RECEIVING BAND V SIGNALS

Practical Television

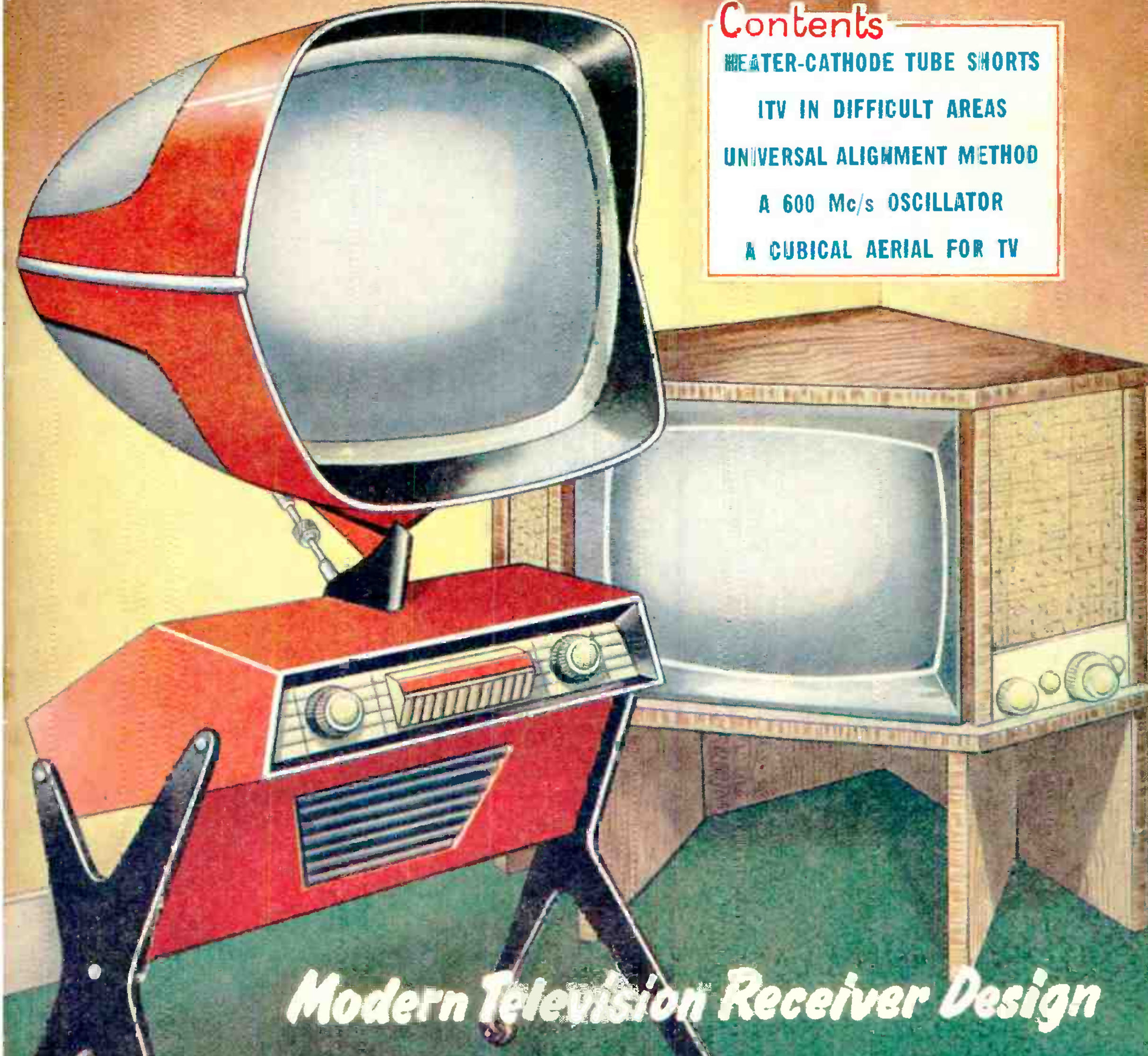
1/3

AND TELEVISION TIMES

JULY: 1958

EDITOR: F.J. CAMM

Contents



Modern Television Receiver Design

SPECIAL OFFER!!!

