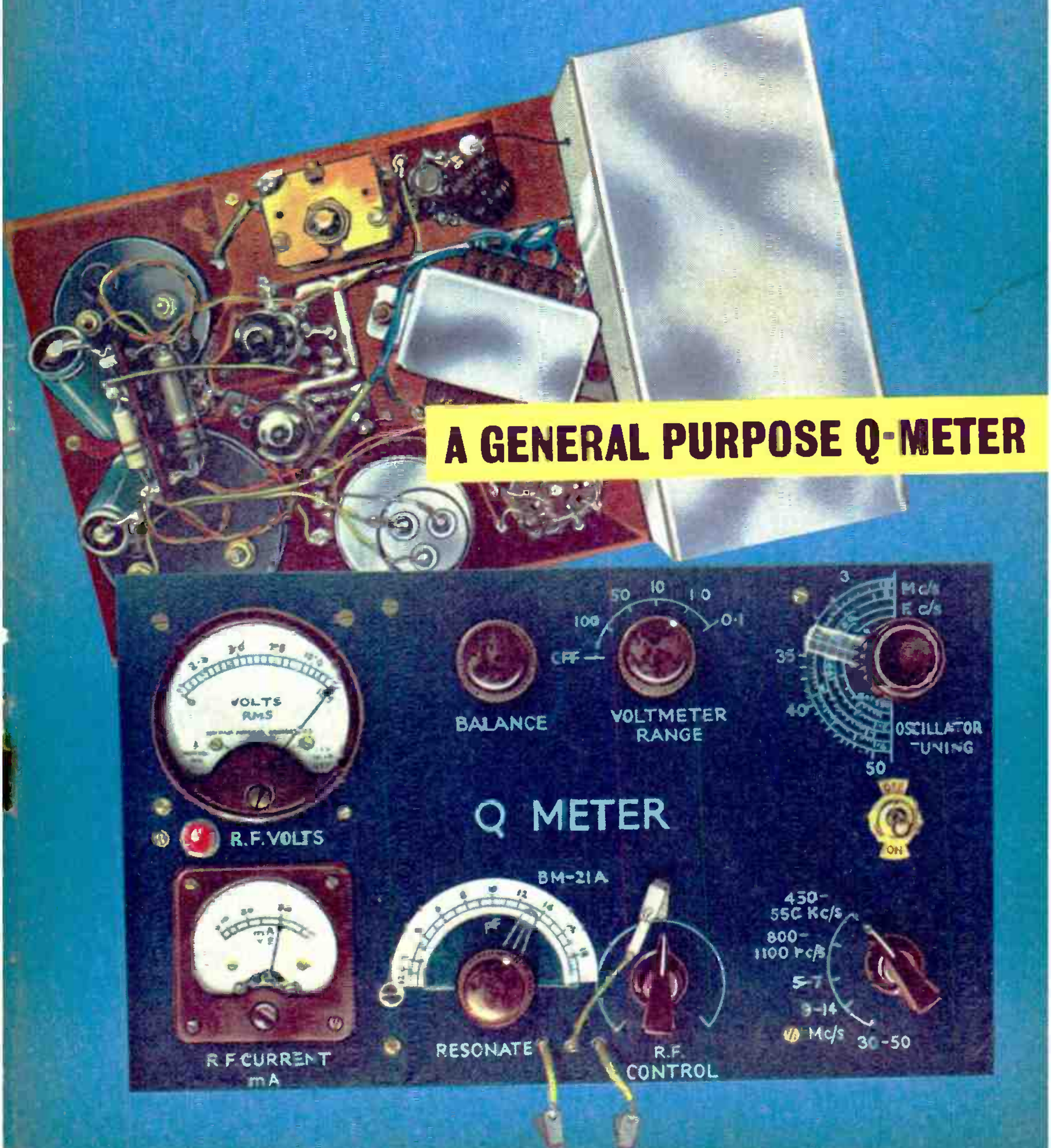
Practical TELEVISION

SEPTEMBER 1962

1'9

A GENERAL PURPOSE Q-METER



★ VALVES ★

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THE MOST COMPREHENSIVE COMPETITIVE VALVE LIST IN THE COUNTRY

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

NEW LOW PRICES GUARANTEED 3 MONTHS

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

Valve	Price
0Z4	5/-
1A5GT	5/-
1A7GT	11/-
1C5GT	9/-
1D5	8/-
1D6	9/9
1H5GT	9/9
1L4	3/3
1LD5	8/6
1LN5	4/9
1N5GT	9/9
1R5	5/6
1S4	8/-
1S5	4/6
1T4	3/6
2A3	6/6
2A7	9/6
3A4	4/9
3A5	9/-
3D6	4/6
3Q4	7/-
3Q5GT	8/-
3S4	6/-
3V4	6/9
5R4GY	18/6
5T4	8/-
5U4G	4/9
5V4G	7/9
5Y3G	5/9
5Y3GT	5/9
5Y4G	11/-
5Z4	11/-
5Z4G	7/6
5Z4GT	11/-
6/30L2	9/-
6A6	4/9
6A7	10/-
6A8G	8/6
6A8GT	13/6
6AB8	7/-
6AC7	3/8
6AG5	3/-
6AG7	7/6
6AK5	5/-
6AL5	3/-
6AM6	3/-
6AQ5	6/-
6AT6	5/9
6AU6	7/6
6B7	8/6
6B8G	3/-
6BA6	5/9
6BE8	5/9
6BG6G	15/-
6BH6	6/-
6BJ6	6/-
6BR7	9/6
6BW6	7/6
6BW7	5/6
6BX6	4/9
6C4	3/6
6C5	5/6
6C6	3/9
6C9	11/-
6CD6G	19/6
6CH6	7/6
6D2	3/-
6D3	9/6
6D6	4/3
6F1	4/9
6F6G	5/9
6F12	3/-
6F13	6/9
6F14	9/6
6F15	9/6
6F16	8/-
6F19	6/6
6F23	6/6
6F24	12/-
6F25	13/-
6F32	6/6
6F33	6/6
6J5	4/3
6J5G	3/-
6J5GT	4/-
6J6	4/-
6J7	8/6
6J7G	4/9
6J7GT	7/6
6J8	9/6
6K6GT	6/6
6K7	5/9
6K7G	2/3
6K7GT	4/6
6K8GT	8/9
6K25	7/6
6L1	12/6
6L6G	6/6
6L18	9/-
6L19	11/-
6LD3	8/-
6LD12	6/3
6LD20	7/9
6N7	7/6
6P1	7/6
6P25	8/6
6P28	12/6
6Q7G	6/-
6Q7GT	8/6
6R7G	8/6
6SA7	5/6
6SG7	4/9
6SH7	3/-
6SK7	5/-
6SL7GT	5/9
6SN7GT	4/6
6SQ7	5/9
6SS7	8/6
6U4GT	10/6
6V6G	5/-
6V6GT	6/-
6X2	7/9
6X4	5/-
6X5G	5/-
6X5GT	5/6
6Y6G	7/6
7A7	8/6
7B6	9/-
7B7	7/9
7C5	7/3
7C6	7/6
7H7	7/3
7K7	9/6
7Q7	8/6
7R7	10/6
7S7	9/-
7V7	7/9
7Y4	6/9
7Z4	7/-
8D3	3/-
10C1	11/6
10C2	14/6
10C14	3/-
10F1	5/9
10F9	10/6
10F18	10/-
10L14	7/-
10LD3	7/9
10LD11	14/6
10LD12	8/-
10P13	11/-
10P14	9/-
10P18	7/-
12A6	4/9
12AH8	9/-
12AT6	7/6
12AT7	5/6
12AU6	9/6
12AU7	6/-
12AX6	6/6
12BA6	7/6
12BE6	7/6
12BH7	9/9
12C8	6/6
12E1	17/6
12J7GT	9/-
12K7GT	4/9
12K8	11/-
12K8GT	9/6
12Q7GT	5/-
12SA7	7/-
12SG7	5/-
12SH7	3/6
12SJ7	5/6
12SK7	4/9
12SN7GT	7/9
13D3	9/-
14S7	14/9
19AQ5	7/6
19BG6	19/-
20D1	9/6
20F2	9/6
20L1	16/-
20P1	8/9
20P3	12/6
20P4	18/-
20P5	15/-
25A6G	8/-
25L6G	6/9
25L6GT	7/9
25Y5G	8/-
25Z4G	7/-
25Z5	8/-
25Z6G	8/-
30C1	7/-
30C15	11/6
30F5	6/-
30FL1	9/6
30L1	6/9
30L15	9/6
30P4	9/6
30P12	7/6
30P16	6/6
30P19	17/6
30PL1	9/6
30PL13	13/-
35L6GT	8/6
35T	25/-
35W4	6/9
35Z4GT	5/6
35Z5GT	8/-
41	7/6
42	7/6
50C5	9/-
50CD6	19/-
50L6GT	8/6
52KU	10/6
53KU	10/6
618PT	11/-
62BT	13/6
75	6/6
78	6/6
80	5/9
83	9/6
185BT	19/6
803	19/-
807(A)	5/6
808	7/6
813	55/-
832	14/-
866A	11/6
954	2/-
956	2/6
9001	4/-
9002	4/9
ATP4	2/9
AZ31	8/-
AZ41	11/-
B36	7/9
C1C	9/6
CBL1	26/6
CBL31	21/-
CCH35	14/-
CL33	9/6
CY31	9/-
D77	3/6
D152	5/9
DA30	12/6
DAC32	9/9
DAF91	4/6
DAF96	7/3
DET19	2/9
DF35	9/9
DF91	3/6
DF96	7/3
DF97	8/6
DH63	6/-
DH76	5/-
DK32	11/-
DK91	5/6
DK92	7/-
DK96	7/3
DL33	8/-
DL35	9/-
DL65	6/-
DL75	6/-
DL82	9/-
DL91	8/-
DL92	6/-
DL94	6/9
DL96	7/3
EABC80	6/9
EAC91	4/6
EAF42	8/-
EB41	7/-
EB91	3/-
EBC33	4/9
EBC41	8/-
EBC81	7/9
EBF80	7/9
EBF83	9/6
EBF89	8/6
EBL21	12/6
EBL31	17/6
EC91	4/6
ECC31	7/6
ECC32	4/-
ECC33	4/6
ECC34	9/-
ECC35	6/-
ECC40	14/-
ECC81	5/6
ECC82	6/-
ECC83	6/6
ECC84	8/-
ECC85	7/9
ECC89	16/-
ECC91	4/-
ECF80	8/6
ECF82	8/6
ECH21	12/6
ECH35	7/6
ECH42	8/6
ECH81	7/9
ECH83	9/3
ECL80	7/-
ECL82	9/6
ECL83	11/7
EF22	7/-
EF36	3/3
EF39	4/6
EF40	12/-
EF41	8/-
EF42	7/6
EF50-BR	2/-
USA	3/-
EF54	3/3
EF80	4/9
EF85	6/6
EF86	9/-
EF89	6/9
EF91	3/-
EF92	4/6
EF96	3/-
EF183	14/-
EF184	12/-
EL32	4/6
EL33	7/9
EL35	7/-
EL41	8/-
EL42	8/9
EL81	11/-
EL83	11/-
EL84	7/-
EL91	4/-
EM80	7/9
EM81	8/6
EM84	9/-
EM85	10/-
EN31	16/-
EY51 Small	7/9
EY86	7/6
EZ35	5/6
EZ40	6/6
EZ41	7/-
EZ80	6/-
EZ81	6/6
FW4/500	8/-
FW4/800	8/-
GT1C	7/-
GZ32	8/9
GZ34	12/6
HL41DD	8/3
HN309	19/-
HVR2	10/6
1W4/350	7/6
1W4/500	7/6
KLL32	8/6
KT32	6/9
KT33C	4/6
KT36	12/6
KT44	7/6
KT45	8/6
KT61	8/6
KT63	5/9
KT76	8/6
KTW61	5/9
KTW62	5/9
KTW63	5/9
KTZ63	5/6
L63	2/9
LN152	7/-
MU14	7/6
N37	11/-
N78	15/-
N108	16/-
N152	8/6
P41	4/6
P61	2/9
PABC80	11/6
PCC84	6/9
PCC85	8/9
PCC88	14/-
PCC89	9/-
PCC189	13/6
PCF80	7/-
PCF82	7/6
PCF84	16/-
PCF86	12/6
PCL82	7/3
PCL83	10/6
PCL84	7/6
PCL85	11/6
PCL86	12/6
PEN45	8/6
PEN46	5/-
PL33	8/3
PL36	9/6
PL38	16/6
PL81	8/6
PL82	6/6
PL83	6/6
PL84	8/-
PL820	8/6
PX4	12/6
PX25	9/6
PY31	9/-
PY32	10/-
PY80	6/9
PY81	6/6
PY82	6/-
PY83	7/-
PY88	6/9
PZ30	9/6
R18	11/-
R19	11/-
SP41	2/6
SP61	2/6
SU25	16/-
SU2150	4/6
T41	7/6
TDD4	7/6
U14	8/-
U18	8/-
U22	6/9
U24	16/-
U25	11/6
U26	9/9
U31	7/-
U33	14/-
U35	12/6
U37	26/-
U50	5/9
U52	4/9
U76	5/6
U78	5/-
U191	12/6
U281	9/6
U282	15/-
U301	15/-
U309	6/9
U329	6/9
U339	11/-
U801	19/-
UABC80	8/-
UAF42	7/9
UB41	7/9
UBC41	7/9
UBC81	9/6
UBF80	8/-
UBF89	7/6
UBL21	14/6
UCC84	14/6
UCC85	7/-
UCF80	15/-
UCH21	12/-
UCH42	7/3
UCH81	8/-
UCL82	9/9
UCL83	13/6
UF41	7/6
UF42	5/6
UF80	7/-
UF85	7/6
UF86	14/6
UF89	7/-
UL41	7/-
UL44	11/-
UL46	9/6
UL84	7/-
UM80	9/6
URIC	8/-
UU6	12/6
UU7	9/6
UU8	17/-
UY1N	11/-
UY21	11/-
UY41	6/-
UY85	6/6
VP41	5/6
VR105	6/9
VR150	6/9
W61M	11/-
W76	4/9
W81	7/3
X61M	11/-
X63	8/6
X65	11/-
X66	11/-
X76M	11/-
X78	21/-
X79	16/6
X81M	9/-
Y63	6/3
Z63	4/9
Z66	9/6
Z152	4/9
Z719	4/9
ZD152	7/0

Tubes

HIGHEST QUALITY—COMPARE OUR PRICES

Carr. & Ins. 12/6.

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

GUARANTEED	6 Months	12 Months
12in.	£2. 0.0	£3. 5.0
14in.	£2.10.0	£3.15.0
15/17in.	£3. 5.0	£4.10.0
21in.	£3.15.0	£5.15.0

NEW TYPES

MW 31/74 £4-0-0

MW 36/24 £5-0-0

CRM 172 MW 43/64 £6-0-0

SPECIAL TEMPORARY OFFER. Due to huge Bulk Special Purchase we are offering MW 31/74 Tubes at the unrepeatable price of 29/-. MW 36/24 ditto. 39/-. P.P. 12/6. The above are guaranteed for 6 months.

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

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

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

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

13 CHANNEL T.V.s

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

12in. **£2.19.0** 14in. **£4.19.0**

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

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

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TRANSISTORS. Red spot 3/6 ea. White Spot 4/6 ea. Yellow Spot 2/9 ea. Germanium diodes 9d. ea., 8/- doz.

TAG STRIPS. From 3-way to 12-way. Mixed parcels of 25—3/9. The best and cheapest way to buy!

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

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

TRANSISTOR INTERCOM. High sensitivity, complete with batteries, usually £9. DISCOUNT PRICE £5.10.0.

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

Famous makes complete with PCF80, PCC84 valves. 38 Mc/s I.F. Fantastic value **19/-**

CONDENSERS. 25 Mixed, Electrolytic. Many popular sizes. List Value £5.

Our Price **10/-**

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

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

100 RESISTORS 6/6

100 CONDENSERS 10/-

Miniature Ceramic and Silver Mica Condensers 3 pF to 5,000 pF. LIST VALUE OVER £5.

IVORY/GOLD KNOBS 1" Diameter, half price 1/2, 5 for 4/6: 1¼" 1/3. 5 for 5/-.

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

RECTIFIERS. Silicone Diodes 125 v. 500 mA, 2 in series make superior replacement for R.M.4 and R.M.5, etc., 8/- each. 250 v., 80 mA, 5/-: RM1, 5/3; RM2. 6/9; RM3, 7/6; RM4, 19/6; RM5, 19/3; 14A86, 17/-; 14A97, 19/6; 14A100, 19/6; 16RC1-1-16-1, 7/9; 18RA1-1-1-16-1, 7/9; 18RD2-2-8-1, 14/-; 14RA1-2-8-2, 17/-; 14RA1-2-8-3, 20/-.

GERMANIUM DIODES, general purpose, 9d. each, 8/- dozen.

LINE TRANSFORMERS. Most types available from stock from 19/-. Also frame and blocking oscillator transformers. S.A.E. enquiries.

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21in T.V. CHASSIS Unused famous make, complete with valves, only requiring MW43/80. To complete 13 channel. Worth £30. FEW ONLY. £16.0.0.

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

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350-352 FRATTON ROAD, PORTSMOUTH.

MAIL ORDER ONLY DEVONIAN COURT,
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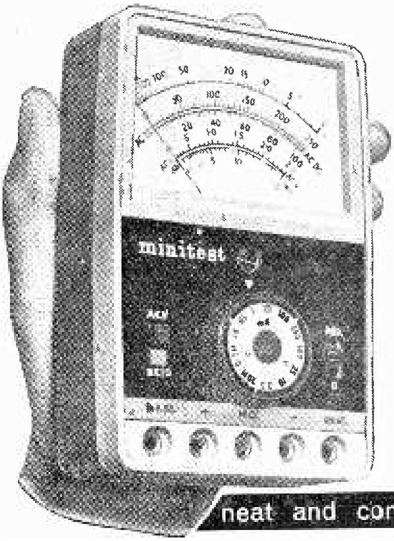

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A new compact instrument suitable for the measurement of D.C. voltages and currents, A.C. voltages and ohms. Its high sensitivity renders it suitable for testing and fault location in all types of electrical and electronic circuits. It is well-built to ensure long and satisfactory service. The instrument is economically priced and supplied with test leads with plug connections at one end. (Leather carrying case available as an extra).

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D.C. Volts 2.5, 10, 25, 100, 250, 1000.
D.C. Amps. 50 μA, 1mA, 10mA, 100mA, 1A.
Ohms 2000 200 000 20 MΩ

ACCURACY:
D.C. Volts & Amps ±3% of full scale deflection
A.C. Volts ±4% of full scale deflection
Ohms ±5% at centre scale.

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Diamond

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BRITAIN'S FINEST—*ONLY THE GLASS IS NOT NEW*

- ★ RE-SCREENED ★ RE-ALUMINISED
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- ★ GUARANTEED 12 MONTHS
- ★ ALL TYPES IN STOCK

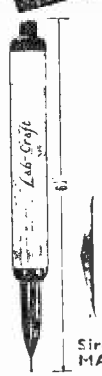
Diamond TV Tubes revitalise your TV. Wonderfully improve definition and brilliance.

