using ECC84 and ECF80 valves.

FRINGE RECEPTION

We are in a valley in a fringe area and television reception is difficult. I have two standard sets, an Ekco TC174 and a Ferguson 998T. The picture on the Ekco is quite reasonable but the sound on the Ferguson is faint, with a 4 element aerial at 30ft. There is no sound at all on the Ekco. I built an Argus pre-amp and a separate power unit H.T. 250V half-wave, L.T. 7·3V and completely screened the amplifier in a metal box, on the same chassis. I use a CV138 (6AM6) valve. I have checked and rechecked but can get nothing through it but very faint sound on the Ferguson. Both the TV chassis and pre-amp chassis were connected to the neutral side of the mains. The sound on the Ferguson is louder without the pre-amp. Is this type of pre-amp design suitable for very low signal areas? Would a cascode circuit be better. Should L1 and L2 be isolated from the chassis with 470pF capacitors?—J. Milton (Barnstaple).

Yours is a very difficult reception area in which, we understand, a "piped" TV service is being installed. A pre-amplifier cannot boost a signal which is not there, no matter how high the booster amplification. All that happens is an increase in background noise. In your case, however, it would seem that the pre-amplifier is failing to tune to the channel required. This may be caused by incorrect connection of the coils (or incorrect number of turns—try taking a turn off each coil), or incorrect alignment.

COLUMBIA C50IN

I would like to add a turret tuner to this receiver and also modify the scanning to take a 17in. tube. Is this easily achieved or would it require considerable modifications.—T. Edwards (Chester).

In spite of the fact that a large number of Plessey Mk11 chassis were modified to take a 17in. CRT we do not consider this modification wholly satisfactory. You would need a new line output transformer, scanning coils, focus magnet and timebase valves and components to make a satisfactory job of it (such components are advertised together with the circuit) and of course a fair amount of experience to overcome the inevitable snags. However, the receiver is easily converted, using a Cyldon E10L, a Brayhead 10P or a Teleng TT13P turret tuner. The I.F. is sound 10Mc/s, vision 13·5Mc/s.

ENGLISH ELECTRIC 16T110,

I suspect trouble in the line oscillation stage as I have touched a screwdriver on to the grid of this valve and voltage returned to normal for a couple of days. I have not been able to do this since. I have replaced rectifiers, (EHT) line output and efficiency diode.—J. Horner (Co. Durham).

Check the 4·7k resistor to pin 8 of the PL81, the 470k resistor to pin 7 of the EF80, the 47pF capacitor to pin 2 and the 0·1μF pin 7 to the control grid of the PL81. If the drive to the PL81 appears to be in order however, check the 0·001μF capacitors associated with the EY51 valves and the 470k resistors.

BANNER 124B

The above receiver has a Cyldon turret convertor TV13K/P164. I am shortly moving to Andover and wish to take this set with me. What new coils do I require and the method of fixing these.—S. Whitewell (Wembley).

You will require coils for channels 3 (BBC) and 11 (ITV). This means you require two pairs of coil biscuits. These coils are 7/6d. per pair and when writing to the manufacturers you should state the type of tuner when ordering—Cyldon P16S (not P164).

REDIFFUSION R.T. 100/12

This is a 12in. set and in good working order but I would like to know if I could fit a larger tube. The existing tube is a Mazda 121A.—L. Massy (Southampton).

The use of a larger tube would necessitate replacement of the line output transformer, scanning coils, focus magnet etc., and a a rebuilt line timebase. This is necessary to provide the extra scanning power and EHT required. Unless you have a good working knowledge of practical circuitry, we would advise you to adhere to the CRM121B (or CRM123) tube.

ARGOSY 14K41

About 15 to 20 minutes after switching the set on, and receiving good picture and sound, the picture starts to flicker or jump so that there are two pictures, vertically. If I switch off for a few minutes, then switch on again, I obtain a good picture for only 2 or 3 minutes. I have tried to adjust it by the frame hold, but to no avail.—D. Olley (Leicester).

There are two valves under the tube. That on the left centre is the PCL82 frame output-part oscillator, that on the right centre a PCF80 part-oscillator sync separator. Either could be at fault, probably the former (PCL82).

MARCONI VC59DA

This receiver has a 12in. tube (Emiscope) and I wish to fit a CRT isolation transformer to boost the tube, as the picture is very dull. Can you tell me the CRT heater voltage and current? — F. Smith (Watnell).

You should obtain a CRT isolation-boost transformer having a mains input primary and a

(13V + boost) secondary. Screw the transformer in a convenient position inside the cabinet, wire the primary tags, one to chassis, the other to terminal 1 on the mains selector panel. Remove the lead to 4 and place at 5 (or if now at 3, fit to 4). Remove the heater leads to the tube base pins 5 and 1 and connect these leads together. Connect the boost tags of the transformer to pins 5 and 7 in their place.