SMALL TYPE ONLY **EY51 10/6** BRITISH MADE

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

1A3	3/-
1A5	6/-
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1H5	11/-
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1LN5	5/-
1N5	11/-
1R5	8/-
1S5	8/-
1T4	7/-
1U5	10/-
2A7	10/6
2D13C	7/6
2X2	4/6
3A4	7/-
3A5	12/6
3B7	12/6
3D6	5/-
3Q4	7/6
3Q5GT	9/6
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5V4G	12/6
5X4G	12/6
5Y3G	8/-
5Y3GT	8/6
5Y4	12/6
5Z3	12/6
5Z4G	10/6
5Z4GT	12/6
6A8	10/-
6AB7	8/-
6AB8	14/-
6AC7	6/6
6AG5	6/6
6AJ8	9/-
6AK5	8/-
6AK8	9/-
6AL5	6/6
6AM5	5/-
6AM6	7/6
6AQ5	8/6
6AT6	8/6
6AU6	10/6
6B4G	6/6
6B7	10/6
6B8GTM	4/6
6B8M	5/-
6BA6	7/6
6BE6	7/6
6BJ6	7/6
6BR7	11/6
6BW6	9/6
6BW7	8/-
6BX6	8/-
6BY7	8/-
6C4	7/-
6C5	6/6
6C6	6/6
6C8	12/6
6C9	12/6
6C10	12/6
6CH6	12/6
6D6	6/6
6E5	12/6
6F6G	7/-
6F6GTM	8/-
6F8	12/6
6F12	7/6
6F13	12/6
6F16	9/6
6F17	12/6
6F32	10/6
6F33	7/6
6G6	6/6
6H6GTG	3/-
6H6GTM	3/6
6J5G	5/-
6J5GTG	5/6
6J5GTM	6/-
6J6	5/6
6J7G	6/-
6J7GT	10/6
6K6GT	8/-
6K7G	5/-
6K7GT	6/-
6K8G	8/-
6K8GT/G	11/-
6L6G	9/6
6L18	13/-
6N7	8/-
6Q7G	10/-
6Q7GT	11/-
6R7G	10/-
6SA7GT	8/6
6SC7	10/6
6SG7GT	8/-
6SH7	8/-
6SJ7	8/-
6SK7GT	8/-
6SL7GT	8/-
6SN7GT	7/6
6SS7	8/-
6U4GT	14/-
6U5G	7/6
6U7G	8/6
6V6G	7/-
6V6GTG	8/-
6X4	7/-
6X5GT	6/6
6Z4/84	12/6
6Z5	12/6
6/30L2	10/-
7A7	12/6
7B7	8/6
7C5	8/-
7C6	8/-
7H7	8/-
7Q7	9/-
7S7	10/6
7V7	8/6
7Y4	8/-
8D2	3/6
8D3	7/6
9D2	4/-
10C1	15/-
10F1	19/6
10F9	11/6
10F18	12/6
10LD3	8/6
10LD11	16/9
10P13	17/6
11E3	15/-
12A6	6/6
12AH7	8/-
12AH8	10/6
12AT6	10/6
12AT7	8/-
12AU7	7/6
12AX7	9/-
12BA6	9/-
12BE6	10/-
12E1	30/-
12J5GT	4/6
12J7GT	10/6
12K7GT	7/6
12K8GT	14/-
12Q7GT	7/6
12SA7	8/6
12SC7	8/6
12SG7	8/6
12SH7	8/6
12SJ7	8/6
12SK7	8/6
12SQ7	8/6
12SR7	8/6
12Y4	10/6
14R7	10/6
14S7	17/-
19AQ5	11/-
19H1	10/-
20D1	16/-
25L6GT	10/-
25Y5	10/6
25Y5G	10/-
25Z5	10/6
25Z4G	10/-
25Z6G	10/-
28D7	7/-
30	7/6
30C1	10/-
30F5	8/-
30FL1	10/-
30L1	9/-
30P12	13/6
30P16	10/-
30PL1	19/6
31	7/6
33A/158M	30/-
35/51	12/6
35A5	11/-
35L6GT	9/6
35W4	9/6
35Z4	7/6
35Z5GT	9/-
41MTL	8/-
50C5	12/6
50L6GT	9/6
72	4/6
77	8/-
78	8/6
80	9/-
83V	12/6
85A2	15/-
150B2	15/-
220P	10/6
807	7/6
956	3/-
1203	7/-
4033L	12/6
5763	12/6
7193	5/-
7475	7/6
9002	5/6
9003	5/6
9006	6/-
AC6PEN	7/6
AC/HL/DDD	15/-
AC/P4	8/-
AC/VP1	15/-
AL60	10/-
AP4	7/6
ATP4	5/-
AZ31	10/-
BL63	7/6