12" —	£4.10.0
14" —	£5. 5.0
17" & 15"	£5.15.0

ALSO 19", 21" and 23"
Carriage and insurance 7/6
C.O.D., C.W.O. or Proforma Invoice
10/- refund on your old tube.

SPECIAL OFFER — LAB CRAFT

TRANSISTOR SIGNAL INJECTION PROBE
Quickly checks: Radio. TV Sound. All forms of Audio Ccts. Printed Wiring. Complete with long-life Mercury Battery. Price: **£4.19.6.** Cash with order, carriage paid.



Self contained. Completely safe. Light in weight. Wide frequency range.
Use for rapid signal injection. Functions as a Wide-Band Modulated Signal Generator emitting a signal rich in AF, IF and RF components. Useful range: 2 Kc/s to 25 Mc/s.

DIAMOND ELECTRONICS CO.

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Practical Television

AND TELEVISION TIMES

VOL. 12, No. 144, SEPTEMBER, 1962

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PRACTICAL TELEVISION

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Contents

Free Data Chart

THE next issue of PRACTICAL TELEVISION will see the beginning of a new series of articles dealing with the principles and practice of television reception during the past few years, and, more especially, with the future of television in the light of recent developments. UHF reception will be a special feature of this series which has been designed to give a detailed explanation of the present system and of systems to come. To help the reader to understand the series and to gain the maximum benefit from it, we are presenting free, in the same issue—dated October 1962—a Data Chart which is packed with information bearing on the new series of articles; a complete list of BBC and ITA stations (with maps) giving their frequency, and polarisation, channel number and radiated power; tables of decibels and power ratios and comparisons of television standards; a guide to television check points; colour codes; aerial information for Channels 1 to 13; designs for attenuators—all this and much more data is included in the Data Chart which is normally priced at 7s. 6d.

However, this Chart has not been designed solely for reference in connection with the new series of articles, to be discarded when the series ends; the information contained on both sides of the blueprint-sized sheet will be found to be of continual use for both the experimenter and the serviceman.

Much of the information on the Chart cannot be found in one single work of reference and thus, for example, the service engineer need not search through several different manuals to find essential information. Similarly, a quick reference to the Data Chart will supply the TV experimenter with all the details he needs to suppress an appliance causing TVI, etc.

The next issue of PRACTICAL TELEVISION will be in great demand and will quickly go out of print, so be sure of getting the Data Chart by ordering your copy of October P.TV. now.

MORE P.W. BLUEPRINTS

The October, November and December issues of our companion journal, *Practical Wireless*, will each contain free double-sided blueprints of the latest P.W. designs. Out of six brand new pieces of equipment, four will be capable of being combined into a quality hi-fi system, consisting of a tuner, pre-amplifier, main amplifier and loudspeaker enclosure. The first issue containing a blueprint—the October issue—will be on sale on September 7th.

INCREASED PRICE

From October, the price of PRACTICAL TELEVISION will be 2s. This increase is forced upon us entirely by the increased costs of production and paper. We can, however, ensure our readers, that the same high standard of article that is associated with P.TV. will continue, and in particular that in the next few months, we will introduce many new articles on practical constructional details for the 625-line transmissions and standards, including whenever possible, methods of converting old receivers for the new definition.

Our next issue dated October, will be published on September 21st.

Telenews

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of June, 1962, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	2,002,682
Home Counties	1,694,290
Midland	1,774,872
North Eastern	1,906,153
North Western	1,581,001
South Western	1,029,846
Wales and Border Counties	719,771
Total England and Wales	10,708,615
Scotland	1,090,992
Northern Ireland	184,076
Grand Total	11,983,683

History Repeats Itself

IN 1928 the Baird Television Co., now the Rank Cintel Division of the Rank Organisation, transmitted the very first television pictures across the Atlantic.

Working on the 30-line definition system the pictures were sent via a 250W transmitter operating on a wavelength of 200m from Coulsdon in Surrey to New York in America. Pictures were also received on board a ship in mid-Atlantic at the same time.

Many of the personnel involved in this historic transmission still work at Rank Cintel.

In the early hours of the 11th July another historic trans-atlantic transmission was made via the Telstar satellite and the very first pictures to be received at the Goonhilly Down receiving station were on a 21in. Rank Cintel Monitor.

Goonhilly Radio Station

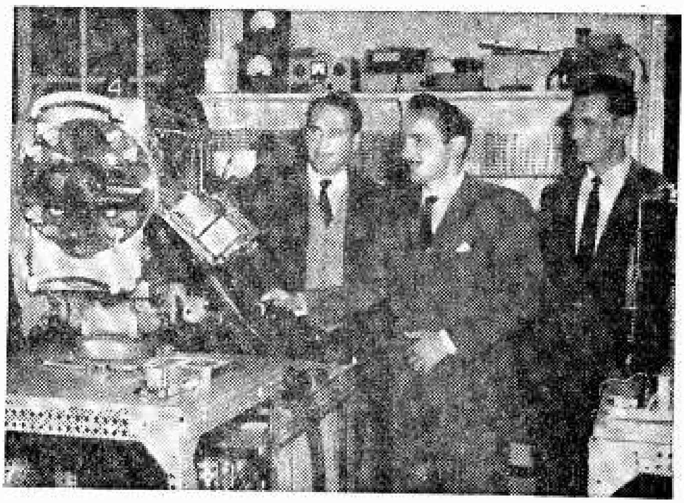
THE output stage of the ground transmitter at the GPO Goonhilly Down Radio Station, Britain's link with the Telstar satellite was designed, built and commissioned by AEI Limited.

The apparatus was completely designed and built by the Company's Electronic Apparatus Division in the very short period of about six months. First news of the requirement came at the end of October last year, part of the equipment was ordered on 7th December and the order for the remainder on 12th January this year. The equipment was shipped to the site on 10th May and run up on power on 25th May.

The equipment provides 4kW of power to the aerial at a frequency of 6,390Mc/s with a signal bandwidth of 100Mc/s. For operating the travelling wave tube high power amplifier (made by Services Electronic Research Laboratory), there are three stabilised EHT supplies for the valve electrodes, magnet and cathode. heating supplies, and water and air cooling systems. The apparatus is housed in cubicles which are installed in the cabin of the aerial turntable.

Conversion of Telstar TV Signals

THE Telstar satellite, launched on Tuesday, 10th July, was designed to prove that satellite communication between continents is practicable. The programmes, which are transmitted from the USA on 525-line standards, are unsuitable for showing in Britain and Europe until they have been passed through a standards converter. Such a converter, manufactured by EMI Electronics Ltd., converts



A recent visitor to Marconi's Chelmsford Works was Señor Fernando Carrera, a senior official of Telesistema Mexicana. Señor Carrera is seen here (centre) looking at a standard Mark IV camera in the Television Test Section. Telesistema Mexicana have 15 Mark IV camera channels in use in Mexico City.

the signals to the 405-line standard for general viewing by the British public, and the 625-line standard for transmission on the Eurovision network to countries other than France where there is a receiving station on the north coast of Brittany.

The satellite, launched by the National Aeronautics and Space Administration in elliptical orbits, reaches a maximum height of 3,000 miles, inclined at approximately 50° to the Equator.

New ITA Mast at Croydon

CONSTRUCTION of the new mast at the Authority's Croydon station has now advanced to a stage at which the structure itself causes some limited interference to the radiation roughly from the present aerial, which may involve ghosting and attenuation roughly along a line from Croydon to Southend. This interference is unfortunately inevitable now that the mast has reached a critical height and it will continue, although the direction and intensity may vary as the height of the new mast is increased. The difficulty will, it is estimated, be at all times strictly localised and it will, of course, cease entirely once the new aerial comes into service in the Autumn.

EMI Type 8 Camera

MARKETING rights have been granted to Clarke and Smith by EMI Electronics Ltd. for distribution of the Type 8 television camera to education authorities and the retail trade. This announcement came shortly after an order by Clarke and Smith for 100 EMI Type 8 cameras.

From the time of the earliest village schoolmasters, children at the back of a classroom have had difficulty in seeing what was happening. With the increasing complexity of modern education the problem has grown, especially in laboratories or workshops where it is essential for the students to view intricate processes.

EMI has greatly eased the problem with the new Type 8 camera, which enables an entire class to view slides under a microscope, a close up of a scientific experiment or a practical demonstration. For such purposes the camera is placed on the demonstration bench and the picture transmitted to one or more receivers strategically placed in the lecture room.

UHF Aerials for Crystal Palace

THE BBC have awarded a contract to Marconi's Wireless Telegraph Company Limited for the supply and erection of a Band IV television aerial to be mounted above the existing Band I aerial at Crystal Palace. The aerial will be omni-directional, horizontally polarised and of high gain. It will be of novel design, consisting of eighty elements of end-fire stacked dipoles mounted in angled fashion from the corners of the tower. This new aerial will have a bandwidth which will cover several television channels and will be extremely simple to erect. It is believed that this will be the first of this type of UHF aerial to be installed for television anywhere in the world.

It is planned to have the aerial available for use early in 1963.

New TV Camera

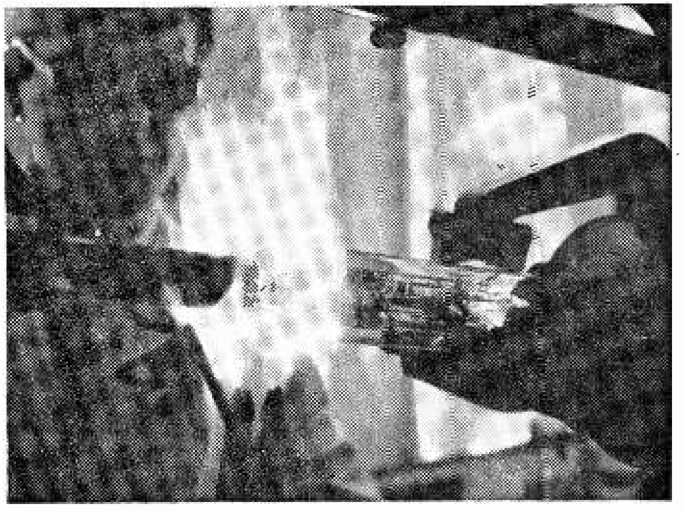
ON show recently for the first time in the north was a self-contained television camera which can operate in mid-air, afloat, on a moving road vehicle or on a remote area miles from a mains supply. Made by EMI Electronics Ltd., the Type 8 closed-circuit television camera was shown at the Instruments, Electronics and Components Exhibition held at Manchester College of Science and Technology, from 5th July to 11th July.

This camera can operate from a 12V D.C. car battery or A.C. mains 50 or 60c/s. It is suited for industrial or domestic use and has an output at radio frequency suitable for feeding a normal domestic receiver tuned to Band I.

CC TV in Hospital Wards

PATIENTS in Raikeswood Hospital, Skipton, Yorkshire, were able to enjoy the tableaux and other floats in Skipton Gala procession, on Saturday, 23rd June, without leaving their beds, through the medium of closed-circuit television.

An EMI Electronics' closed-circuit TV camera was positioned at the gate of the Hospital to cover the scene as the mile-long procession passed. A commentator with a roving microphone interviewed local celebrities—the mayor, the local beauty queen and some of the people riding on the floats—and gave the patients a sense of participation by interviewing members of the crowd watching the procession.



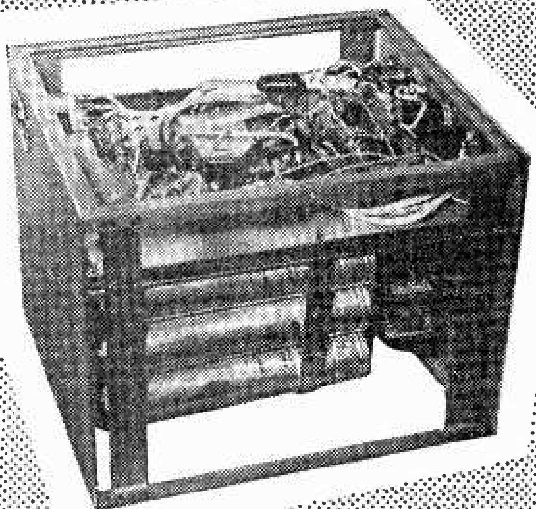
Instrument Tube Production in the Sylvania-Thorn Colour Television Laboratories. Here, the gun is being sealed into the neck of the tube. At a later stage, the processed bulb is joined to the sealed in gun on a glassblower's lathe, similar to the one in this picture.

An Ultra-Stabilised H.T. Supply

COMPONENTS USED AND PERMISSIBLE ALTERNATIVE PARTS

By M. L. Michaelis

(Continued from page 543 of the August issue)



LAST month, a method of adjusting VR1 using a meter and a second H.T. supply was given; this month another method is described using a suitable oscilloscope.

The second method of adjusting VR1 has the advantage that, if errors are made in the sequence of operations, there is no danger of destruction of a meter. But this requires the availability of an oscilloscope of which the Y-amplifier input will tolerate (and block) a D.C.-component of at least 300V at any setting of the gain.

No backing-H.T. is then needed, and the oscilloscope is connected as in Fig. 5. VR1 (Fig. 1) is adjusted until the kicks observed in the position of the timebase-trace are a minimum when the load is switched on or off. Note that, in this case, the normal changes of about 0·1V on applying or removing the load will also kick the Y-amplifier, but equally in both directions as the load is switched on or off respectively. The criterion for correct setting of VR1 having been reached is therefore, in this arrangement, that the oscilloscope trace kicks by *equal* small amounts both when the load is switched on and switched off. Incorrect settings will cause a vastly greater kick in one direction than the other, and the "preferred direction" of kick will change over as the correct setting is passed through.

Fuses

Some care is needed in the choice of the H.T. output fuse, F2 (Fig. 1). This is because an incorrectly chosen fuse-cartridge can have several times the self-resistance that the H.T. supply itself has. In fact, strange as it may seem, the self-resistance of the fuse F2 was found to be one of the major limiting factors for how low the final internal resistance of the H.T. supply as a whole could be made!

The ideal fuse would be a 200mA "slow" cartridge. Such a cartridge, however, on account of the heat-dissipating series-spirals common to all slow cartridges, was found to have a self-resistance of 4Ω in a typical sample, which is about eight times the actual internal resistance of the "electronics" of the unit. Thus such a fuse would immediately deteriorate the stabilisation by a factor of about eight! A slow 0·5A cartridge had only some quarter to half ohm resistance, and would thus be suitable in this respect. But, although the short-circuit current is over 800mA, it was found to take far too long to blow. In fact, it could not be made to blow at all in the prototype before the short had to be removed again for fear of destroying components. Thus, finally, a *fast* 600mA cartridge was chosen, having a self-resistance of about 0·25Ω and was found to blow immediately upon shorting the output. Together with the internal resistance of the electronics (0·5Ω), this gives a final impedance of 0·75Ω, approximately, for this H.T. supply. Thus there would be a change of 150mV, nominally, between no-load and full-load (200mA) conditions. This represents a maximum change of output voltage between no-load and full-load of only a twentieth of 1%, which fully justifies the name "*Ultra*-Stabilised H.T. Unit". The nominal figures just given were fully confirmed by measurement on the prototype, which behaves smoothly and is perfectly stable over long periods once adjustments as detailed above have been made.

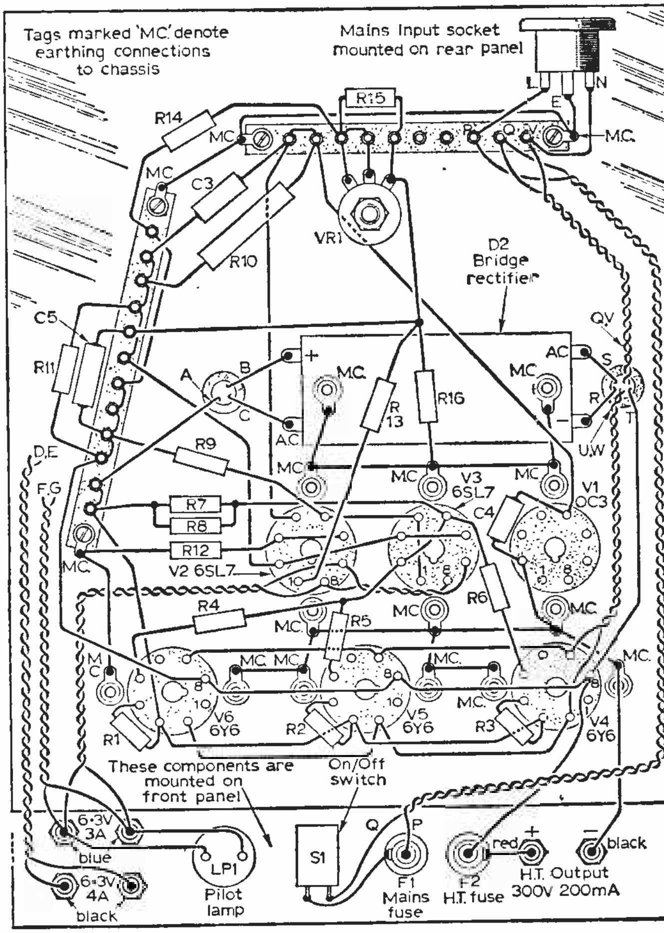


Fig. 4—The underchassis wiring diagram.

Capacitors

Note that the use of electrolytic capacitors is highly undesirable, as the remaining fluctuations of the order of a fraction of a volt common to most electrolytics will here be of the same order of magnitude as the remaining fluctuations and ripple from other sources. Thus, stabilisation is likely to deteriorate by a factor of at least two if electrolytics are used. As is seen, quite small smoothing capacities of only 4 or 5μF each are needed for C1, C2 and C6, since the main smoothing is obtained by electronic multiplication of C5 through the gain of the whole circuit functioning as a two-stage D.C. amplifier V2, V3 with cathode-follower output stage V4, V5 and V6. The effective gain is well over a thousand, so that the effective capacity of C5 for smoothing purposes is also multiplied by this figure, giving a *virtual effective* smoothing capacity between 150 and 200μF. Consequently, the high degree of smoothing actually present will be understood, in spite of the very low actual capacity values used. The remaining mains-hum ripple, at full load even, should not exceed a tenth of 1% at the very most. It will depend slightly on precise positions of heater wires, etc., and will very likely turn out to be even less. It can justifiably be said that this unit gives one of the purest D.C. sources that one could imagine, probably better in many respects than a chain of lead accumulators!

Omission of C3 was found to lead to certain kinds of instability under some circumstances. The value is not critical. C4 suppresses any noise from the neon, which would otherwise appear amplified in the main output. The value is again not critical.

Anti-Parasitic Stoppers

R1 to R6 are grid-stoppers to suppress parasitic oscillations in V4, V5 and V6. Such measures are particularly important when operating high-slope pentodes in parallel, because in addition to individual parasitics, possibilties then arise for combined polyphase-ring oscillations. It must be remembered that the total effective slope of V4, V5 and V6 taken together here is well over 20mA/V, and must therefore be treated with due respect.