ULTRA WT917

For some time the picture has gradually been fading until it was impossible to see it. I fitted a new U25, U801, ZOP4 and 10P13. All the other valves have appeared reasonable when tested and all the valve heaters are in order. The raster is faint and has fold-over at the bottom. The sound is approximately half volume. There is no improvement on the raster when a 5k 10W resistor is placed betwen mains dropper yellow lead and pin 12 of the CRT. The raster alters with adjustment of the controls—brightness, height. A good whistle is present which varies when controls are moved. I propose to fit a reconditioned CRT and would like advice on removing and fitting tube and also the reason for loss of volume. I have also fitted a new volume control (½M) because the on-off switch of the old one appeared to have burnt out. White lines at approximately 1in. intervals also appear across the raster. — W. Ramsden (Sheffield).

See that the ion trap magnet in the rear of the tube neck is correctly adjusted for maximum brilliance. Check parallel 8·2k anode resistors of V6—10F1 video amplifier and feed components to CRT cathode. CRT is removed with chassis and is secured to it by a front band and supports. Volume control is 0·5M. Check 20P3, alignment of sound I.F.'s and sound section electrolytic capacitors.

IS THERE ENOUGH SIGNAL?

(Continued from page 523)

The current in V1 is metered by M1, and in the no-signal condition the current through V1 is adjusted by P2 to give full-scale deflection of M1. When a signal is applied and tuned by the turret, the negative control bias which is then produced reduces the current of V1 and thus gives a deflection of M1 of magnitude depending on the applied signal. A very strong signal will make V1 tend towards anode current cut-off and give only a very small reading (large deflection for maximum current) of M1. This acts as an overload protection and prevents the meter movement from being damaged by a large signal.

Sensitivity

Switch S1 gives two positions of sensitivity. In the position shown, the full negative control bias (developed across R1 and R2 in series) is fed back to V1, and this is the most sensitive position. In the other position, the sensitivity is decreased by approximately ten times, since only the voltage across R2 is fed back to V1. In order to obtain a ×10 reduction in sensitivity, R2 may have to be adjusted carefully in value by padding with either series of parallel resistors until the exact × 10 decrease is secured. Exact calculation of this component is difficult owing to the curved characteristic of the controlled stage.

The video or audio of the rectified signal can be heard for signal identification by connecting a pair of headphones across the terminals indicated. The variable resistor, P1 should be adjusted to give the best accuracy over all the turret channels. The best position will normally be towards minimum resistance.

H.T. and L.T. Supply

The power pack is of very simple design, though adequate for this purpose. A simple mains transformer, with isolated primary, gives approximately 125V r.m.s. at 80mA maximum across its H.T. secondary, and 6·3V at 1·5A across the L.T. winding. The Brimar RM2 metal rectifier provides about 140V D.C., this being smoothed by two 16μF electrolytics and the filter resistor.

Meter M1 should have a full-scale deflection of 1mA or less, and a suitable shunt resistor can be connected across it to give full-scale deflection with the 'set zero' control at about the middle of its range.

The I.F. transformers should match the I.F. output of the tuner. These can be made in accordance with normal practice or can be purchased. Setting up involves connecting a signal to the input socket and adjusting the turret to the matching channel. A pair of headphones connected to the 'phones terminal assist in adjusting the I.F.'s to the vision signal with the fine tuner at midrange. The I.F.'s are simply peaked to the signal on the local channel. With other receivable channels, the oscillator cores in the corresponding coils are simply adjusted to give maximum vision signal with the fine tuner at midrange, it not being necessary to re-adjust the I.F.'s

The 'phones can then be disconnected and, with the signal removed, the 'set zero' control adjusted for full-scale deflection on the meter. When the signal is re-applied the meter deflection will decrease depending upon the strength of the signal. Calibration is best carried out by using a signal generator with a fairly accurate attenuator. If this is not available, most dealers catering for the experimenter would be prepared to calibrate the instrument for a small fee by plotting on a graph the meter deflection against signal voltage. Later, if required, the meter can be re-scaled in terms of microvolts (μV) and millivolts (mV). The accuracy of the ×10 attenuator and the calibration over all channels can also be checked at this time and suitable correction curves can be produced if necessary.

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PRACTICAL TELEVISION, JULY, 1960

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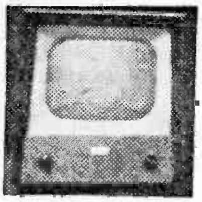

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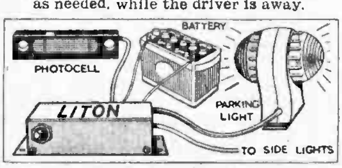

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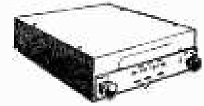

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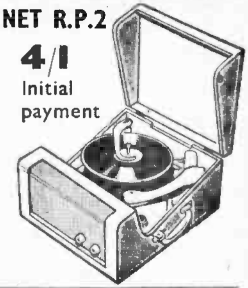

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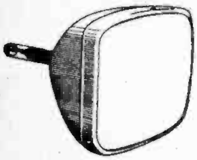

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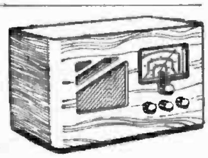

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