CK505	6/6
CK506	6/6
CK523	6/6
CV63	10/6
CV85	12/6
CV271	10/6
CV428	30/-
D1	3/-
D42	10/6
D63	5/-
D77	6/6
DAC32	11/-
DAF91	8/-
DAF96	10/-
DF33	11/-
DF91	7/-
DF96	10/-
DH63	10/-
DH76	7/6
DH77	8/6
DK91	8/-
DK92	12/6
DK96	10/-
DL2	15/-
DL33	9/6
DL66	15/-
DL92	7/6
DL94	9/-
DL96	10/-
DLS10	10/6
DM70	8/6
EA50	2/-
EA76	9/6
EABC80	9/-
EAC91	7/6
EAF42	10/6
EB34	2/6
EB41	8/6
EB91	6/6
EBC33	7/6
EBC41	10/-
EBF80	10/-
EBF89	9/6
EC52	5/6
EC54	6/-
EC70	12/6
ECC31	15/-
ECC32	10/6
ECC33	8/6
ECC35	8/6
ECC81	8/-
ECC82	7/6
ECC83	9/-
ECC84	10/-
ECC85	9/6
ECC91	5/6
ECF80	13/6
ECF82	13/6
ECH35	9/6
ECH42	11/-
ECH81	9/-
ECL80	14/-
ECL82	12/6
EF36	6/-
EF37A	8/-
EF39	6/-
EF40	15/-
EF41	9/6
EF42	12/6
EF50(A)	7/-
EF50(E)	5/-
EF54	5/-
EF73	10/6
EF80	8/-
EF85	8/-
EF86	17/6
EF89	10/-
EF91	7/6
EF92	6/6
EL32	5/6
EL41	11/-
EL42	11/6
EL81	15/-
EL84	10/6
EL91	5/-
EM34	10/-
EM80	10/6
EM81	10/6
EN31	34/9
EY51 (Small)	10/6
EY51 (Large)	12/6
EY86	15/-
EZ35	6/6
EZ40	8/-
EZ41	10/6
EZ80	9/6
EZ81	10/-
FW4/500	12/6
GZ30	10/6
GZ32	12/6
GZ34	14/-
H30	5/-
H63	12/6
HABC80	13/6
HK90	10/-
HL23	10/6
HL41	12/6
HL133DD	12/6
HVR2	20/-
HVR2A	6/-
KF35	8/6
KL35	8/6
KT2	5/-
KT33C	10/-
KT44	15/-
KT63	7/-
KTW61	8/-
KTW62	8/-
KTW63	8/-
KTZ41	8/-
KTZ63	10/6
L63	6/-
LN152	14/-
LZ319	10/-
MH4	7/-
MHL4	7/6
MHLD6	12/6
ML4	12/6
ML6	6/6
MU14	10/-
OA10	12/6
OA70	5/-
OA71	5/-
OC72	30/-
P61	3/6
P215	10/6
PABC80	15/-
PCC84	9/-
PCC85	12/6
PCF80	10/-
PCF82	12/6
PCL82	12/6
PCL83	17/6
PEN40DD	25/-
PEN45	19/6
PEN46	7/6
PL82	10/-
PL83	11/6
PM2B	12/6
PM12	6/6
PM12M	6/6
PY80	9/-
PY81	9/-
PY82	9/-
PY83	9/6
QP21	7/-
QP25	15/-
QS150/15	10/6
QVO4/7	15/-
R2	10/-
R12	10/6
SD6	12/6
SP4(7)	15/-
SP41	3/6
SP42	12/6
SP61	3/6
SU61	10/6
TP22	15/-
U16	12/-
U18/20	12/6
U22	8/-
U25	15/6
U31	10/-
U43	10/6
U45	10/6
U50	8/-
U52	8/6
U76	7/6
U107	11/10
U251	15/-
U404	10/6
UABC80	10/6
UAF42	10/6
UB41	12/7
UBC41	8/6
UBF80	9/6
UBF89	10/6
UCC85	10/6
UCH42	11/-
UCH81	11/6
UCL82	15/6
UF41	9/-
UF80	10/6
UF85	10/6
UF89	10/6
UL41	10/6
UL46	15/-
UL84	11/6
UY41	8/6
UY85	10/6
V1507	5/-
VLS492A	£3
VMP4G	15/-
VP2(7)	12/6
VP4(7)	15/-
VP13C	7/-
VP41	7/6
VR105/30	9/-
VR150/30	9/-
VT61A	5/-
VR501	5/-
W76	7/6
W81M	6/-
X61	12/6
X63	10/-
X65	12/6
X66	12/6
XD(1.5)	6/6
XFW10	6/6
XFY12	6/6
XH(1.5)	6/6
XSG(1.5)	6/6
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Z729	17/6