It is necessary to solder R1 to R6 all *very close* to the grid pins in question. The anodes of V4 to V6 should be checked for oscillations by holding an absorption wavemeter close to them (but not in electrical contact), or a less sensitive method, by means of a neon-screwdriver. If any remaining parasitics are found, which is unlikely with the layout and components specified, the values of R1 to R6 will have to be increased somewhat. Using values one-and-a-half times to twice as large throughout could be tried. Do not forget to check under all load conditions. If parasitics are inclined to start in a particular layout, they will often be absent at low output currents, the circuit bursting into violent R.F. oscillation at some condition of increased loading where the currents in V4, V5 and V6 are greater.

Although much space would be saved, it is probably undesirable to use three EL34 valves for

V4, V5 and V6, as the total slope is then so large that freedom from parasitics would be very difficult to achieve apart from the fact that only 150mA output current would then be possible.

There is no reason against using three 6L6 valves for V4, V5 and V6 if these are already to hand, and performance should be little different, although stabilisation may be slightly poorer. Three 807 valves would also appear to be suitable, but these may be rather large, and could give trouble with the layout on account of the great distance between anodes and screens. However, this type of valve is normally very cheap to obtain, and experimenters could certainly try the slight obvious modifications necessary for using these valves.

Other Valves suitable for V2, V3

The direct Mullard equivalent of the specified 6SL7 is the ECC35, and this may certainly be used. The identical valve is also sometimes found under the type-number "6113". Among the miniature noval-based valves, the ECC83 would appear suitable. Do not be tempted to use other ECC types which happen to be in the junk box, as characteristics differ too greatly from the 6SL7. It might

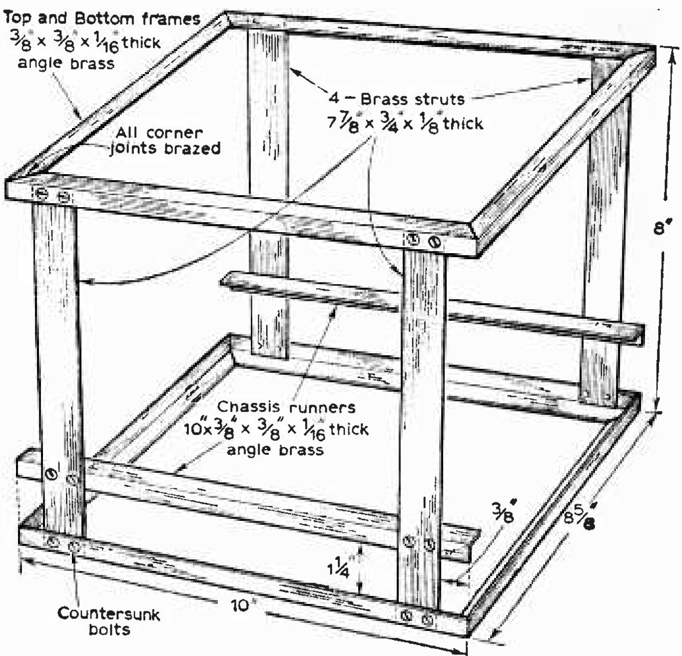


Fig. 7—The form of the all metal cabinet and chassis used in the prototype. The chassis plate should be an exact push-in fit on the runners, and secured by bolts. The top and bottom plates forming part of the cabinet should be an exact fit on the angle-brass frames; the plates forming the long sides of the cabinet should be flush at the ends with about 2mm overlap top and bottom; the plates forming the front and rear of the cabinet should have about 2mm overlap all round. The material is aluminium, about 2mm thick. The parts of the cabinet should be made so that they may be replaced in any order (to simplify re-assembly).

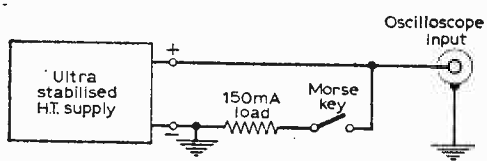


Fig. 5—Circuit for using an oscilloscope for obtaining the point of optimum adjustment of VR1 (see text).

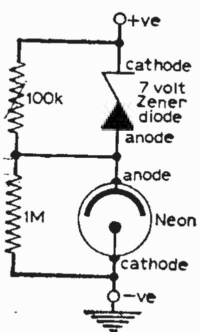


Fig. 6—To obtain variations of some 10 to 20V in the output voltage, the neon may be backed with suitable zener diodes in series.

prove beneficial to gain extra room for the large 807 valves for V4 to V6 by using the small ECC83 types for V1 and V2.

Other Valves for V1

As already stated earlier, a type should be chosen for V1 which is as close as possible to a third of the desired output voltage. The 100V neon V1, here specified as an OC3 for a 300V final output, is the direct equivalent of the VR105, and a close equivalent of the miniature B7G type 108C1. A 90C1 is suitable (B7G base) if 250V output is desired, whereas a VR75 would probably enable an output voltage in the region of 200V to be obtained (reduce transformer secondary to 300V in that case). Remember that R9 and R12 will require careful trimming when other neons are used for other voltages, or when alternative choices of valve are made for V2 and V3. R9 should always be about twice R12, but the exact values depend on the voltage desired. The simplest procedure is to insert variable resistors first. After setting VR1 to give an output of three times the neon voltage, R9 and R12 are adjusted (in 2:1 ratio) for minimum kicks as described above. If a switch is used to select various neons for various voltages, then this must also select individual appropriate resistors in

(Continued on page 587)

The ABC of TV Circuits

AN ANALYSIS OF THE DEVELOPMENT OF TELEVISION CIRCUITS

By T. L. May

(Continued from page 539 of the August issue)

IN very early receivers the picture signal was coupled from the anode of the video amplifier valve to the grid of the picture tube through a capacitor. Since a capacitor is able to pass only A.C., the D.C. component of the picture signal was lost in the coupling.

Restoration of the D.C. component was thus necessary and this was accomplished by a simple diode circuit connected to the tube grid. The early readers of *Practical Television* will remember the so-called D.C. restoration circuits.

Direct Coupling

It later became common practice to couple the picture signal to the tube cathode, which meant that the D.C. component could be retained because it was possible to use a direct coupling from the anode of the video amplifier valve to the cathode of the tube as shown in Fig. 6.

Although this arrangement was used for a number of years it possessed two major shortcomings. One was that signal fading, such as caused by the aerial moving in the wind, or passing aircraft resulted in very prominent, and often disconcerting, flutter of the picture black level. The other was that the potential between cathode and heater of the picture tube was almost equal to the full H.T. line voltage in the absence of a picture signal or on scenes with low-level modulation.

This latter effect became rather important when the tube heater was connected in a series mains-powered chain. Two alterations to the coupling network solved both problems, as may be seen from Fig. 7. Here the potential on the tube cathode is reduced to a relatively low maximum value under conditions of zero signal by the potential-divider comprising R1 and R2. In other words, the H.T. voltage at the cathode can never be any higher than that at the junction of the two resistors. If we exclude the effect of R3 and R4, then the potential-divider by itself would reduce the voltage on the cathode from a 200V H.T. line to approximately 140V.

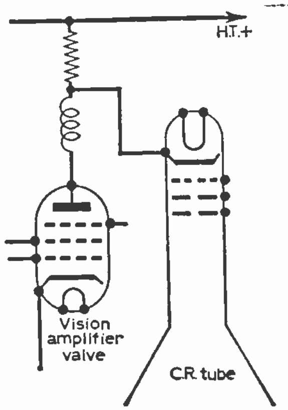
In reality, of course, R3 and R4 in series are in parallel with R1 and there is a flow of video amplifier valve anode current, so the voltage distribution is altered slightly, but the tube cathode potential is still well below what it would be in circuits such as Fig. 6.

Reducing the D.C. Component

The video signal is mostly coupled from the anode to the tube cathode through C1. This capacitor, as we have seen, removes all D.C., but just the right amount is introduced by R3. This circuit greatly reduces the effects of picture flutter and is found in a similar form in almost all present-day receivers.

The smaller potential between cathode and heater in the A.C./D.C. type of receiver is less likely to result in heater-to-cathode breakdown, and certain tubes are unable to withstand the higher potential of direct coupling from the video valve anode, which is a point well worth remembering when substituting a more modern tube in an old set.

The circuit can be fitted to most receivers but to achieve the correct tube bias and the correct operation of the brightness control the brightness



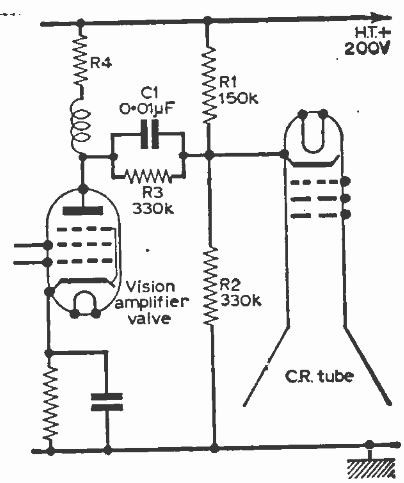
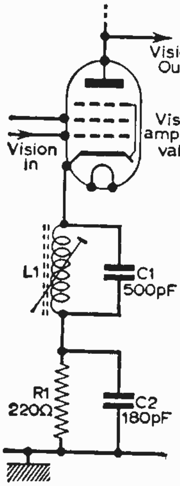


Fig. 6 (left)—Direct coupling was used on most early sets from the anode of the video amplifier valve to the cathode of the picture tube, but this was found to aggravate aircraft flutter and similar effects.

Fig. 7 (right)—In this circuit, only a portion of the D.C. component of the picture signal is used, as coupled by R3. The potential divider R1/R2 reduces the voltage between the heater and cathode of the picture tube.

control circuit will also need to be altered. This simply means increasing the value of the resistor connected between the top of the brightness control and the H.T. line. The correct value should give an even control of brightness from zero up to a maximum which does not overload the tube. On no account should it be possible to make the tube grid go more positive than the cathode, even at the setting of maximum brightness.



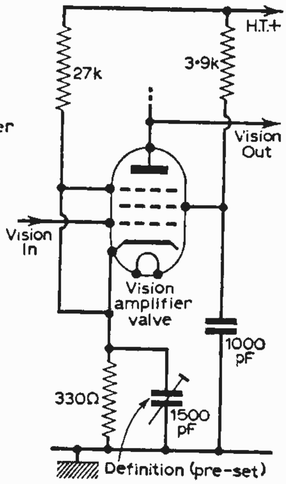


Fig. 8 (left)—The tuned circuit L1/C1 forms a dot pattern suppressor connected in the cathode circuit of the video amplifier valve.

Fig. 9 (right)—The pre-set capacitor across the cathode resistor of the video amplifier valve provides a useful degree of definition control.

3·5Mc/s Dot Suppressor

The video bandwidth of most recent receivers is approaching 3Mc/s, but in most sets there is also a small response up to about 3·5Mc/s. Such a high bandwidth is attributable to the improved picture definition of newer sets as compared with the old models.

Although the TV authorities rarely modulate the vision carrier up to frequencies as high as 3·5Mc/s there is, nevertheless, a 3·5Mc/s signal present in the vision channel, which is due to the beat between the sound and vision carriers—the difference in all cases (405-line British system) being 3·5Mc/s. On sets designed for high definition pictures this 3·5 Mc/s beat shows up on the picture as a dot pattern. The effect is that the horizontal scanning lines are broken up to form dots or small dashes, and it is more noticeable when the fine tuning control is carefully adjusted for optimum picture definition—usually just prior to the position on the control which results in sound-on-vision.

This trouble is taken care of in current receivers by a rejector circuit in the cathode of the video amplifier valve as shown in Fig. 8. The rejector comprises L1 and C1 and is tuned to 3·5Mc/s by the dust-iron slug in the coil.

R1 and C2 are the ordinary cathode components, the resistor for bias and the capacitor for response compensation.

At frequencies other than 3·5Mc/s (including D.C.) the rejector circuit has no effect whatever on the normal function of the video amplifier. At 3·5Mc/s, however, the impedance of the parallel L1/C1 rises appreciably, as with all resonated parallel-tuned circuits. Across the impedance occurs the 3·5Mc/s signal, which is reflected back into the control grid circuit of the amplifier (via the ordinary grid resistor) in opposite phase, and in this way the unwanted 3·5Mc/s is cancelled out or suppressed. The operation of the circuit is rather like ordinary sound rejector circuits which are included in the cathodes of the vision I.F. amplifier valves.

Correct Adjustment

There are two ways in which this circuit can be adjusted. One is to apply a modulated signal at exactly 3·5Mc/s to the grid of the video amplifier valve and listen to the signal at the anode in a pair of headphones (suitably isolated from H.T.). L1 should then be carefully adjusted for minimum output. The other method is to adjust the fine tuning control for maximum display of the dot pattern on a picture and then adjust L1 to eliminate the effect.

On old sets which have been modified and carefully realigned for optimum picture definition such a circuit may well be worth fitting, especially if the dot pattern is present. The coil, which should have a value of about 8μH, should be tuned with a capacitor of 500pF. The existing connections to the valve cathode should be removed and reconnected on one end of the L1/C1 combination, while the other end should be connected direct to cathode.

Definition Control

Many sets now have some means of adjusting definition to compensate for propagation troubles (and aerial mismatch) and certain shortcomings in transmissions which are prone to some areas more than others.

The most popular idea is to arrange the video amplifier stage in such a way that a pre-set (or switched) capacitor may be connected across the cathode load resistor as shown in Fig. 9.

Video amplifier response correction is made easily possible in the cathode, since a capacitor across the cathode resistor makes the circuit frequency-selective in terms of negative current feedback. For example, without a capacitor at all, feedback occurs at almost all frequencies, but when a capacitor is shunted across the resistor feedback occurs progressively more towards the lower video frequencies, for at the higher frequencies the capacitor acts as a by-pass and the feedback signal is short-circuited.

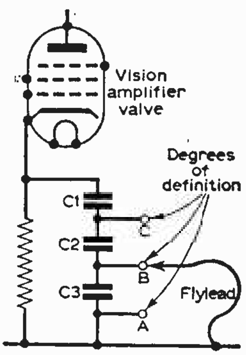


Fig. 10—A plug and socket arrangement is sometimes used instead of the pre-set capacitor shown in Fig. 9.

(Continued on page 595)

UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

BY ICONOS

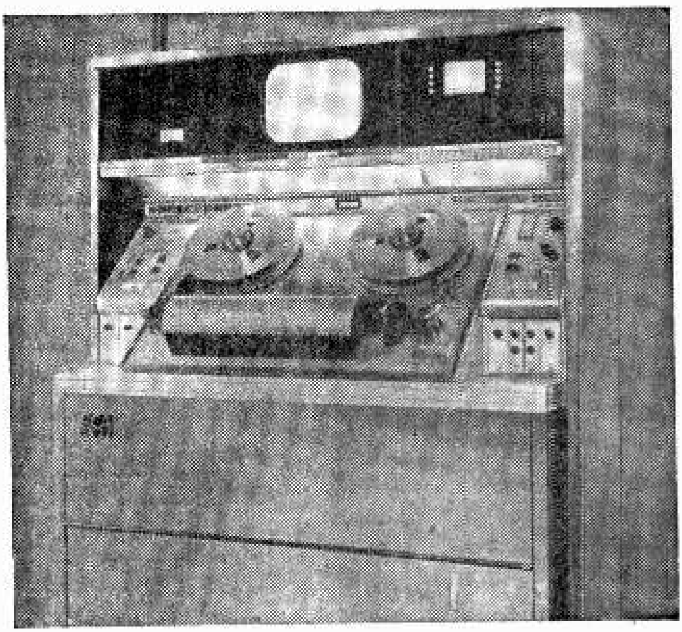
THE Pilkington Committee has had its say, the Government has issued its first White Paper on the findings, and now the radio and television industry can proceed with their plans, more or less safe in the knowledge that few of Pilkington's organisational recommendations will be adopted. The projected change from 405 to 625 lines and to colour was a foregone conclusion, but the attack upon the Independent Television Authority was overplayed to an absurd degree. This was recognised by many Members of Parliament of all three political parties. One Labour Member called it an "arrogant puritanism." Bold will be the political party who dares to nationalise "Coronation Street's" Ena Sharples! There are Members of the Pilkington Committee who are known to have very odd ideas on literature, economics and the British way of life. What puzzles me is—who picked 'em and why?

Bouquets for I.T. News

Anyway, even the most extreme Pro- or Anti-Pilkington partisan will agree with the terms in which reference was made to the Independent Television News. This is a magnificent example of television journalism which has been setting the pace, not only for the BBC, but for the whole world. Geoffrey Cox, the Editor, well deserves the highest praise, as do the pioneers who first set up the organisation, Aidan Crawley and Philip Dorte. Since the early days it has steadily developed. The reporting is accurate, the "dialogue" writing crisp, clear, and thoroughly English in style, humour is not entirely absent, and the technical values are excellent. Little is known of the superb work carried out at a fast speed by the technicians at the ITN headquarters in Kingsway, headed by W. H. O. Sweeney, whose all-round past experience in film studios and in the BBC, have obviously been of great value. The least the Pilkington Committee could have done would have been to have conceded that ITN led the way in television for many years, until the BBC copied it.

Dual Standards

The change-over to 625 lines will not be an easy transition. For a time, many transmissions will be simultaneously broadcast on 625 and 405 lines —from different transmitters and aerials, probably on the same mast. Up to now, the problem of sending out first-class pictures on the two line standards has not been resolved. If the studio cameras and video tape machines are switched to operate on 625 lines, then a standards converter will have to be used for transferring the same pictures on to the 405 line service. There is a very decided degradation in this operation, which is basically a 405 line camera looking at a high quality monitor screen displaying the 625 line picture. The quality is much worse when the original picture is on the lower line standard, and the optical conversion is made to 625. A far better method for plays and features programmes would be



An R.C.A. TR-22 transistorised TV tape recorder recently demonstrated at Teddington.

to photograph them direct on to 35mm film—but using all the electronic aids and lighting of the television studio—and play the film off on telecine machines which scan the film twice, once on 405 lines followed a second later by 625 lines. In this way, with the superb British telecine equipment now available, it will be possible to put top quality pictures on both line standards. A further advantage over the use of video tape, is that prints of the film can be sold all over the world.

TV Exports

It is a curious fact that the BBC is much more alive than ITV to the revenue earning possibilities in the export market of its tele-recorded programmes. The ITV companies mainly use tape recording on 405 lines, which you cannot sell to Australia, Canada, America, or, for that matter, to Cyprus, Malta or Gibraltar. But by tele-recording—or better still, photographing on film—the whole world market is open to you. This is where Hollywood has seized its opportunity. Hollywood is no longer the world centre of the cinema film production industry; Rome has taken its place, but Hollywood is certainly the world centre of the television film industry. Film on 35mm or 16mm is a world currency for television stations. Two TV transmitting stations open somewhere every day and most of them are very small, depending almost wholly upon three or four hours daily of programme on reels of 16mm film. Local news, advertisements and the simplest kind of shows are put on for short periods to give a local flavour, but the programme film is the main attraction, a fact which has been noted by the Ronnie Waldman's Department of the BBC, who have built up a first-rate business connection for the sale of these BBC films.