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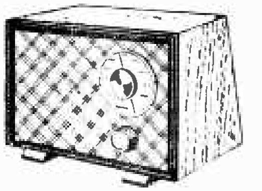
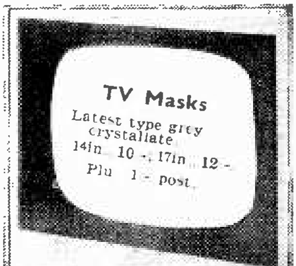


THE SKYSEARCHER

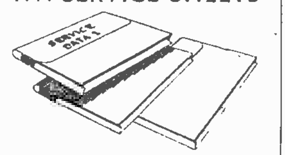
This is a 2-valve plus-metal receiver set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, 19 6. Post and ins., 2 6. Data free with parts or available separately, 1 6. **3-valve battery version also available at the same price.**



Simplex Transistor Kit

Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case 19 6, case 5 - extra, post and ins. 1 6.

T.V. SERVICE SHEETS



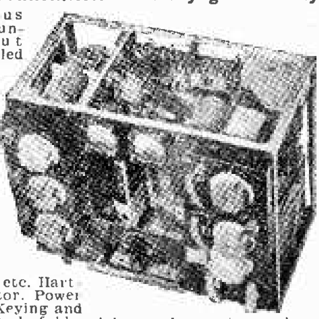
100 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc. £1 post free.

Unused and Boxed Valves

American list, others in stock. Enquire or order C.O.D.

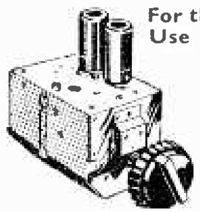
1A4	9 -	6C4	6 6	6TH8	12 -
1A6	9 -	6C6	6 6	6U5	8 6
1A7	12/6	6C8	5 -	6V6	9 6
1C5	12/6	6D6	6 6	6X5	7 6
1D7	9/-	6F5	9/6	6Z5	15 -
1F6	12/6	6F6	7 6	7A7	9 6
1H5	10/-	6F8	9 6	7C7	9 6
1LD5	3/6	6G6	7 6	7V7	9 6
1T4	7/6	6H6	2 6	7Y4	8 6
1R5	7/6	6J5	5 -	25Y5	10 -
1S5	7/6	6J7	6 -	25Z4	9 6
1T5	8/-	6K6	7 -	25Z6	10 6
2A5	12/6	6L5	9 -	27	10 -
2A6	12/6	6L6	9 -	28D7	3 6
2A7	12/6	6L7	10/6	36	10 -
2X2	4/6	6N7	8 6	39/44	10 -
3A4	7/-	6P8	9 -	41	9 6
3A5	7/-	6Q6	9 -	42	8 -
3S4	8 -	6Q7	9 -	43	10 -
3V4	9/-	6R7	9 -	57	10 -
5Y3	8 -	6SA7	8 -	58	10 -
5R4	9/6	6SC7	9 -	71	9 6
5U4	8 -	6SH7	6 -	75	12 6
5Z3	15/-	6SJ7	8 6	78	8 6
5Z4	9/6	6SK7	6 -	84	8 6
6A7	12/6	6SL7	8 -	89	12 -
6A8	10 -	6SN7	7/6	807	6 6
6B4	5 -	6SQ7	9 -	1625	10 6
6B8	4/-	6SS7	9 -	954	3 6

Famous Transmitter virtually given away



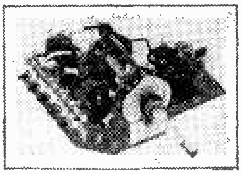
The famous R1154N—unused but slightly soiled and not tested. Covers 200-500 Kc/s, 3-5.5 Mc/s and 5.5-10 Mc/s. Has unique "click stop" mechanism (7 stops) and permits selected frequency to be held, returned to, etc. Hartley Oscillator, Power Amplifier, Keying and Speech. Wonderful breakdown value, meters, relays, switches. Complete with valves—real bargain at 29 6 plus 10 - carriage.

For the Best from Band III Use Our Turret Tuner



Brand new stock, not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33/38 Mc/s. Series heaters Model 2 I.F. output 16/19 Mc/s. Parallel heaters. With instructions and circuit diagram. 79 6. With knobs 3 6 extra, post and insurance 2 6.

Coil Pack Snip



Covers the Medium Waveband 200-550 metres and two short wavebands 35/120 metres and 13-42 metres, for 465 Kc. I.F. Extremely well made, supplied complete with diagram of connections. Only 9 6, plus 1 6 post and insurance.

Super Sensitive (2,000 O.P.V.) Multimeter

Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries, 0-500,000 with external batteries.

All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price 32 6, plus 2 6 post and insurance.

Latest AVO Testmeter

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

FREE GIFT.—All purchasers will receive Range Extender scale and data which add: capacity 0-1 m.f. in two ranges. Inductance 0-100 henrys, etc., etc.

Summer Sale Bargains

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

4 Valve Superhet Chassis. Long and medium wave complete with valves, but not scale. Unused but slightly soiled and may need servicing (no data available). **29/6,** plus insurance 3 6.