"Dinner Party"

Various methods have been devised for presenting discussion programmes, but few have managed to achieve a relaxed atmosphere so well as ATV's "Dinner Party". Lord Boothby and three famous personalities (mainly one each week), dine together and afterwards, as the port circulates, conversation flows. Unfortunately, as the decanter of port makes its traditional journey, the viewer is missed out and becomes merely an eavesdropper and not a participant. With jaundiced eye, he watches the jovial peer nattering away with his friends, who are more obviously conscious of the presence of the television camera. Lord Boothby is completely at home, as indeed, as a host, he should appear to be, even if his dining table is actually in a television studio. Nevertheless, this is a discussion programme which always seems to be contrived, though it is quite informal and unscripted; only when the discussion becomes heated and arguments assail the ears of the powerless viewer does the programme take on a sense of reality.

Chichester Festival Theatre

Chichester is right in the centre of Southern Television's area, and it was only right that the opening of the Chichester Festival Theatre should be "covered" by their film unit and their outside broadcast truck. This was no ordinary opening—it was the premiere of a theatre in a town which had never before had a live theatre. Furthermore, the theatre is brand new and of unusual character, especially designed for the best possible presentation of the theatre-in-the-round. The audience almost surrounds the stage, in the manner of Shakespeare's old Globe Theatre. This was a fine subject for television reportage, especially as the first-night audience included many stars of the stage and screen. But the main interest, after all, was the construction and idea of the theatre and the principal personalities behind it, including Sir Laurence Olivier. What happened? Alas! The introductory film sequences were poor, overloaded with music and commentator's cliches. Roy Rick's interview with Sir Laurence Olivier was badly photographed, making each participant look old and haggard, and the shots of the interior of the auditorium were quite uninspired, making it seem more like a circus ready for a trapeze act. The less said about the interviews in the foyer on the first night with various stars, the better. This type of interview is never very exciting, because the stars have little to say that is worth saying, and on this occasion, excepting for Sybil Thorndike, they said even less than usual. Pity! Southern has a splendid reputation for the best outside broadcasts of any regional station, ITV or BBC. But on Chichester's opening night they were clearly off-colour. Let's hope they pay this unique theatre another visit and let viewers see what it is really like.

SERVICING TELEVISION RECEIVERS

No. 81—SOBELL TPS180 and series

(Continued from page 534 of the August issue)

By L. Lawry-Johns

Common Faults

From a study of readers' letters it appears that one of the most frequently occurring faults is compression of the lower part of the picture. This is occasionally due to a faulty 250μF electrolytic bias capacitor C104, occasionally a faulty bias resistor R79 or R80, but most often C98 (0·01μF) appears to be the culprit changing value up to about 0·02μF. V13, the PL84, is less often at fault.

Lack of Height

If the loss of frame scan is uniform; equal top and bottom, check R76 330k from the height control to pin 1 of V12A. This resistor can increase in value up to 1M or more. Also check V11 and V12.

Frame Hold

If the hold control is at the end of its travel, check V12, V11 and R75 (100k). If the control is

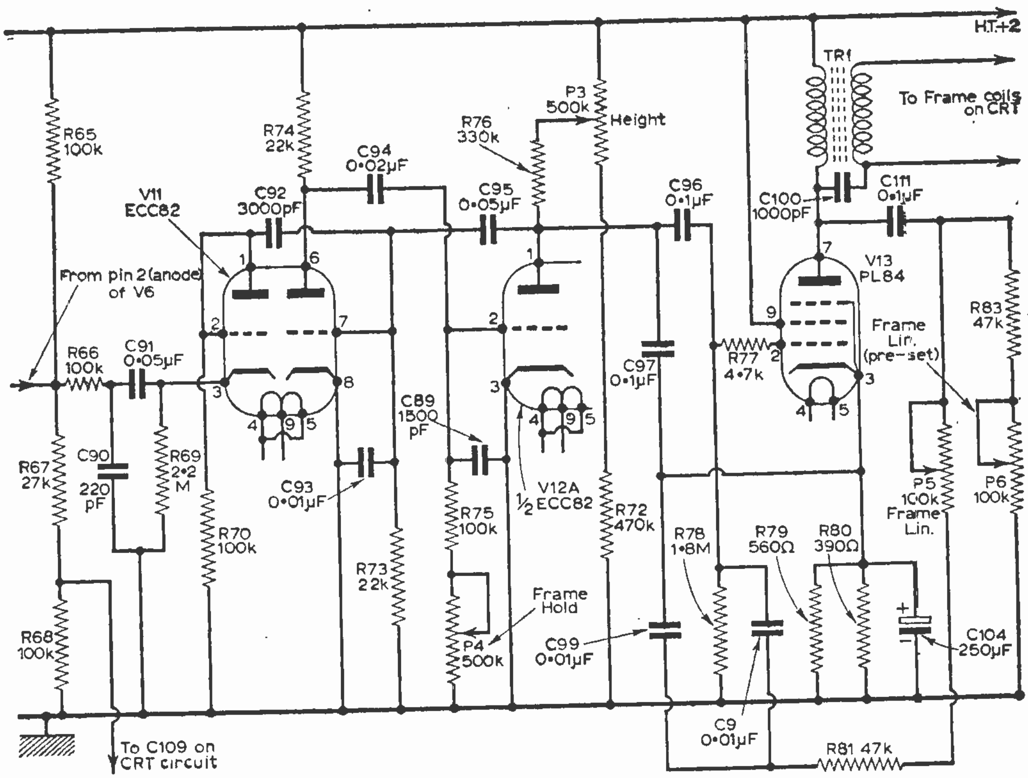


Fig. 5—Circuit of the sync separator and frame timebase stages.

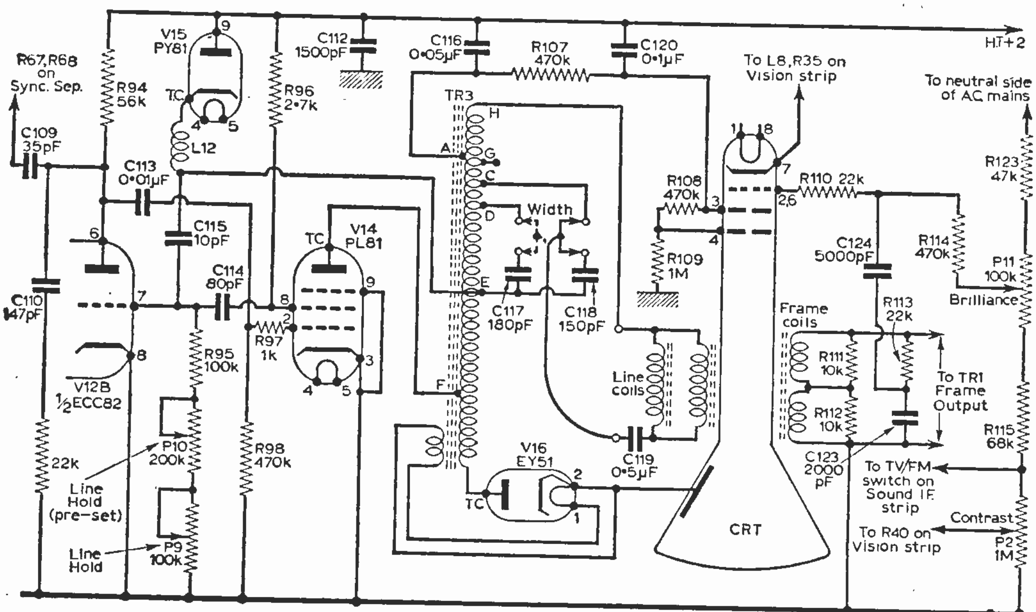


Fig. 6—The line timebase and C.R. tube circuitry.

not at one end but the picture cannot be made to lock, check V11, C92 (0·003μF), C91 (0·05μF) and R69 (2·2M). At this stage it may be mentioned that V13 (PL84) is the frame output valve, V12 (ECC82) is part frame and part line oscillator and V11 is part frame oscillator and frame interlace diode. Thus, whilst V11 is concerned wholly with the frame timebase, V12 is associated with both frame and line timebases. It is worth bearing this in mind when line timebase faults are experienced.

Before turning from the frame timebase, however, the symptom of no frame scan at all may be discussed.

Horizontal White Line

This denotes a complete breakdown in the frame circuit. Before making routine tests, it is as well to check upon one or two points first.

See that the leads to the frame scan coils are properly connected, that the plug has not been accidentally pulled out of the TR1 frame output transformer. See that V11 and V13 are lighting up as one may have a cracked envelope and may therefore be "gassed". This is usually evidenced not only by the heater not visibly glowing, but also by a white deposit on the inside of the envelope. A purple glow in the PL84 may indicate a similar condition.

The next step is to see that H.T. is reaching pin 7 of the PL84 or the pin 7 tag of the TR1 frame output transformer. Absence of voltage here may well denote an open circuit in the primary winding of this transformer and it is as well to check C100 (0·001μF) for shorts although a short in this capacitor is more likely to cause the 1A fuse to blow rather than the winding of TR1 to fail.

C100 is associated with the transformer and is not on the timebase panel. If C100 is found shorted, check C111 (0·1μF—top left of the timebase panel) as a dangerous rise in voltage at V13 anode takes place if the linearity circuit becomes o.c. This rise will exceed the voltage rating of C100 and will probably cause sparking at the V13 valveholder and at TR1.

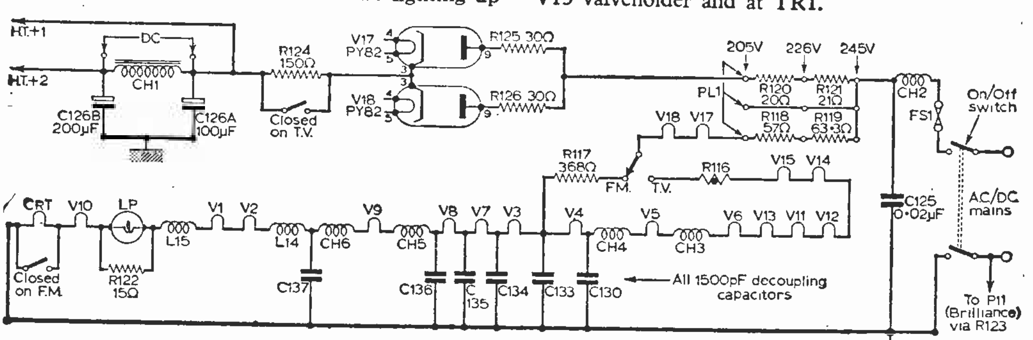


Fig. 7—The power supply sections of the receiver.

Line Timebase—Line Hold

If the picture appears as a scramble of lines, which the hold control may or may not correct temporarily, check V12. The lines may resolve themselves after a period of time but this period may be extended each time the receiver is switched on. Replacement of V12 will usually clear the fault. It a new valve results in the hold control being at the end of its travel, rotate this to its mid-position and adjust P10, the pre-set line hold for a locked picture. Check V14 (PL81) if necessary.

If the valves are in order and neither control can lock the picture, check R95 (100k) which can go high.

This condition should not be confused with the symptom of loss of line sync, where the picture can be made to hover at about the correct position but will not hold. This should direct attention to C109 (35pF) and if the frame locking is also weak, or unobtainable, check V6 (PCL84) the triode section of which functions as the sync separator, and R65 (100k) C53 (0·1μF).

Lack of Width

Check V12, V14 and V15 and note that persistent failure of V14 (PL81) may be due to a low emission V12 (ECC82) providing insufficient drive which results in V14 becoming overheated. If the lack of width is accompanied by lack of height, particularly at the bottom of the picture, check the H.T. voltage which should not be below 190. If it is, check V17 and V18 and also R125 and R126, as either of these may fail causing one PY82 to be inoperative and thus throwing the whole load upon the other. If the H.T. is well down, check C126A (100μF) which may be o.c.

Distorted Sound—TV Only

Check R59 (4·7M), MR2 and C83.

Distorted Sound—F.M. Only

If weak, check C84 (5μF) and V9 EB91. Suspect reflected signals on the aerial and ensure this is efficient and correctly sited. Note the effect of using a separate, if temporary, horizontal dipole or H-aerial correctly aligned.

All Sound Distorted

Check V10 and the loudspeaker. Check C106 for leakage, C108 for a short, and the value of R93 (390Ω). If the sound is weak, also check R86 (100k).

TV in Order but No Results on F.M.

If the valves light up on TV, but all fail to light on F.M., check R117 (368Ω) which will almost certainly be found o.c. If the valves light, check R124 (150Ω).

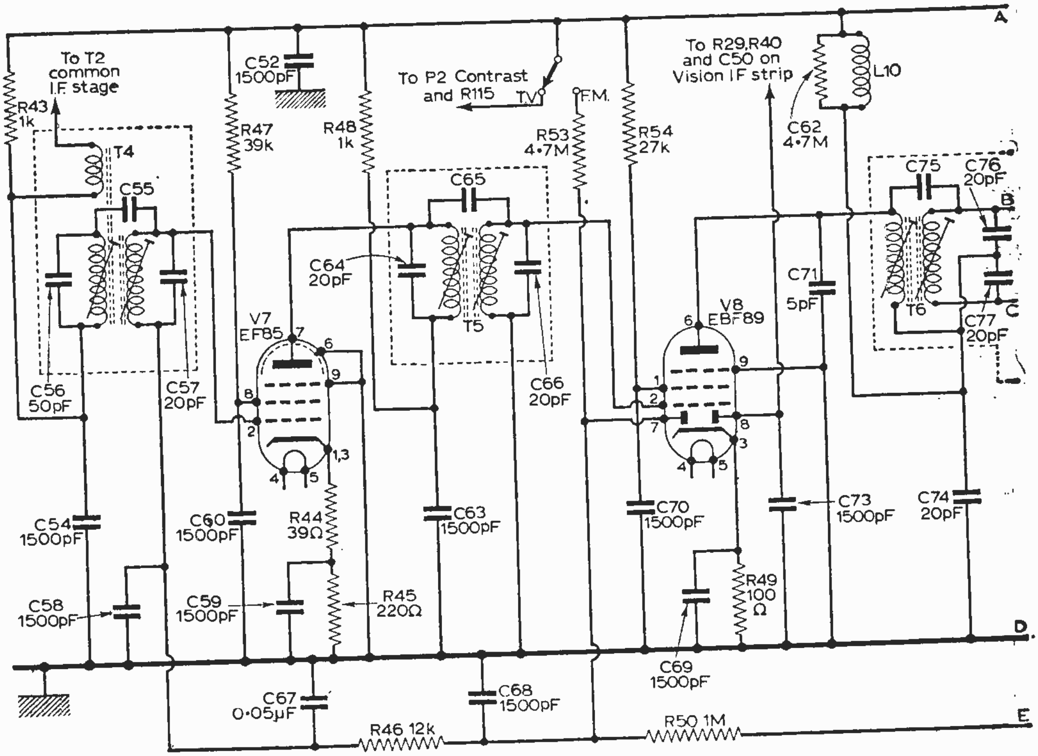


Fig. 8a—The circuit of the sound I.F. stages.

F.M. in Order, No Results on TV

If some valves light when switched to F.M., but none when switched to TV, check the heaters of V15, V14, V12, V11, V13, V6, V5 and V4. Check with neon or meter in the order given (the heater pins are 4 and 5 except for the ECC82 valves which use pins 4, 5 and 9).

UNBOXING
M74HFC, SC270, M247HFC and SC24

Proceed as for the TPS180, MP18, M74T, T278 and T24 (dealt with on page 534 last month), but it is unnecessary to remove the side panel and knobs. Also there are two studs on the rear of the cabinet floor to enable the chassis to be rested and hinged backwards with support cords connected to the tube assembly.

Complete Removal

Remove the knobs and panel and front screen. On table models, lay the set face-downward and remove the bottom four fixing screws. On console models, the four screws are removed from inside the cabinet.

Setting up the Controls

Width: This is a plug and socket adjustment on the rear of the line output transformer.

Line Linearity: This is a shorted turns device in a paper sleeve on the tube neck with a plastic ring for adjustment. There is a mark on the ring which must be located at the "three o'clock" position. The sleeve may be slid along the tube neck into or out of the scanning coils to effect expansion or contraction of the left side of the picture. Contraction occurs as the sleeve is inserted further into the coils. It must not be inserted too far, or overheating may occur and general lack of width be experienced.

Centring

Our diagram (Fig. 2 last month) depicts one type of centring device consisting of two plates which are magnetised. As these plates are rotated, in relation to each other, the picture is shifted accordingly.

The alternative shift device is a clamp holding a round magnet. Shift is achieved by rotating the magnet in its clamp or by rotating the clamp round the tube neck as necessary.

Frame Form or Linearity

The top of the picture is adjusted by P5 which is situated near the aerial socket and the formation of the bottom is adjusted by P6, located on the top left side of the timebase panel.

Line Hold

The external control (P9) is mounted near the aerial socket. This should be set at approximately its mid-position and the picture locked by adjustment to the slider of P10 on the bottom left of the timebase panel.

(Continued on page 582)

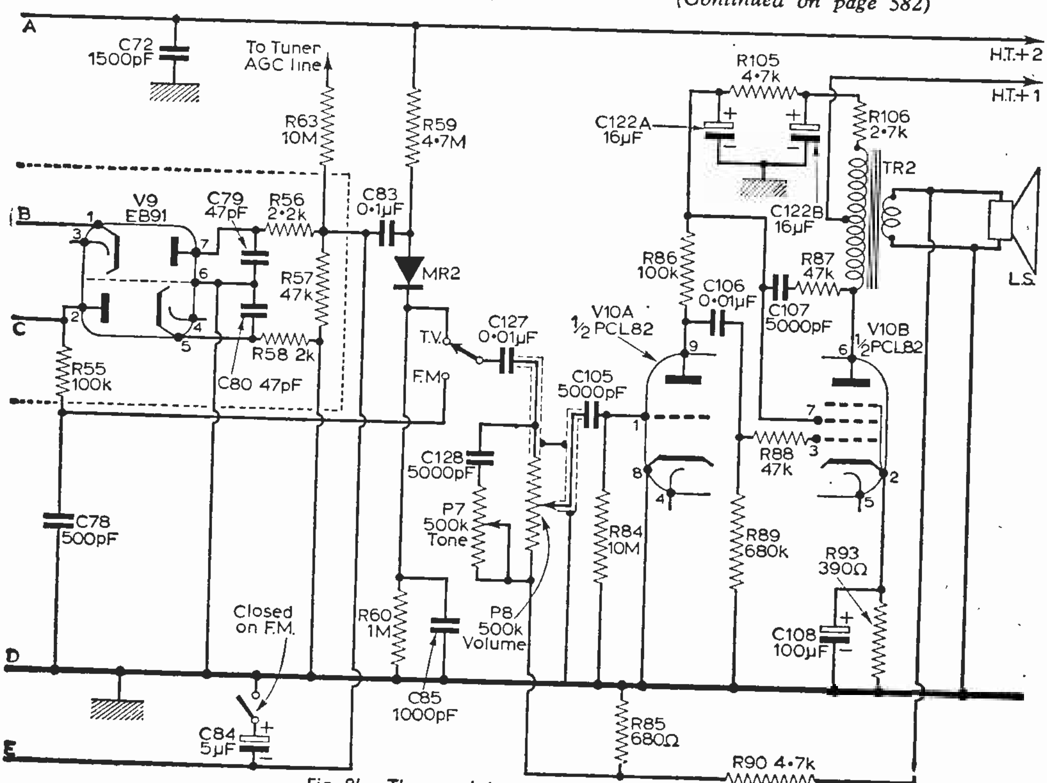


Fig. 8b—The sound detector and output stages.