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

Isolation Transformer. 150 watt, mains in, isolated mains out, makes servicing safe. **29 6.**

Filament Transformer. 6.3 volt 3/4 amps., tapped primary. **8 6.**

Transistor Suitable A.F. or low R.F., new tested, O.K. most circuits **6/6.**

Midget Output Transformer, standard pentode matching. **4 6.**

Midget Output Transformer. Special for battery sets, pentode matching. **4 6.**

14in. T.V. Cabinet by famous maker cost over £4 to make, new and perfect. **15 -,** carriage 4 6.

Metal Rectifier. 250 v. 60-80 milliamps, ideal for mains set or instrument or to replace that expensive valve. **4 6.**

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

Toggle Switch. Standard metal body, type with round dolly, fixing ring and on off indicating plate, **1 3** or **12/-** doz.

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

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

Midget I.F. coils 465 Kc/s but with feed back winding for economy circuits, **6 6** pair.

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

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

50 Assorted Resistors. Well mixed and useful values ¼ and ½ watt. **5 -** for 50.

Ditto but 1 watt, **6 6** for 50.

.1 mfd 350. Small tubular metal cased condensers made by Dubilier, **2 6** doz.

Loudspeaker 8in. energised field, **9 6,** carriage 3 6.

6ft. Unbreakable Mains Lead. Type of lead fitted to electric razors makes fine lead for test meters and any other devices where subject to continuous bending. Twin figure eight construction, soft cream P.V.C. covered. Normally costs 2 - per yard—we offer three leads for 2/-.

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Cathode Ray Tube VCR517. 7 6. carriage, etc., 3 6.

Thermal Delay Vacuum Relay with book of interesting circuits **4 6.**

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Post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66, Grove Road, Eastbourne, marked Department 7.

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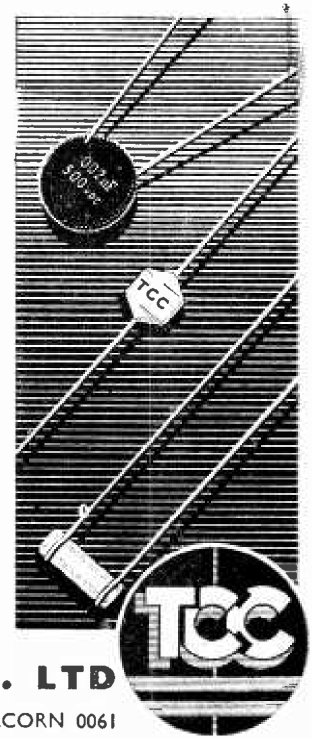
29, Stroud Green Rd., Finsbury Park, N.4. PHONE: ARChway 1049 Half day, Thursday.

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

CERAMICS

for all electronic applications



Silvered Ceramic Condensers cover a variety of useful shapes, including Pearls, Discs, Beads and Tubes, and have many applications in R.F. circuits — particularly where ultra-high frequencies are present, when their low inductance and excellent power factor are of special advantage. A wide choice of negative and positive temperature co-efficients permits the temperature compensation of other components, and frequency stabilisation of tuned circuits.

Hi-K CERAMIC DISCS
for decoupling purposes in T.V. and spark suppression in small electrical apparatus—extremely low inductances. Up to 10,000 pF at 500 v. D.C. working. Finished in a moisture-resisting compound that does not soften or crack up to 100°C.

LOW-K TUBULARS
with the choice of four temperature co-efficients and a wide range of capacity values, serve many purposes in general circuitry.

Hi-K TUBULARS
combine high capacity with small physical size: used widely as by-pass condensers in T.V. and other H.F. receivers where low inductance is of special value.

LOW-K PEARLS
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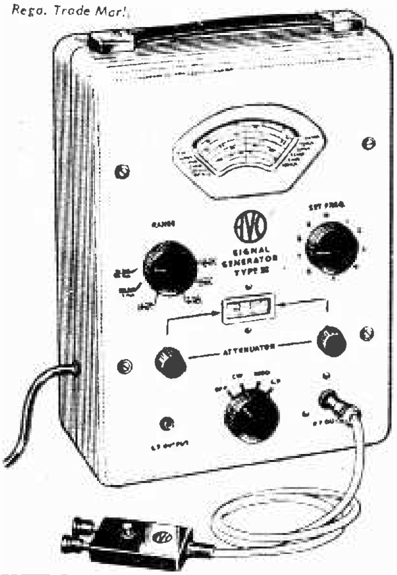

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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

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CONTENTS:

TELEVIEWS

BBC v. ITV

ACCORDING to Television Audience Measurement (TAM), during April 70 per cent. of the total time spent viewing television in the homes which have a choice of BBC and ITV was devoted to watching ITV, or 3 per cent. more than in March. This does not necessarily mean that ITV are putting out programmes which appeal to the majority, but it can mean that their programmes are appealing to a higher proportion of the teenage group. Much as we may criticise BBC programmes, it cannot be said that the quality of the ITV programmes is better than the BBC. The BBC programmes, in general, appeal to a more adult audience, and because of lack of advertising, especially advertising of a cheapjack nature (and much of the ITV advertising matter comes within this description), their programmes are more compact and cohesive. The ITV programmes are no more advanced technically than the BBC. The latter, in any case, has a quarter of a century of experience behind it.