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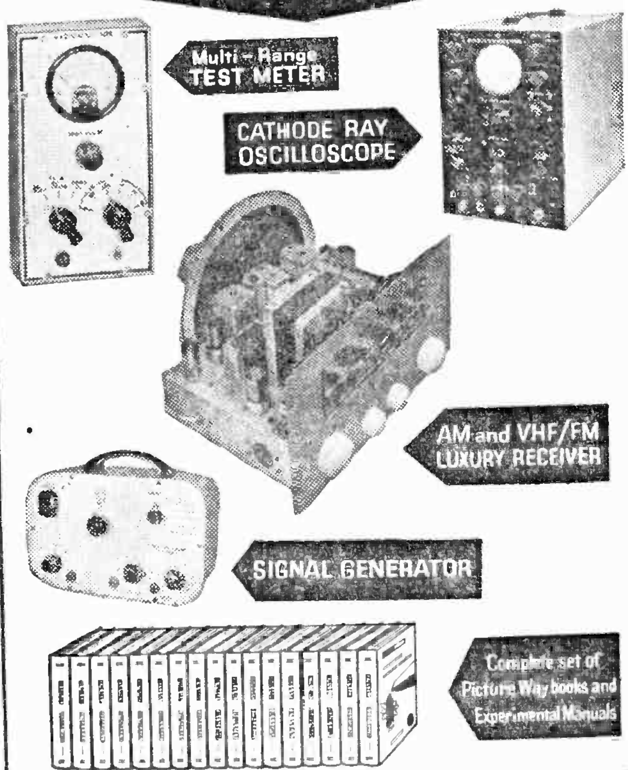

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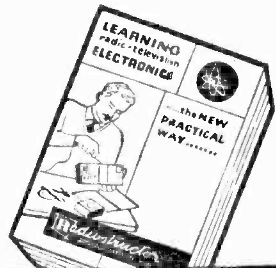

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SOUND-ON-VISION and VISION-ON-SOUND

By J. Longrise

NEARLY all viewers have experienced the symptom of sound-on-vision at some time or other and most receivers exhibit the effect as the result of maladjustment of the fine tuning control. Both the sound and vision signals radiated by a television transmitter are picked up simultaneously by the aerial at slightly different frequencies, the difference being 3·5Mc/s. Both signals are conveyed by the downlead to the R.F amplifier stage in the tuner. the response of which must be wide enough to amplify both signals simultaneously.

The frequency changer also accepts both signals, and as there is just one local oscillator, two I.F. signals are produced at the output of the frequency changer, one corresponding to the vision signal and another, displaced by 3.5Mc/s, corresponding to the sound signal. Whether the sound I.F. is below or above the vision I.F. depends on whether the local oscillator is working at a frequency equal to the signal frequency minus the I.F. or the signal frequency plus the I.F.

Sound and Vision I.F.'s

This factor is rather important and should be cleared up completely. Let us suppose that the set is tuned to Channel 4 where the sound is at 58.25Mc/s and the vision at 61.75Mc/s, and that the local oscillator on that channel is working at 96.4Mc/s; i.e. above the signal frequencies by a frequency equal to the I.F. This means, then, that the oscillator will heterodyne with the vision frequency and produce a vision I.F. of 34.65Mc/s and will also heterodyne with the sound frequency to produce a sound I.F. of 38.15Mc/s. Thus, in this case, where the local oscillator is working above the signal frequencies, the sound I.F. is *above* the vision I.F.

The I.F.'s given in this example are, in fact, the now "standard" I.F.'s which are to be found in almost all modern receivers. The set-up is given in diagrammatic form in Fig. 1. In earlier models, the local oscillator was often operating below the signal frequencies, meaning that the sound I.F. was *below* the vision I.F. (Fig. 2). On multi-channel receivers, a channel change simply means that both the incoming frequencies *and* the oscillator frequency are changed simultaneously in the same ratio, so that the sound and vision I.F.'s remain the same.

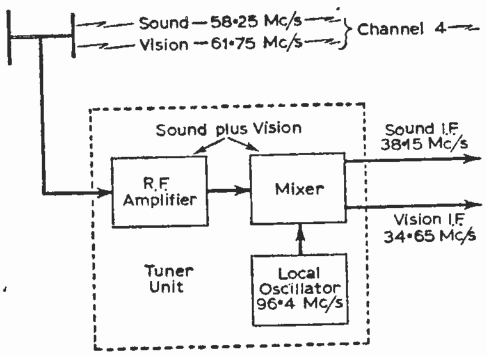

Fig. 1—A block diagram of the first two stages in a television receiver common to both sound and vision. The standard I.F.'s (e.g., sound at 38.15Mc/s and vision at 34.65Mc/s) are produced by the local oscillator operating above the signal frequencies, causing the sound I.F. to be higher than the vision I.F.

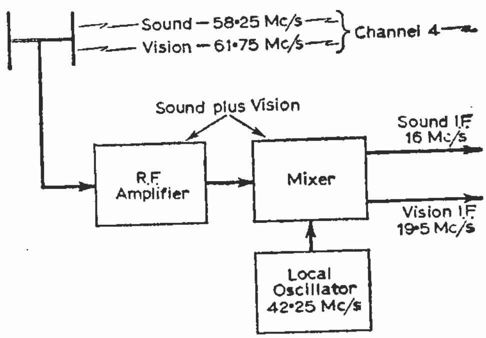

Fig. 2—In early TV sets, the sound I.F. was often lower than the vision I.F., since the local oscillator was arranged to operate below the incoming frequencies, as this diagram shows. An example using such a combination is the Ultra 72 series of receivers.

Sound and Vision Separation

To make the sound signal operate the loudspeaker and the vision signal work the picture tube without interaction, absolute separation of the two signals must occur. This separation takes place in the sound and vision I.F. channels either directly after the frequency changer (note that "frequency changer" relates to the dual functions of mixing and the production of a local oscillator signal) or after the first I.F. amplifier stage which may also be wide-band to accept and amplify both the sound and vision signals simultaneously.

The current trend is to use a common I.F. amplifier stage for both vision and sound signals before splitting into the two separate channels, and a typical circuit along these lines is given in Fig. 3. Here V3 is the common I.F. amplifier valve which picks up the sound and vision I.F. signals from the tuner. V4 is the vision I.F. amplifier valve and V9 the sound I.F. amplifier valve. GR1 is the vision detector diode, while the diodes in V10 are used for the sound detector. The triode section of V10 is simply the sound A.F. amplifier and diode GR2 is the sound interference limiter, these items being included here for the sake of completeness.

Now, unless the sound and vision signals are held in their respective channels, the sound will enter the picture signal and cause the picture to jump about in sympathy with the sound modulation, and the vision will enter the sound signal and produce a disconcerting buzz from the loudspeaker, which will alter both in pitch and volume with changes in picture content. The former is known as sound-on-vision and the latter as vision-on-sound. In severe cases of sound-on-vision, the picture may fail to lock during loud passages of sound, particularly at high audio-frequency, the effect being line tearing, frame jumping or both.

In the I.F. channels, two artifices are adopted to avoid interchange of signals. In the vision channel, tuned circuits, known as sound rejectors, are included to suppress the response to the sound signal, while in the sound channel, the normal I.F. tuning is such that the response embraces only the sound signal—the response or amplification being right down at the fringe of the vision signal.

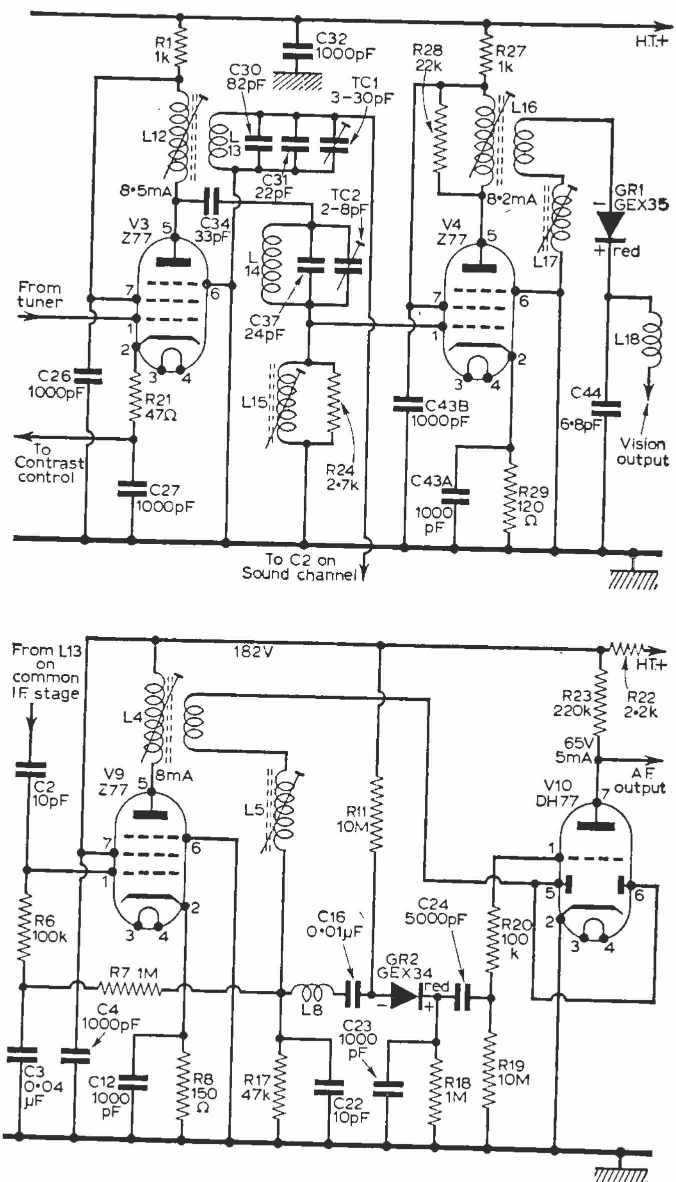

Fig. 3—This circuit shows how the sound and vision I.F. signals are separated after the common I.F. amplifier state V3. Here, V4 is the vision I.F. amplifier valve fed via C34 and V9 is the sound I.F. amplifier valve fed via L13 and C2.

Circuit Techniques

Across the tuned anode load (L12) of V3 in Fig. 3 exist both the sound and vision I.F. signals in amplified form, so that at this point it is necessary to separate them and feed them to their respective channels. On sound, this is accomplished firstly by the tuned circuit L13, C30, C31 and TC1, which is inductively coupled to L12. This circuit, then, is tuned to the sound I.F. (or, sometimes, just a little away from it to provide maximum sound rejection in the vision channel, as we shall see).

The sound signal, so selected, is fed through C2 to the control grid of the sound I.F. valve, the anode circuit of which is also tuned to the sound I.F. by L4. L4 feeds an untuned secondary winding, the output of which is fed to the sound diodes in V10. However, further sound I.F. discrimination is provided by the tuned circuit comprising L5 and stray capacitances, this also being tuned to the sound I.F., and given the required circuit continuity back through the sound interference limiter circuit.

Thus, provided all the tuned circuits mentioned above are tuned to the sound I.F., the overall response will be only just wide enough to cater for the sound carrier and sidebands, and the vision signal and its sidebands will fall outside the sound response (Fig. 4). This happens automatically, of course, there being no special circuits involved for vision rejection, as there are for sound rejection in the vision channel.

However, should the sound I.F. alignment be out of adjustment, then there is every likelihood of the vision breaking into the sound channel. Why this could happen is revealed by the broken-line

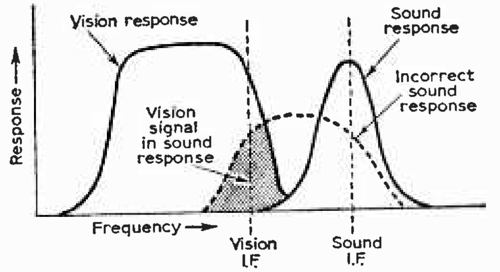

Fig. 4—This diagram shows that when the sound I.F. stages are aligned correctly, the sound response curve is well out of range of the vision signals, but due to misalignment (as shown by the broken-line curve), the sound response will almost certainly embrace the vision response and cause vision-on-sound.

response curve in Fig. 4, which very well could occur due to incorrect adjustment of the sound I.F. trimmers and slugs. Here, the response is somewhat off tune and spreads well into the vision response. Such maladjustment would cause two faults: one, low sound output, requiring maximum setting of the volume control and two, very bad vision-on-sound, the latter being aggravated by the fact that the volume control now has to be turned up to a setting which is higher than normal.

The Cure

If severe vision-on-sound occurs when the fine tuning control is adjusted for maximum sound consistent with minimum *sound-on-vision*, and if there is *no* sound-on-vision, then the trouble is almost certainly caused by a misaligned sound I.F. channel unless the trouble occurs only on Band I or Band III. The cure in this case simply resolves to realignment and, provided the vision channel is normal, realignment is often possible without any special equipment.

Looking again at Fig 3, all that would be necessary is careful adjustment to L5, L4 and TC1, in that order, to give ***maximum*** sound output with the fine tuning control adjusted for the best vision, consistent with minimum sound-on-vision. It is most important to ensure that the fine tuning control is adjusted correctly before touching the sound I.F. tuning. This is because the fine tuning control causes both the sound and vision carriers to move along the sound and vision I.F. response curves, and all we are interested in at this time is to make the two response curves correctly displaced from each other, simply by altering the width and position of one curve—that associated with the sound signal. The problem would be considerably different if both the sound *and* the vision were affected, as we shall see later.

As the sound I.F. circuits are brought into correct tune, so it will be possible to turn down the volume control to maintain a given sound output, and this in itself will progressively improve the sound-signal/vision-interference ratio.

Sound Take-off

There is just one point, however, and that is the sound take-off tuned circuit which, when adjusted for maximum sound, may cause a little sound break-through to occur on the picture. At this stage, do not be tempted to readjust the fine tuning control, but instead very carefully adjust the sound take-off tuning for maximum sound rejection. The correct tuning point will be a little removed from that for maximum sound output, but not very much and will not impair the sound output to any large extent.

The sound take-off in Fig. 3 comprises the tuned circuit L13, C30, C31 and TC1, and, in such a circuit, TC1 must be adjusted to provide the conditions previously described. Some sets use a dust-iron core instead of a trimmer capacitor, but the procedure for adjustment is exactly the same. The sound take-off on all sets is the tuned circuit which feeds the sound signal from the common I.F. amplifier stage to the sound I.F. valve.

In effect, the sound take-off tuned circuit looks to the vision I.F. channel as a sound rejector, so although it couples the sound signal it must, nevertheless, be adjusted as a sound rejector; that is, for minimum sound-on-vision.

Sound-on-Vision

Here the problem is a little more involved, but let us assume that there is *no* vision-on-sound, but very bad sound-on-vision even with the fine tuning control adjusted for maximum sound consistent with ***minimum*** sound-on-vision. At this stage it must be noted that sound-on-vision and possibly, vision-on-sound will occur on most sets (particularly on Band III) if the fine tuning control is incorrectly adjusted, so it is imperative to ensure that this control is *always* adjusted for maximum sound consistent with minimum sound-on-vision. However, if sound break-through cannot be eliminated by the fine tuner and, provided there is a point within the range of the tuner where maximum sound *can* be obtained, then misalignment of the vision I.F. channel (possibly the sound rejectors) is most likely to be responsible.

If there is no point within the range of the fine tuner where maximum sound can be obtained, and if the sound output tends to increase when the control is adjusted to one end of its range, the trouble here may simply be caused by incorrect adjustment of the oscillator trimmer in the tuner corresponding to the channel affected. The cure in such cases is to set the fine tuner to the centre of its range and then very carefully adjust the oscillator core for maximum sound consistent with minimum sound-on-vision. The oscillator core on the channel selected is usually accessible through a hole in the front of the cabinet, directly beneath the channel selector knob.

(To be continued)

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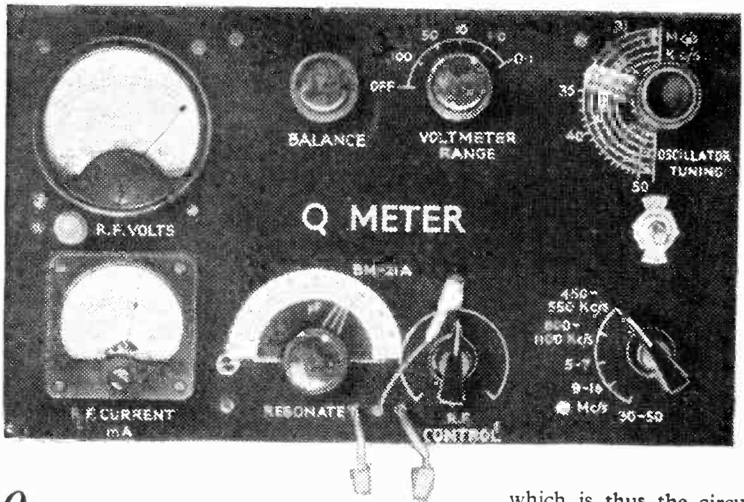
Q-M



IN receiver design it is always important to ensure that the bandwidth of each tuned circuit is appropriate to its application. This is especially important in receivers intended for the reception of F.M. signals, and, of course, in television receivers, overall bandwidth is very critical. Where coupling between two inductances has to be adjusted to a precise value—a common problem—it is necessary to know the Q of each coil. The experimenter is constantly confronted with the question, "What is the Q of this coil?" and unless he can determine it in some way his design has to be conducted in an empirical manner. This is time-consuming to say the least, and the instrument described here—which was made up very cheaply at the cost of about five hours actual construction time—will be found to pay its way in time saved in a very short period.

The chief causes of energy loss in coils intended for tuned circuits are dielectric losses in the material included in the distributed self-capacitance of the coil, such as wire insulation and former material, eddy currents in nearby metallic objects—including slug cores if used—and core losses if iron dust cores are involved. Skin effect in the wire of the coil is also important. The normal "ohmic" resistance is usually negligible, though sometimes it has to be taken into account. It will thus be seen that in all practical cases it is hopeless to try to calculate the losses of a coil, even if with special arrangements calculation is sometimes possible. Even more is this the case when the coil is connected to a valve, where other effects occur also to increase circuit losses; with transistors similar effects—but more marked—occur.

Coil losses are usually expressed in terms of an equivalent series resistance damping an ideal coil of no losses. The "goodness" of the coil can then be expressed in the following way. If the inductance of the coil is L and its resistance R, consider a current I flowing through it at resonance. This current develops a voltage $V=IR$, but it is clear that the voltage developed across the inductance must be $V'=2\pi fLI$ and if $2\pi fL$ is greater than R, as is usually the case, the circuit has exhibited the property of "circuit magnification". The ratio

$$\frac{V'}{V}$$

which is thus the circuit magnification is seen to be equal to

$$\frac{2\pi fL}{R}$$

or expressed simply, as

$$\frac{\text{reactance}}{\text{resistance}}$$

This is the quantity which is with certain reservations known as Q; these reservations include the fact that the self capacitance of the coil has been neglected or, if thought about, it has been decided to charge all the losses in the circuit to the account of the coil. Except in special circumstances this is justifiable.

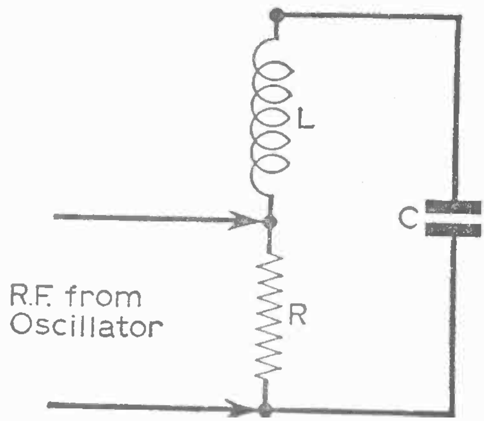


Fig. 1—An explanatory circuit for the Q-Meter.

Q is nearly equal to the reciprocal of the power factor of the coil. It may be noted that with capacitors the power factor is usually quoted, although sometimes Q is used.

The instrument now to be described uses this effect to measure the Q of a coil. The essential circuit is shown in Fig. 1. L represents the coil under test, C a good quality capacitor the losses of which can be neglected, and R is a small resistor of which the value is known accurately. An oscillator connected across R causes an R.F. current to

ERAL RPOSE METER

y D. R. Bowman

flow through the resistor and this causes a small voltage to be developed across it. The resistor R forms part of the series circuit LCR, and thus the R.F. voltage is injected into the circuit. Resonance is achieved by adjusting the value of C or by varying the frequency of the oscillator, or both, and a much larger voltage then developed across L is measured by means of a valve voltmeter of very high input resistance. The R.F. current input has of course to be known and it is convenient to measure this with a thermocouple milliammeter which can be calibrated accurately in a simple manner. The introduction of the resistance R naturally increases the resistance of the circuit, and so R has to be kept as small as practicable. In commercial instruments the standard value of R is 0·04Ω; this is not easy for the amateur to manage, and necessitates the use of a heavy current. In addition there is a much worse trouble to be encountered, which will now be discussed.

This is the reactance of the resistance wire and its leads. It will be realised that any wire, however short and thick, possesses some inductance. If the wire carries R.F. current a voltage equal to $2\pi fLI$ is set up across it, and when it is mentioned that half an inch of 22s.w.g. wire has an inductance of about 0·01 microhenries, it will be realised that the voltage set up by even a small current may not be negligible. If it is not negligible in comparison with the voltage set up by the resistive property of the wire, errors of large magnitude will occur—not only because of the large spurious voltage itself but also because this voltage is not necessarily in or out of phase with the required voltage.

An example will make this clear. If the resistance is to be 0·1Ω, then the reactance must be such that at the frequency required its value does not exceed 0·01Ω. Suppose the frequency is 50Mc/s, then

$$X_L = 2\pi fL \text{ or } L = \frac{X_L}{2\pi f} = \frac{0{\cdot}01 \times 10^6}{6{\cdot}3 \times 50 \times 10^6} \text{ microhenries}$$
$$= 0{\cdot}000032 \text{ microhenries.}$$

This represents a quite unrealisable figure which even in very elaborate instruments cannot be attained. In fact, the Q value at such frequencies has to be obtained by other methods.

Accordingly, a much larger value of resistance is used in this instrument, namely 1Ω. This resistor is made up from a measured length of resistance wire, is wound non-inductively, and is mounted on a support of special construction of which the inductance is

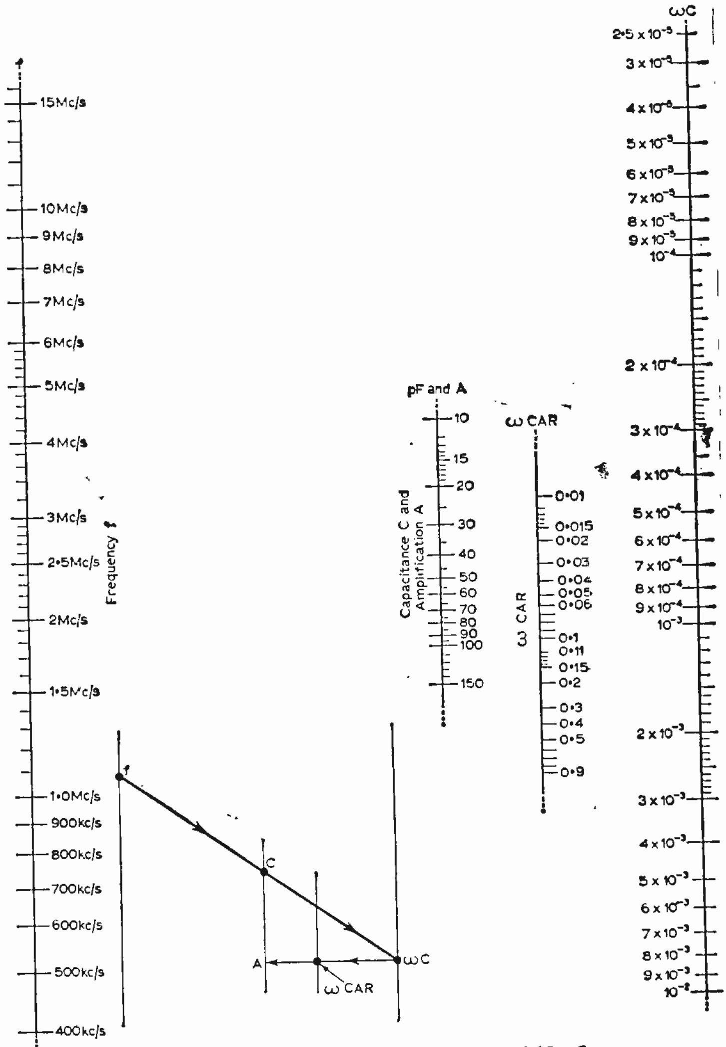


Fig. 2—A nomograph for finding the value of ARωC.

about 0·001 microhenries. The instrument can then be used with good accuracy to a frequency of 10Mc/s.

However, the introduction of as much as 1Ω into a tuned circuit is sufficient to render the observed value of circuit magnification much less than Q, unless Q is quite low. Fortunately, the means needed to apply the appropriate correction also affords an alternative means of measuring Q at higher frequencies. This is in fact a calibrated variable capacitor.

At the risk of repeating the well-known, it will be as well to have a look at the very simple mathematics of the circuit. Let r be the intrinsic R.F. resistance of a coil of which the inductance is L, and R the inserted standard resistance. The circuit magnification observed is A, while C is the total capacitance of the circuit (including the capacitance of the calibrated variable capacitor at its setting) and $\omega = 2\pi f$.

Then $Q = \dfrac{\omega L}{r}$ and $A = \dfrac{\omega L}{r+R}$

So $\dfrac{Q}{A} = \dfrac{r+R}{r}$ and $Q = \dfrac{A(r+R)}{r}$ or $A(1+\dfrac{R}{r})$. . .(1)

Now $Q = \dfrac{\omega L}{r}$ so $r = \dfrac{\omega L}{Q}$

Substituting in equation (1) above

$$Q = A(1 + \frac{QR}{\omega L}) = A + \frac{ARQ}{\omega L}$$

Cross-multiplying,

$$\omega LQ = A\omega L + ARQ$$
$$\omega LQ - ARQ = A\omega L$$

$$\text{or } Q = \frac{A\omega L}{\omega L - AR} \quad \text{.........................(2)}$$

From this equation it can be seen that if the circuit magnification A, the operating frequency, the inductance of the coil and the added standard resistance are known, Q can be calculated simply enough.

It is quite usual for the inductance of a coil, when wound, to be known only very approximately. Hence equation (2) is best rearranged so that capacitance is involved rather than inductance; it is usual for a single variable capacitor to do duty for tuning over all ranges of frequency, and its calibration is not a difficult matter, though of course it needs some care and time. The rearrangement is carried out by remembering that at resonance

$$X_C = X_L \text{ or } \omega L = \frac{1}{\omega L}$$

Substituting in equation (2)

$$Q = \frac{A}{1 - AR\omega C} \quad \text{.............................(3)}$$

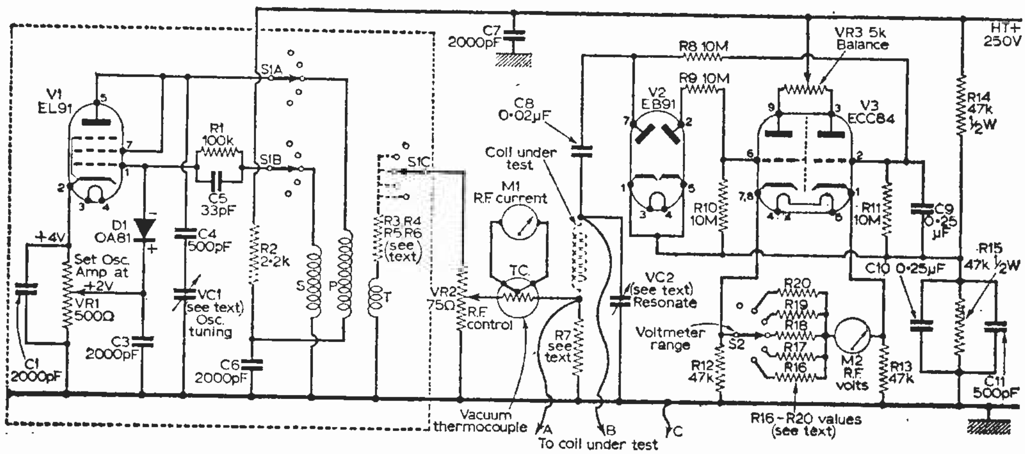


Fig. 3—The circuit.

From equation (2) or (3) it will be noted that if the added resistance R is very small Q = A. This is the way it would be most desirable to use the instrument, but it is out of the question, unless Q is relatively low. However, the formula enables the true value of Q to be obtained from the observed quantity A. The formula should always be applied when A is found to be 60 or more. Fig. 2 is a nomograph from which the value of $AR\omega C$ can be found easily and with sufficient accuracy. The use of this will avoid the tedious calculations of $AR\omega C$, and the chance of getting the decimal point in the wrong place.

The circuit diagram of the Q-meter is shown in Fig. 3. It consists of a small power oscillator in which the range required is selected by means of a Yaxley switch. Tuning is accomplished in the usual way with an air-spaced capacitor of good quality. In the prototype, this component had a maximum capacitance of about 80pF, but a larger one would not be unsuitable except perhaps on the highest frequency range, 30-50Mc/s. The oscillator has provision for amplitude stabilisation. This is necessary to minimise the amount of harmonic current generated, and the stage operates without grid current. If harmonics are present in any great quantity, it will be seen that the reading of the R.F. milliammeter will include them. But the tuned circuit picks out the fundamental—the frequency to which it is tuned—and so reads a lower voltage than is accountable to the R.F. current flowing. The arrangement used works very well, and has the advantage of being simple. It has however the property of employing negative feedback, and because of this it is possible that at the lower frequencies audio oscillations may be set up which modulate the oscillator. This is no disadvantage in this particular application.

The ranges to be provided are at the discretion of the constructor. Details of the coils used in the prototype will be given, and the ranges used may well be found to be generally suitable. If not, similar proportions may be used in other coils wound to the constructor's own needs. There is little point in attempting to go to much higher frequencies as accuracy is not very likely to be obtainable.

The valve voltmeter consists of a vacuum diode with a very high input resistance and its output is amplified by a triode arranged in a cathode follower circuit. Drift of this D.C. amplifier is exceedingly small, and zero stability is very good also. The number of ranges of voltage provided may occasion some surprise. The reason for this provision is that the valve voltmeter has many uses, and can be used independently of the Q-meter for any purpose desired. The actual ranges provided will depend on what indicating meter is available. The prototype utilised a 0-25μA movement obtained cheaply as Government surplus. This enables a low range of 100mV to be added; it will not in general be used for the operation of the Q-meter, but is very useful for other purposes. If an instrument of 500μV f.s.d. is available it will be found to suffice.

The instrument used for measuring R.F. is worthy of some comment. Small thermocouple meters are available very cheaply. but they seldom if ever read as low a current as is needed in this instrument. Generally they are intended to have a full scale deflection of about 0·5A to 1A. The current required here is however only about 30mA to 50mA. To measure this small current, a vacuum thermocouple is needed, and such devices usually have a maximum output of 15mV at about 3mA. Thus, what is needed to read properly with a vacuum thermocouple is not a sensitive movement but one with a low internal resistance. In practice. the thermocouple may be removed from a "surplus" instrument and the latter used with the vacuum thermocouple instead. Most amateurs will possess a thermocouple type of meter which has been burned out; this is ideal for the job, as long as the movement itself has not been damaged.

The thermocouple specified for the Q-meter was obtained from L. Glaser and Co. of Aldergate Street, London.

(To be continued)

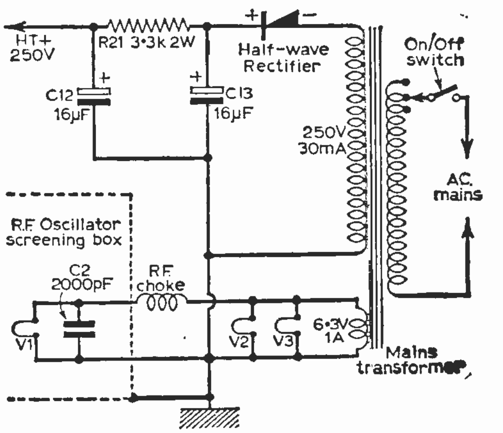


Fig. 4—The circuit of a suitable power-pack for the meter.

COMPONENTS LIST (Fig. 3)

Resistors (all $\frac{1}{4}$W, unless otherwise stated):

R1	100k	R11	10M
R2	2·2k	R12	47k
R3	see Table 1	R13	47k
R4	see Table 1	R14	47k $\frac{1}{2}$W
R5	see Table 1	R15	47k $\frac{1}{2}$W
R6	see Table 1	R16	see text
R7	see text	R17	see text
R8	10M	R18	see text
R9	10M	R19	see text
R10	10M	R20	see text
VR1	500Ω variable		
VR2	75Ω variable		
VR3	5k variable		

Capacitors:

C1	2000pF	C7	2000pF
C3	2000pF	C8	0·02μF mica
C4	500pF	C9	0·25μF
C5	33pF	C10	0·25μF
C6	2000pF	C11	500pF
VC1	see text	VC2	see text

Valves:
V1 EL91 V2 EB91 V3 ECC84

Meters: see text

General notes on the components employed in the instrument can be found in the text.

Notes on Capacitors and Resistors:

C1 C2 C3 C6 C7 disc-ceramic type
C5 C12 C13 mica or silver-mica
C8 mica or polystyrene film
C10 C11 high quality tubular

Resistors are all $\frac{1}{4}$W except R14 and R15, which are $\frac{1}{2}$W

VR1 VR2 VR3 may be wire-wound or carbon-track types

R8 R9 R10 R11 should be wiped with a clean rag moistened with carbon tetrachloride before soldering into place, and not touched by hand thereafter.

Valveholders:
V1 any suitable
V2 and V3 ceramic or P.T.F.E.

Leads A, B, and C:
These leads should be as short as possible, P.V.C. insulated, and terminated in miniature crocodile clips.

COMPONENTS LIST (Fig. 4)

R21 3·3k 2W	C12 16μF 350V
C2 2000pF ceramic	C13 16μF 350V

Rectifier: E250C50
Mains on/off switch
Transformer: mains primary; 250V 30mA and 6·3V 1A secondaries.
R.F. choke

Line and Frame TIMEBASE Stabilisation

DETAILS OF CIRCUITS FOR PREVENTING CHANGES IN PICTURE WIDTH AND HEIGHT

By T. D. Lawrence

MANY of our readers will have noticed that almost all television receivers of recent vintage have far better stabilisation of the line and frame timebases than their old-style counterparts. With early receivers, it was often necessary, for example, to set the height control for a slight overscan of the frame so that when the set warmed up the resulting frame shrinkage gave a picture of the correct height. However, as the set further increased in temperature, so the frame scan progressively decreased in amplitude, thereby calling for frequent adjustments of the height control. In severe cases, frame non-linearity also occurred, and after the set had been working for several hours it may have been almost impossible to produce an ideal frame scan.

Effect is Normal on Old Receivers

Such symptoms are inherent to the design of early models and, although frequent change of the frame amplifier valve may have alleviated the trouble to a small degree, there was little that could be done in the way of component replacements to provide a permanent cure. Certain old sets in use today exhibit such symptoms, and if the set has been acquired by way of the surplus market, the new owner may not realise that the effects are "normal" and may spend hours unsuccessfully trying to find a remedy. One has to live with shortcomings of this kind and either put up with a progressive increase in frame scan distortion or resort to frequent adjustments of the height and frame linearity controls.

Similarly, old sets were afflicted with timebase troubles due to power voltage changes. Again, the frame scan—and also the line scan—tended to decrease badly with a fall of mains voltage. During the winter months, these symptoms are prevalent on old sets, while new receivers work quite happily over a reasonable change of mains voltage. This is because new models incorporate circuits for stabilising the timebases against both temperature change and voltage fluctuations.

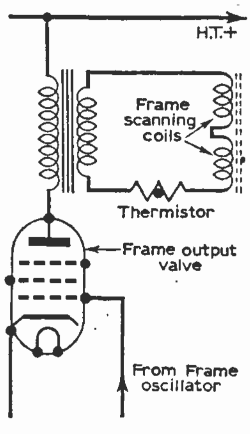


Fig. 1 (right)—In order to maintain a constant loading on the frame output valve in spite of alteration in the resistance of the windings of the frame scanning coils, a thermistor may be connected in series with the coils as shown above. With increase in temperature, the coil resistance increases, and the thermistor is chosen and positioned so that its decrease in resistance with temperature increase compensates for the opposite effect occurring in the coils.

Fig. 2—The resistance of a normal resistor remains constant with variations in the voltage present across it; thus, the voltage/current characteristic is linear as shown in (a). With a voltage-dependent resistor, however, the resistance is not constant, but fall as the voltage across it increases. This gives a non-linear voltage/current characteristic shown in (b).