It would be a mistake, we think, for the BBC to change the style of its programmes in order to recapture some of its loss of audience, and thus start a sort of war with ITV. Experience has shown that pop singers are very popular but only for a very short time and it may be that the public will tire equally quickly of advertising programmes.

SALES OF TV RECEIVERS

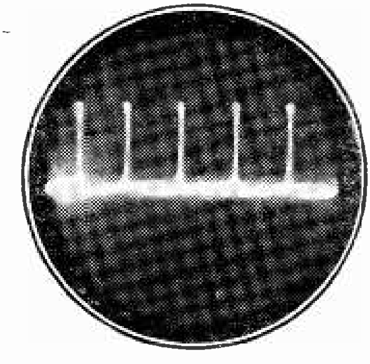
IN March, 1958, the last period for which figures are available, sales of TV receivers by retailers to the public were above those for March, 1957. But the sales of radio receivers and radiograms were lower. During March, 1958, 88,000 TV receivers were sold, 82,000 radio receivers and 16,000 radiograms. Thus, TV shows an increase of 11 per cent. over the comparable period for 1957, whilst radio shows a decrease of 1 per cent. and radiograms 20 per cent. In the first quarter of 1958, the total sales of TV receivers were 318,000.

ANOTHER PRACTICAL TV SPONSORED LECTURE

READERS will remember that last year this journal, in conjunction with Mullard Ltd., sponsored at the Caxton Hall a film show of radio and television interest. There have been numerous requests for a similar yet different programme and we are pleased to announce that arrangements are now completed for the evening of Thursday, January 22nd, 1959. There will be no charge for admission, but the seating capacity is limited to 500. Readers wishing to attend should apply now. —F. J. C.

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

A TV Pattern Generator



This Useful Apparatus Duplicates the BBC Waveform for Test Purposes. By D. R. Bowman

(Continued from page 532 June issue)

THE oscillator is a modified "cathode Hartley" circuit, the modifications of interest being the inclusion of R1 in the oscillatory circuit and the omission of the usual grid condenser and leak for automatic bias. The purpose of R1 is to stabilise the output of the oscillator, so that to whatever frequency L and C are tuned, that frequency is maintained accurately and at constant amplitude. Its value depends on the Q of the LC circuit, and with the coils to be described shortly a maximum value of 10,000 ohms was found to be appropriate. The resistance is made variable in order to adjust R.F. amplitude.

R2 and the radio frequency choke are arranged to have together a D.C. resistance about right for the standing bias needed on the grid of the valve. The idea is to operate the valve under Class A conditions as nearly as possible, and so a total resistance of about 200 ohms is required for the valve specified—half an ECC81. The R.F. choke should have a self-resonant frequency of less than 100 kc/s however, and if the choke used is big enough for this it may have enough D.C. resistance without the inclusion of R2. If on the other hand its resistance is appreciably higher than 300 ohms, a suitable choke will have to be wound instead. It is better to have rather too high than too low a resistance, so that the valve cuts off rather than runs into grid current under oscillatory condition.

It is important to realise that this oscillator must operate only between the line sync pulses. During sync pulses it has to be cut off altogether. What is more, each time it oscillates the oscillations must start in the same phase. The reason for this is the need for vertical bars to traverse the whole length of the TV picture. Any delay in starting oscillations would result in an irregular edge to the vertical bars, and while this would not matter unduly if picture line linearity were the only quality to be investigated, it would rule out any possibility of the apparatus giving "fine detail" bars at 3 Mc/s. It is for this reason that the more usual grid condenser and leak have been omitted and a "keying" stage (stage e) incorporated.

The Keying Stage (Stage e)

The other half of the ECC81 is connected as shown in Fig. 8. The operation is simple enough. When V1 grid is positive V1 conducts heavily and damps the LC circuit so that oscillations stop. When V1 grid is driven negative V1 is cut off, V1 cathode drops sharply in potential—with the grid of V2. The condenser C cannot change its charge instantaneously however and it is thus left at a positive potential—i.e. at the peak of a cycle. The result is that C always starts off by discharging (through L) and therefore oscillation always begins in the same phase.

If the output from the gating stage is now applied to the grid of the "keying" stage, the oscillator will function in a series of bursts of R.F. oscillation coincident with the duration of line scan pulses and will be cut off for the rest of the time.

Combining R.F. Oscillations and Sync Pulses (Stage g)

The apparatus so far described has succeeded in producing the necessary elements, and it now remains for these to be combined into a form suitable for modulating the main R.F. oscillator. It has to be remembered that at the receiver 30 per cent. modulation in black level; it therefore follows that the sync pulses must occupy the first 30 per cent. of the modulation envelope, the R.F. signal the remaining 70 per cent. The problem of combining the R.F. and sync pulses thus involves clamping both these signals to a definite level.

This is the first that has been heard of clamping or D.C. restoration in this circuit; the reason is that, so far, all the clamping needed has been at zero level and the grid of a triode or other valve has been suitable. In this case clamping has to be effected at a level other than zero, so a clamp diode must shortly figure in the circuit.

Fig. 10 shows the long-tailed pentode pair used

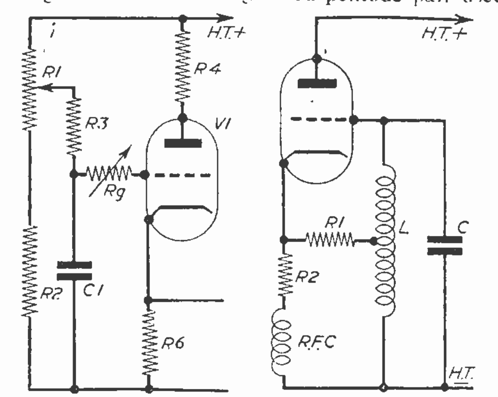


Fig. 6. (Left).—Modified Fig. 2, to give variable flyback time. Fig. 7. (Right). -R.F. oscillator for vertical bar generation (see previous article).

for the mixing stage. This is an entirely straightforward stage, the point to note being that X is maintained at the correct bias point by virtue of the network of resistances between H.T.+ and H.T.—. R.F. is clamped at zero, negative-going, by the grid-diode action of V1, while the sync pulses are clamped, positive-going, by the diode V3. The amplitude of the sync pulses relative to the amplitude of the R.F. is pre-set by the value of the common anode resistor in the gating circuit, and the R.F. amplitude can be adjusted as described previously.

The combined output of the circuits so far described gives about 8-10 volts peak-to-peak,

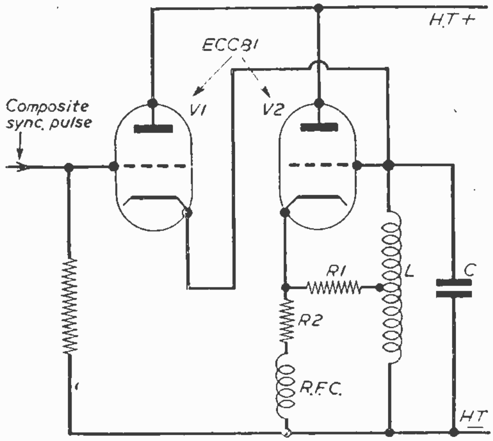


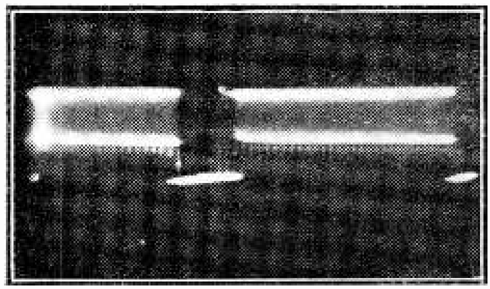
Fig. 8.—Oscillator and keying stage.

which is just about right for modulating the final stage of this instrument. Alternately positive and negative modulation is easily obtained.

The R.F. Output Stage

This is an orthodox oscillator of tuned-anode circuit. Bias for the suppressor grid—by which modulation is effected—is obtained by a cathode resistor. Output is taken at low impedance from a tertiary winding coupled to the tuned circuit. The tuning for this stage is arranged to cover the bands shown in Table 3, and from this it will be seen that, practically, all usual needed frequencies are covered without range-switching. This is possible because the oscillator produces on the fundamental far more output than is ever needed—even for preliminary alignment of a receiver, and even the fourth harmonic can be relied upon to swamp a receiver which is even roughly aligned.