Resistance Change

The frame scan amplitude of any television receiver is governed by the amount of linear

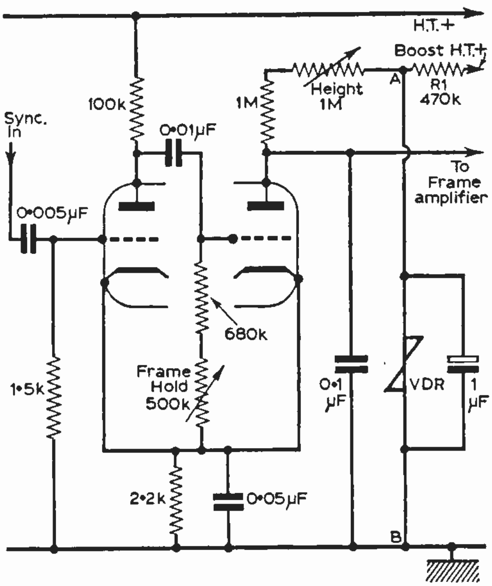


Fig. 3—A circuit showing how a multivibrator frame generator can be stabilised with a voltage-dependent resistor.

current rise in the frame scanning coils during the scanning stroke of the frame oscillator. The current in the scanning coils is partly limited by the resistance of the windings, and, to give a full scan, the height control is adjusted to produce a scanning current which overcomes this resistance to give sufficient magnetic flux to cause full vertical deflection of the scanning spot. All is now well and would remain well provided all the circuit elements held solidly in terms of value and characteristic.

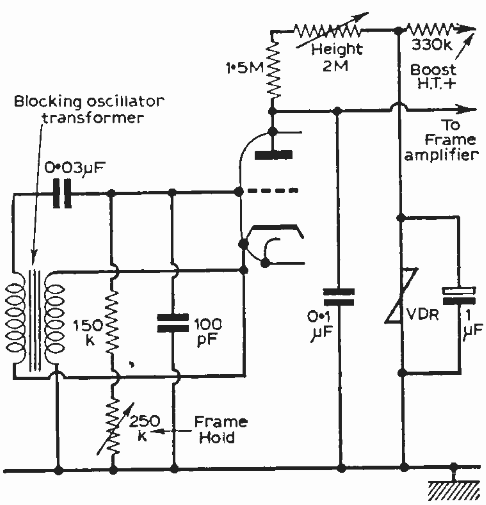


Fig. 4—In this circuit, a VDR is used to stabilise a frame blocking oscillator.

Unfortunately, this is virtually impossible, and the main thing that happens is that the resistance of the scanning coils increases. Copper wire, which is what the scanning coils are wound with, has what is called a "positive temperature coefficient of resistance." This means that as the temperature of the wire increases, so also does its resistance.

Now, since the height control has been adjusted to give the correct scan when the set was first switched on, and when cold, the increase in resistance of the coils as the set warms up results in a reduction in scanning current, with a consequent reduction in spot deflection. Thus, the scan decreases, and in order to compensate, the height control has to be turned up a little more. This is progressive, of course, up to a certain temperature, and as the set warms up to that temperature so the height control has continually to be advanced.

If the set is well ventilated, the correct temperature may be reached after ten to twenty minutes, but if the set is badly ventilated the rise in resistance may go on for almost the whole of the viewing time. This, then, is a point well worth bearing in mind. If a receiver is extremely unstable over long periods of time, ensure that the ventilation slots in the base and rear covers are completely free of obstruction. Also make sure that the set is not operated close to a wall; always leave plenty of room for air to circulate.

The Use of a Thermistor

A very simple method of compensating for the rise in resistance of the frame scanning coils is the use of a thermistor. A thermistor is, in effect, a resistor in which the resistance *decreases* when the temperature increases. It is thus a resistor with a "negative temperature coefficient" —the exact opposite to the temperature coefficient of copper wire, for example. The materials used for the manufacture of thermistors include semi-conducting oxides of iron, nickel and cobalt with small quantities of other materials added.

The temperature of a thermistor can be made to rise either by placing it in thermal contact with the heat-producing element or by passing a current through it. In the former case the resistance can be arranged to decrease in the same ratio as the resistance of the heat-producing element increases, thereby providing a compensating control, while, in the latter case, the current in a circuit can be caused to rise at a given rate due to the self-generated heat of the thermistor resulting in a fall of circuit resistance. The former application is invariably used in frame timebase circuits, while the latter is mostly used to avoid current surges in series-connected heater circuits.

In Fig. 1 is shown the connection of a thermistor in a frame timebase circuit, the thermistor simply being connected in series with the scanning coils. However, it is placed either in thermal contact with the scanning coils themselves or in a critical position inside the cabinet where it can sample the temperature with reasonable accuracy.

The thermistor is chosen so that the fall in resistance matches the increase in resistance of the coils, and so the current in the coils remains constant over a wide range of temperatures. The thermistor also ensures that the load on the output valve remains constant. In that way, once the height control is adjusted for a full scan, the scan remains correct for the current in the coils cannot alter.

Frame timebase faults, giving the symptoms of total failure of frame or reduced height, may now be caused by trouble in the thermistor, and this component can easily be checked simply by shorting it out. If the frame scan is now restored, then the thermistor must be replaced. For a temporary measure, however, the set can be run without stabilisation (with the defective thermistor shorted) until the correct replacement is obtained. It is most important to replace with the correct type, and to fit it in exactly the same position as the original. Failure to observe these simple rules will severely disturb the compensation.

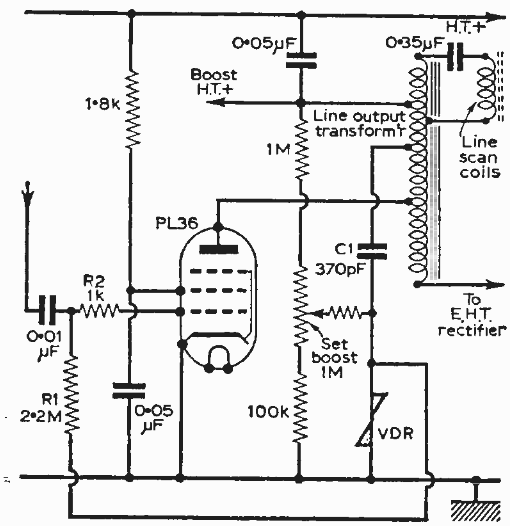


Fig. 5—Stabilisation of the line timebase is accomplished by the VDR producing a form of line output stage gain control voltage.

The Use of a Voltage-Dependent Resistor

With an ordinary resistor, the resistance value remains constant despite any variations of the voltage applied across it—Fig. 2(a). However, there is a special type of resistor recently introduced in which the resistance is not constant, but falls as the voltage applied across it is increased —Fig. 2(b). Such resistors have been evolved by Mullard Limited, from whom full details can be obtained.

Resistors of this nature have various interesting applications, some of which have been dealt with in past issues of this journal, but to maintain completeness of this article, the various ways in which they can be used for timebase stabilisation will now be considered.

In Fig. 3 is shown a multivibrator frame oscillator circuit which is stabilised by a voltage-dependent resistor (VDR). The symbol of this component should be noted, for it will be found more and more in circuits of new receivers. The amplitude of frame signal fed to the frame amplifier depends upon the voltage across points A and B. This means that any change of boost voltage as may occur due to a change of mains voltage, for example, will affect the frame scan amplitude.

However, with the VDR connected across points A and B, a decrease in supply voltage will cause the resistance of the VDR to rise, and since this component forms the bottom arm of a potential-divider, with R1 in the top arm, the actual voltage applied to the oscillator through the height control will be stabilised.

This circuit, and also that in Fig. 4, which is a frame blocking oscillator, reduce a 10% change of supply voltage down to something like 3% so far as the actual supply to the oscillator circuit is concerned.

Line Timebase Stabilisation

The circuit in Fig. 5 shows how a VDR can be utilised to stabilise the line timebase. Here the VDR receives a line pulse from the line output transformer, via C1. Owing to the non-linear characteristics of the VDR, the pulse is rectified, and across the VDR occurs a negative potential, relative to chassis. This is fed through R1 and R2 to the control grid of the line output valve. To the valve, it is a bias voltage and thus sets the operating conditions of the stage.

To facilitate the initial setting up of the circuit, the operating conditions of the VDR can be accurately established by the " set boost " control. This is really a potentiometer circuit which feeds the required amount of direct voltage to the VDR for the correct non-linear operation. It is rather like a delay control of an AGC system which, of course, also has an effect on the standing bias of the line amplifier.

The stage is thus stabilised by the voltage produced by the VDR, since if the line pulse amplitude falls so the negative voltage fed back to the output valve control grid decreases, and the stage operates at a higher gain, thus restoring the pulse to the original amplitude. As the pulse is a sample of the amplitude of the signal in the line amplifier, including the line scanning coils and EHT system, the whole of the network is stabilised against voltage fluctuations and EHT loading. ■

SERVICING TV RECEIVERS

(Continued from page 570)

Interference Limiter

This control is P1 on the upper left side of the I.F. panel. It should be set first to cause the highlights of the picture to flatten and then back from this point so as to cause true whiteness to return. At this point, interference pulses will be reduced to this level.

I.F. Alignment

This should not be attempted without a signal generator and full instructions. The sound I.F. transformers (T6, T5 and T4) should not be adjusted unless absolutely necessary. ■

SERVICING DATA AND MODIFICATIONS

By D. Elliot

MORE FRAME FAULTS AND SOME TUNER DEFECTS

(Continued from page 527 of the August issue)

IN last month's article it was reported that intermittent vision is sometimes caused in the Ferguson 406T series by a dry soldered joint on the video coupling coil. It is well worth noting that trouble of a similar nature also occurs quite frequently in the Ekco T217 series. The usual symptom is that the set operates for an hour or so quite normally and then the vision suddenly fades, leaving just the raster. Probing at the termination of L17 (see Fig. 28) reveals the trouble, and it can be cleared permanently by resoldering, but first ensuring that the coil wire and termination wire are perfectly clean.

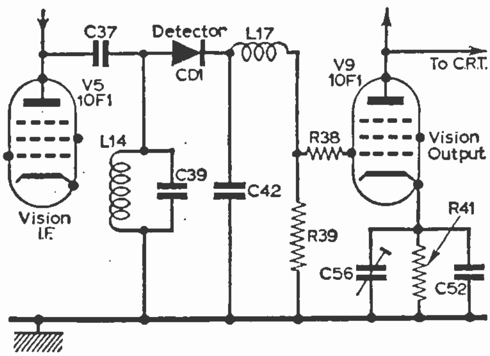


Fig. 28—Intermittent vision in the Ekco T217 series is often caused by a dry-soldered joint developing in L17, the vision coupling inductor. Check by probing with an insulated tool, and resolder if necessary.

Ekco T217 Series

Still keeping to the Ekco range of sets a rather interesting symptom can occur on the picture of the T217 series due to a defect in the frame output valve. Here several scanning lines towards the middle of the screen tend to pair badly, giving the impression of extra thick lines in the centre of the picture. The peculiar thing about this fault is that the frame valve (10P13) checks normal on a valve tester, but without doubt a replacement valve clears the trouble.

To save expense, the sound output valve, which is exactly the same type, can be interchanged with the frame valve. This clears the frame trouble and, in most cases, the faulty valve has no effect on the sound quality.

Ekco T221 Series

This model employs a circuit for frame flyback suppression and the circuit is coupled to the grid of the picture tube via an 0·001μF capacitor. This capacitor has a tendency to leak. One resulting symptom is that the frame oscillator alters in speed and, in some cases, the frame hold weakens. Leakage of the capacitor often increases with increasing temperature inside the set and the frame may thus be gradually pulled out of lock. In addition the picture brightness is sometimes affected and a slow picture fade can occur as the leakage increases. Another symptom, which may accompany those given above, is a 50c/s hum bar across the picture.

All these symptoms should first lead to a check of the capacitor, preferably by substituting it for one known to have good insulation.

The picture tube in this series of sets is held with a rubber lining which is clamped by the tube cradle. After several years' use the rubber band invariably "welds" itself to the tube, making tube replacement extremely difficult. The trouble can be overcome, however, simply by using a few drops of switch cleaner around the band and leaving for several minutes. When the fluid has properly soaked in the band can easily be peeled off the tube and cradle.

Poor Band III Reception

It may suddenly happen that the Band III pictures and sound become very weak, with noise and poor locks on vision, while the Band I reception is virtually unaffected. This is a fairly good clue that the trouble lies in the tuner. What usually happens is that a 200pF capacitor decoupling the H.T. feed to the cascode valve V1 short-circuits. This causes the associated 330Ω resistor to overheat badly (and also, sometimes, a 100Ω

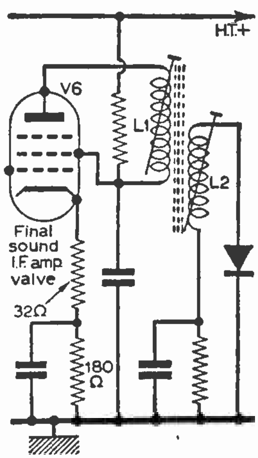


Fig. 29—Sound channel instability often results in the early versions of the Masteradio TE4T and TE7T models. This can be caused either by defective decoupling in the sound I.F. stages or excessive gain in the final stage shown. The trouble can be countered either by de-tuning L2 slightly, or by including a 32 Ω resistor in the cathode circuit, as shown. A too peaky sound channel response impairs the operation of the sound interference limiter.

resistor connected in series with it to the H.T. tag on the tuner socket), but the heavy current in the capacitor results in it going open-circuit before either resistor breaks down.

Usually, though, the resistors change in value and, since the decoupling is now effectively destroyed, the Band III performance is considerably affected, though reception on Band I is barely affected. The cure, of course, is to replace the 220pF capacitor and also, if necessary, the overloaded resistors. The components and wiring should be disturbed as little as possible in the interests of maintaining alignment and stability.

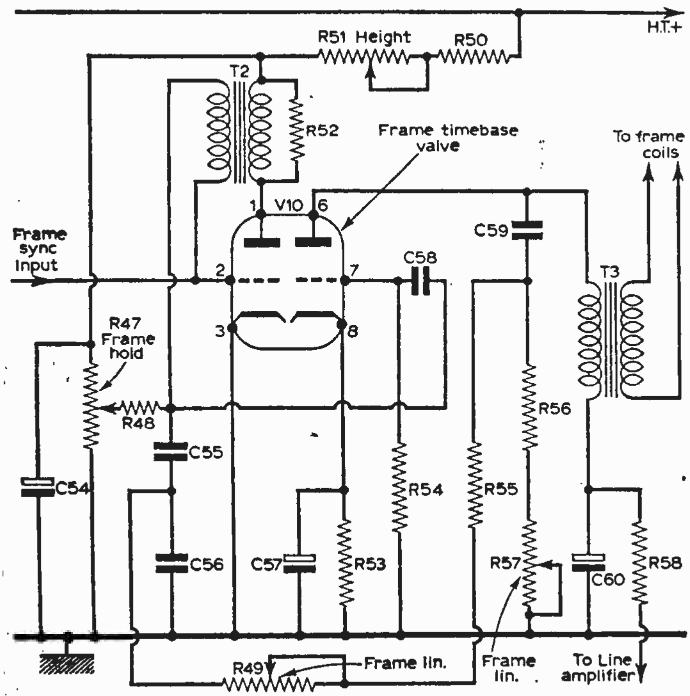


Fig. 30—Extra height can be obtained in the Masteradio series by (a) including R52—47k and (b) increasing C56 from 0.03μF to 0.04μF by adding an extra 0.01μF in parallel.

Masteradio TE4T and TE7T Series

As there are quite a few of these models in use at the present time a few words about their faults would not be amiss in this series. As a start it is interesting to note that failure of the 0·005μF capacitor connected to the grid of the picture tube (pin 2) does more than introduce frame flyback lines at high brightness levels. It also encourages an apparent "ringing" effect in the line output stage, the symptom being a series of vertical dark bars, closely spaced at the left of the screen but widening out towards the centre.

Owing to the high sound channel gain in these models instability is sometimes experienced, and this may give the effect of overloading on sound. The trouble exists in the final sound I.F. amplifier stage and there are several things that can be done to improve stability. One is to detune slightly the secondary of the transformer (L2 in Fig. 29). Another is to apply degenerative feedback by inserting a 32Ω resistor in the valve cathode circuit as shown. It is best to retrim the final I.F. transformer after such alterations, but too peaky a response has a bad effect on the action of the sound interference limiter.

Lack of height can be corrected by (a) connecting a 47k resistor across the secondary of the frame blocking oscillator transformer, if not fitted, and by increasing the value of the capacitor connected between the first frame linearity control and chassis to 0·04μF from the existing 0·03μF (e.g., a capacitor of 0·01μF should be connected in parallel with the original component). The resistor concerned is R52 and the capacitor C56 (in Fig. 30).

An improvement in vision channel gain and better action of the contrast control can often be accomplished by shunting R36 (Fig. 31) with a resistor of about 15k. This reduces the negative voltage applied to the AGC line and thus increases the overall gain.

There is another difficult fault here, which is open-circuiting of R36. This causes much-impaired line synchronisation, with extreme "cog-wheel" effect on Test Card C.

A sudden reduction in picture height can be caused by open-circuiting of the 8μF electrolytic (C54, Fig. 30) in the frame circuit. This should be checked by substitution before closer investigation is undertaken.

Philips 1446 and 1746 Series

These are also very popular sets and well worthy of attention. An interesting fault which occurs time and time again is reduced height. If the potentials at the various electrodes of the frame timebase valves are reasonably correct, and the components related to the height control circuit proper are in order, the trouble is invariably caused by open-circuiting of a 10,000Ω resistor connected to a 56,000pF capacitor, the capacitor being returned to chassis in the coupling network to the frame output valve (PL82). This is a high-stability resistor, but replacement with an ordinary component seems to work quite well.

Lack of frame scan can be caused by many causes, of course, one of which is a fault in the frame blocking oscillator transformer. However, before this component is finally condemned, attention should be directed to the 10k resistor which is connected between chassis and a capacitor in the frame oscillator section (see Fig. 32). This has been known to go very high in value or open-circuited on numerous occasions, causing the symptom mentioned—i.e., a horizontal bright line on the screen.

(Continued on page 587)

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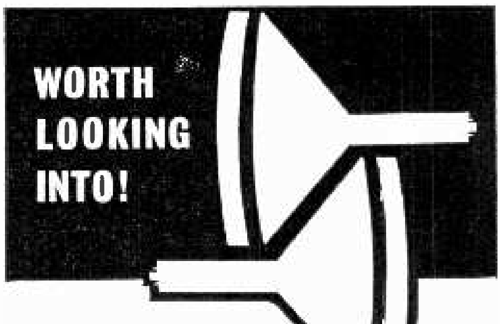

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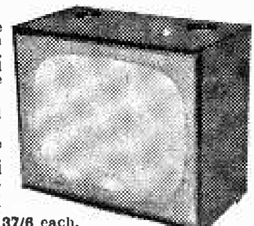

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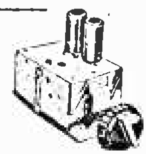

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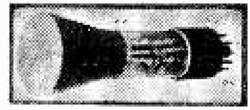

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EF183	12/6	UB41	7/6	6Q7G	5/11	50CD6G	19/11
EF184	12/6	VP23	6/6	6SG7	4/9	80	6/11
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(Continued from page 584)

Other Timebase Troubles

Frame judder should lead to a check of the 47k resistor connected in parallel with a 1,000pF capacitor to the grid of the frame blocking oscillator triode. This resistor may go high in value or open-circuited.

Poor line and frame sync should lead to a check of the sync separator ECL80 and the 1M screen feed resistor on the pentode section for value increase. The 0·056μF to the control grid of the pentode should also be checked for insulation resistance and value.

Poor frame hold is often reflected from a defect in the video amplifier stage and typical is value increase of the 10μF electrolytic connected to the screen of the video output valve (V10 EF80). If this component is low in value there is also a tendency for frame jitter.

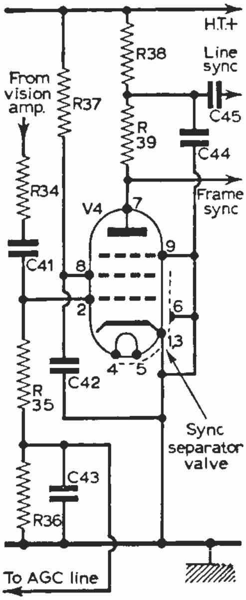

Fig. 31—Improved vision channel gain and better control of contrast is sometimes possible by shunting R36 with a resistor of about 15k.

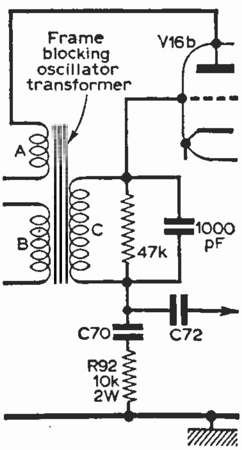

Fig. 32—For frame collapse in the Philips 1446 and 1746 series, check R92 for open-circuit. For frame judder, check the 47k resistor for open-circuit or value increase.

Persistent cases of line tear can be cured by connecting a 68k resistor in parallel with the screen by-pass capacitor of the sync separator valve — pentode section of ECL80 V14.

Poor BBC; no ITA

Again this is a tuner defect which shows up mostly on the higher frequency bands. The PCC84 often starts the trouble by short-circuiting internally in some way. This causes the 680Ω resistor connected to the anode circuit of this valve to go high in value or even open-circuited. The curious thing about this is that even if the resistor goes completely open-circuited the tuner continues to work on BBC, though well below the usual standard.

The cure is, of course, to replace the resistor and also the associated 820pF feed-through capacitor and, to be on the safe side, the PCC84, since the internal short often rights itself after the initial current surge and there is nothing conclusive to indicate that the valve was to blame in the first place. Similarly, one cannot tell whether or not the associated feed-through capacitor became short-circuited momentarily. To be safe both suspects should be replaced.

Trouble in the tuner can also give rise to disturbing flashing on the picture and crackling on sound. In the event of these symptoms check with a voltmeter between the earthed grid of the second triode of the PCC84 and chassis. If the reading varies in sympathy with the disturbances the trouble is almost certainly caused by poor insulation in the 820pF feed-through capacitor connected between the grid of the valve in question and chassis. If a feed-through capacitor is not immediately available a successful repair can be effected by the use of a 1,000pF ceramic capacitor of ordinary type.

To conclude this month's article it may be of interest to many to know that the Stella 6414U and 6417U are equivalent to the Philips 1446U and 1746U respectively.

(To be continued)

ULTRA STABILISED H.T. SUPPLY

(Continued from page 562)

positions R9 and R12. Also, do not forget to instal a second wafer on the switch to select appropriate transformer tappings, which should lie always about 100V higher than the final D.C. output. Use a good ceramic quick-action switch, with break-before-make characteristics, to avoid shorting portions of the transformer H.T. winding temporarily during switching. Otherwise strong arcing, and rapid destruction of switch or transformer or both will take place.

It should be found that one and the same setting of VR1 is optimum for all neons, for all output voltages. Shifts of some 10 or 20V in any of the output voltages are possible by backing the neon with suitable zener-diodes in series. (Fig. 7). Use types as close to 7V as possible, as these generally have the smallest temperature coefficients.

Stabilisation against Drift of Mains Voltage

The symmetrical arrangement of the D.C. error-amplifier V2, V3 gives minimum response to changes of heater voltage caused by any fluctuations of mains voltage and thus stabilisation against mains charges is also very great—provided, again, that VR1 is set correctly. Incorrect settings of VR1 cause rapid loss of this aspect of stabilisation. ■

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.***

TV SET TO 'SCOPE

SIR,—In the past there have been many articles on the construction of oscilloscopes for TV use. It seems to me that an old set, with suitable timebase modifications, could be converted. Indeed, tube emission need not be high as only a single trace would be formed.

It would appear that this is an interesting proposition and I would be glad to hear from any readers who have performed such a conversion.—GREGORY J. POWELL (Weald Rise, Litmarsh, Marden, Hereford).

A SUGGESTION

SIR,—I am a long-standing reader of *Practical Television* and *Practical Wireless.* I should like to make a suggestion which I think would be of benefit to all interested in TV and all your readers. The suggestion is that you publish a book with all the letters and answers for the past years from "Your Problems Solved" column.

I think that, like myself, anyone interested in TV would find very useful information in these letters and answers if they were printed like they are in *Practical Television.*

On many occasions I have looked in the back numbers and found a problem that has helped me a great deal.—C. CHAMPION (Penistone, Yorkshire).

What do other readers think?—Ed.

LIGHT INTERFERENCE

SIR,—The problem of Mr. S. W. T. Crunden, of London, N.20, as described on page 499 of your July issue may have a simple explanation.

I myself suffer from two bands of interference at times and have experienced this on a K.B. LFT50, a Philips 1500U, a Pye VT4 and a 9in. Pye, all on Channel 1. After some weeks of study the trouble was traced to a fluorescent light fitting in a neighbour's kitchen. After some amiable discussion and a letter to the manufacturer of the light a replacement tube was supplied and fitted and the trouble minimised. However, whilst the initial offender has been rectified others have been installed in the vicinity and viewing suffers at dusk!

The estate here is of 1958-built houses with ring mains at first-floor level and I am wondering if this is a factor. My aerial is in the loft, but the interference appears on some neighbouring sets with chimney-top arrays, but not to such a degree as with mine.

I am wondering if lamp-ballast fluorescent fittings are inherently liable to cause radiation, perhaps in the waveband associated with their physical length (i.e., 5ft tube plus ends = Channels 1 and 2) and if other readers suffer.—N. P. TUCKER (Leighton Buzzard).

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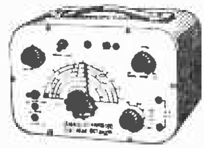

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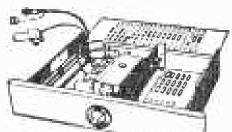

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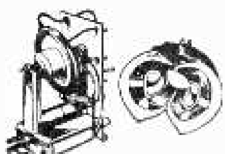

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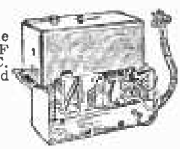

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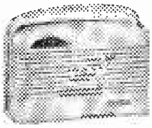

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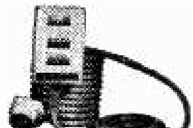

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PETO SCOTT 1611T

The picture went off and there were only dashes across the screen. The sound and raster are o.k., but the contrast control has no effect. I have tried changing all valves except the PL81 and the PY81. This set is BBC only.—H. Pearson (Timperley).

If you examine the service sheet you will observe that there is only one vision I.F. amplifier (V5 EF80). You should check the H.T. supply to pins 7 and 8. If H.T. is absent, check R22 (1k) and C11 (0·01μF). If V5 is operative, check the EB91 circuit to the video amplifier via the choke, and then check the video amplifier components.

PHILCO 1010

A short time ago, the picture lost width and no adjustment of the brightness control or width control could make the picture fill the screen.

Later the set went dead; no sound, no vision. I found that the PY32 had no output at the cathode and I exchanged it. The set worked o.k. for about one week and now it has no vision. First the width failed as before, and later there appeared a black line at the bottom of the picture, then the vision failed. For a time after the picture failed, on turning up the brightness control, a raster could be seen.—W. Blakely (Newry, Co. Down).

We would advise you to concentrate your attention upon the line timebase. Check the ECC82 line oscillator valve, the PL81 line output valve and the 1·8k screen dropping resistor R63. The PY81 is a less likely suspect. If R20 is damaged check C36 and C33.

BAIRD C1815

This set receives only BBC at present, but I would like to make alteration so that it may receive ITV.—J. Young (Glasgow).

The I.F. is 9·5Mc/s-13Mc/s. A suitable tuner unit is the Brayhead 10s or the Cyldon P10L.

K.B. P.V.70 F.M.

On switching on, there is a slow frame slip, which can be rectified by the vertical hold at the back. This condition prevails for a short period of time (perhaps 5 to 10min.), when the picture slips again.—H. Edwards (Liverpool, 13).

You should change the PCL82 valve in the centre of the chassis and if necessary change the 120k (brown, red, yellow) resistor wired to the PCL82 valve base. The hold control itself could be at fault.

MARCONIPHONE V.T.69 DAM

On switching on and the picture appearing on the tube, a broad white line appears 1in. to $1\frac{1}{4}$in. wide from top to bottom of the tube, just to the left of the centre. It appears to be a fold-over as the left edge of the frame seems to be pulled in from the edge of the tube. After about an hour, all that is left of the distortion are two faint white lines $\frac{1}{8}$in. wide and about $\frac{1}{2}$in. to $\frac{3}{4}$in. apart, and the picture fills the tube correctly. The tuning is critical as it is very easy to get a negative picture. —E. S. M. Ayscough (London, S.E.6).

Check the effect of the line drive control at the rear of the chassis (next to the frame form). Replace the 3·3k resistor wired across the linearity coil. The negative picture tendency indicates failing emission in the C.R. tube.

BEETHOVEN B94

The trouble with this set is an irregularly shaped raster.—J. Rocks (Doncaster).

The valve next to the PY82 is the ECL80 frame output valve. If the picture distortion is at the bottom, this valve and associated components should be checked. If the edges are curled in, the tube would appear to be of low emission (MW43-64).

PYE V4

This set has a Brayhead converter. The trouble is the picture has closed in to about 4in. square, very dim and out of focus. Also, the valves are very dim. When I turn up the brightness control, the picture goes right out, and the same thing happens to the valves. I have tested all the old valves and also put in a new set of valves, but this has not made any difference.—G. Smith (Larkhall).

The symptoms suggest low H.T., and we advise you to check the 100 + 200μF electrolytic in the H.T. line.

COSSOR 930T

The line output transformer burnt out (the centre coil). This has now been replaced with a new component. All valves in the H.T. section have been tested and all heaters glow except the SU61. There is a strong spark at the single end of this valve. I removed the EHT lead from the tube to check for a short, but there was still no glow from the SU61, on shorting the EHT lead to chassis, only a very weak spark can be obtained. When the first line output transformer burnt out, there were sharp cracks from the set, and blue sparks from the copper earth tabs on the outer coating of the tube. The sound is o.k., and a normal strong whistle can be heard from the line timebase.—M. Reid (Sherwood).

We suggest you check your EHT by lighting the EY51 heater with a well insulated battery and observing how much raster you obtain. The trouble could be due to either a faulty deflector coil or inefficient main smoothing. Try fitting a new 20P4 "GP".

MURPHY V.150-L

The picture does not fill the screen (by about 2in. top and bottom). I have fitted all new condensers round V13 and V14 and also resistors. When I advance the frame hold, the picture enlarges a little. The height control is fully advanced. I have changed the valves over but there is no difference.—P. W. Field (Oxhey).

We suggest you try replacing the two electrolytics in the frame timebase circuit. These are the 20μF decoupling the blocking oscillator and the 25μF decoupling the output valve cathode.

EKCO T330

This set had developed a sound output at the frame frequency. The level and frequency were controlled by the setting of the height control but the level is unaffected by the volume control. Speech and music were normal.

The interference ceased suddenly and the set then behaved quite normally. The following day the interference reappeared as before, but the picture and sound qualities were unaffected. After having the interference for a week, it ceased again but the picture quality had now deteriorated. It became impossible to eliminate the "negative picture" effect at any setting of the contrast control, although the brilliance control would still give a very bright screen. In addition, the horizontal and vertical holds were more critical and changeover from BBC to ITV sometimes necessitated readjustment of the hold controls.

The only fault found is that movement of one of the I.F. 30F5's would make the picture vanish and similar movement of the second valve in the tuner unit would upset the picture. It is not known what caused the interference but it was noticed, before it stopped, that the same noise (in synchronism) could be heard on a pair of earphones from H.T. + to earth. The interference was definitely coming from the frame timebase and was not A.C. from the mains.

The position now is that the negative picture cannot be eliminated and all else is normal.—G. Humphrey (Emsworth).

The replacement of the main smoothing condenser should clear up your symptoms. We would say that the 200μF condenser is the offending section.

BUSH 24A

The tube, up to a few days ago, gave a rather dim picture. The brightness had to be fully advanced and the contrast control well over. The picture could be aligned satisfactorily and was in good focus but raster lines were difficult to eliminate. Then, I noticed a bright zig-zag streak appeared running from the centre of the screen downwards. I then switched off and the screen has since been completely blank, but the sound is still good.

All valves including the EY51 and the CRT appear to light up all right with no excessive heating, but I notice the capacitors in front of the line transformer board and underneath appear to be sweating badly and yet no overheating is apparent.—H. S. Binyon (London, W.10).

If the EY51 lights up, the EHT is almost certain to be present at the CRT anode, but you could check this (for a spark). The bright vertical line probably denoted a defect in the PL81 but there are several other possibilities. The capacitors behind the PY81 and PL81 are unlikely to be at fault if the EY51 lights up and we would advise you to check the tube heater, as this may be partially shorted. This would result in the heater glow being very dim and a voltmeter would reveal an A.C. reading of only 3-4V across pins 1 and 12 instead of 6·3V. If inspection shows that the EY51 does not in fact light up, check the PL81 and PY81 and note the effect of removing the tube anode clip (on the EY51 and EHT).

INVICTA T119

I am unable to obtain more than a very light spark of the anode of the EY51. The PL81, PY81 and ECL80 at the side of the line output transformer are in order. I suspect the line output transformer. If I find that this is faulty, is it possible to substitute a transformer from an Invicta T120?—W. McFetters (Edinburgh, 9).

The transformer appears to be at fault. The T120 transformer is identical and may therefore be used.

PYE V4

I have a Pye V4 working well, and also a Pye V7 cabinet. I understand the two models employ the same chassis. Could I therefore make it into a 17in. set by buying the appropriate tube, or are the line output transformer and scan coils different for the V7?—M. J. Richardson (Cwmbran).

There is no electrical difficulty in the conversion you describe. The tube to use is an MW 43/69 which will be accepted into the present circuit without modification.

PILOT PT651

Although I live only about twenty miles from the BBC and ITV transmitters, picture strength is poor because of nearby hills. I have adjusted the AGC to maximum and I am wondering whether an increase in gain could be obtained by substituting a 30L15 valve for the PCC84 in the tuner unit. If a gain could be obtained, would you please let me know what adjustments, if any, would be required.

My second query concerns a "blink" which appears on the screen at times during a night's viewing. When this occurs, an increase of contrast and volume of sound is apparent. This increased level is maintained for about three or four seconds and then the set reverts to its lower level of sound and vision. The "blink" occurs on both Channel 5 and Channel 10.—B. Lewis (Port Talbot).

It is quite in order to fit a 30L15 in place of the 30L1 on the tuner with a slight adjustment on the adjacent studs (trimmers). The "blink" could be due to reception conditions or to a fault on the AGC line which is preventing maximum gain to be obtained.

INVICTA 138

My set has recently developed a rather disturbing symptom connected with sound only (the vision is perfect). After switching it on, any movement of the volume control is accompanied by a rasping scratching noise and at times, during viewing, the sound will suddenly cut out, then after a short

(Continued on page 595)

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DL91	8/3	ECL80	7/3	KT33C	6/-	PY31	7/-	UAF42	8/-	5U4	4/9	6V6	5/-	30FL1	9/3
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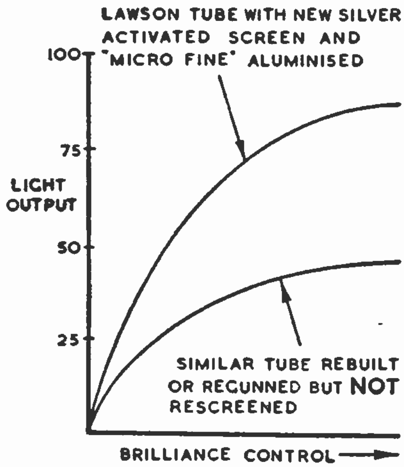

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2 PEACHFIED CLOSE, MALVERN, WORCESTERSHIRE.

(Continued from page 592)

while there will be a faint click and the sound will return to normal.—E. A. Vaughan (Chesterfield).

You should check the V18 PCL83 audio output valve which is on the front right-hand side.

PETO SCOTT 1418T

The picture has gone blank and there was no brightness. The sound is o.k. I replaced the EY51 with a new valve and also the PL81 in the line timebase. The EHT is in order and there is line whistle. I have checked the ion trap magnet position.—D. Gray (Inverlochy, Fort William).

We would advise you to check the tube base voltages at pins 2 and 10. The pin 2 voltage should rise to that at pin 11 as the brilliance is advanced. If it does not, check the brilliance control (100k) and the 33k wired from the control to H.T.+. The pin 10 voltage should be well over 300V. If absent check the 0·02μF capacitor.

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This coupon is available until SEPTEMBER 21st, 1962, and must accompany all Queries sent in accordance with the notice on page 591.

PRACTICAL TELEVISION, SEPTEMBER, 1962.

ABC OF TV CIRCUITS

(Continued from page 564)

On early sets the cathode by-pass capacitor nearly always had a fixed capacitance, chosen to provide optimum video response in relation to the other circuit parameters. Of recent years, however, it has been found that a degree of adjustment is highly desirable, for then the picture may be adjusted to suit both the transmission and the viewer.

This is accomplished on some sets simply by making the cathode by-pass capacitor pre-set as shown. Other sets, however, utilise a flylead and plug and socket arrangement to facilitate the connection of different value capacitances across the resistor. This system is shown in Fig. 10. With the flylead connected to socket "A", C1, C2 and C3 in *series* are connected across the resistor, in socket "B" C1 and C2 are used, while in socket "C" only C1 is in parallel with the resistor.

Such a definition control is quite easy to fix in most sets, but it is as well to undertake a little experimenting with capacitor values to secure the most desirable range of definition control.

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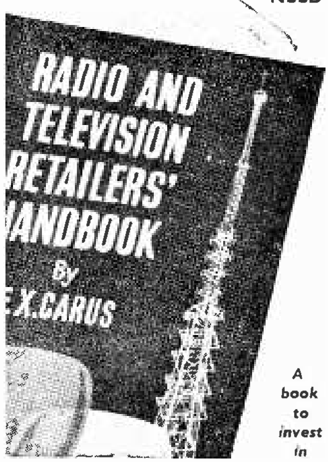

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Postage 2/- each transformer
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AUTO TRANSFORMERS. 150 w. .. 22/6
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1T4	3/-	6N7M	6/-	EBC81	8/-	PL83	8/-		
2X2	2/-	6Q7G	6/-	EBF80	9/-	PY80	7/-		
3S4	7/-	6SN7	5/-	ECH42	9/-	PY81	8/-		
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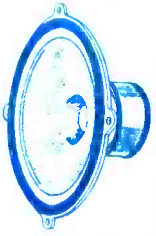

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