It has not been thought necessary to provide calibration for the R.F. output stage, because normally an accurate signal generator is used for receiver alignment. The function of this apparatus is



General view of the final wave-form. Note the narrow line sync pulses below the R.F. by the broad frame sync pulse.

to enable small adjustments to to made to I.F. and R.F. circuits to obtain correct definition, or to scan circuits for linearising the raster. However, if it is desired, a good slow motion dial and a highly stable tuning circuit may readily be fitted. If this is done, the only modulation should be by the sync pulses, and a switch may be placed in the heater circuit of the ECC81 (Stages e and f) for the purpose of rendering the bar generator inoperative. If the H.T. is switched off and the heater left running, there may be some danger of the cathode emitting surface deteriorating. The usual method of dropping the H.T. to 20-30 volts does not always prevent the stage oscillating.

Constructional Notes

There is in the main little to go wrong in this circuit, and values of resistor and capacitor are not highly critical. Layout does not present great difficulty, and any straightforward arrangement of components should prove satisfactory. The development work for the circuit was carried out on a chassis 2½in. deep, 13in. long and 7in. wide, but though there was not overmuch room there was no special cramping. The chassis employed was, in fact, one which had previously been in use for television receiver development: and as it just fitted nicely the unsightly holes left by I.F. transformers and unwanted valve-holders were tolerated—after all, it has to go into a metal screening cabinet to prevent stray radiation. Probably a slightly larger chassis would enable a better appearance to be obtained.

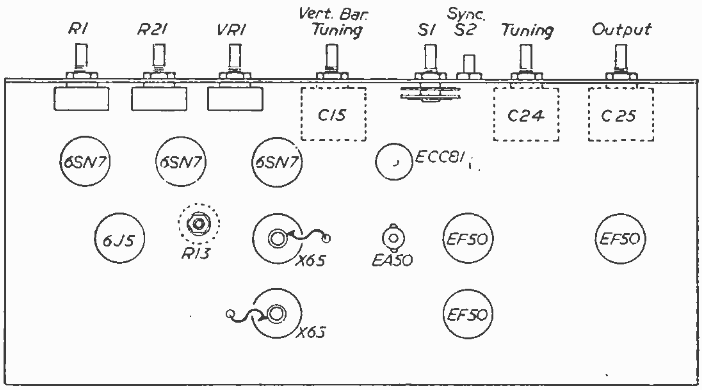
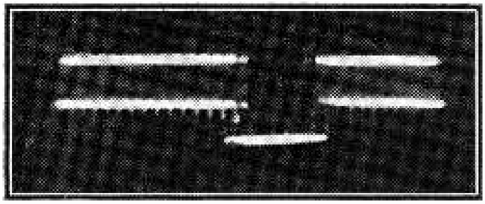
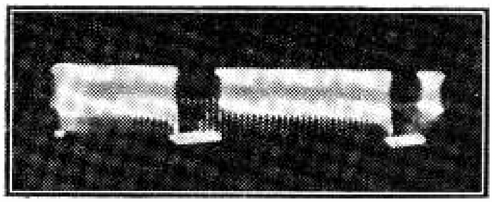


Fig. 9.—Suggested layout.



Details of the frame sync pulse. The interruption of the R.F. by each line pulse can be seen in this illustration



Another view of the final wave-form shown on page 563.

The vertical bar generator and the associated keying stage should be totally enclosed in a good screening can—coils, switch, etc. The adjustment of VR2 can enable square-topped R.F. to be developed in the gating stage, but the harmonics so generated can be contained easily by screened leads at P and Q (in the main circuit diagram). If VR2 is adjusted to give sine waves only, very few harmonics are generated as the ECC81 stage is running under very nearly Class A conditions.

The multivibrators give very little trouble, about the only special precaution needed being to adhere to a logical layout. The phase-splitter stage may be offset from the three 6SN7's in line, and is then conveniently placed for supplying input to the gating stage (d). Fig. 9 shows the layout recommended, looking down on top of the chassis from above.

Power Supplies

A very well-smoothed power supply is needed for the H.T. input. It should consist of at least two filter sections, and a final smoothing capacitor of 100 μF or more is not too much. It is quite important that no hum modulation occurs, and a ripple of ½ volt or less must be the aim. Preferably, too, the power pack should be stabilised, because variations in H.T. voltage can and do cause material variations in multivibrator speed. About 50 mA at 250 v. is the supply current, and R50 should be so chosen that the voltages given on the complete circuit diagram are obtained. Approximately 1,000 ohms 3 watt will be needed.

Alternative Components and Valves

Some readers may wish to use "near values" for some components, so it is fair to state what limits must be imposed. C1, C3 and C5 must be within the normal manufacturing tolerance unless the constructor is prepared to re-design the multivibrators. With C4 and C6 rather smaller values may be used—but not much smaller and certainly not larger. R7 is fairly critical, but 4.7 K. will do instead and doubtless a 5.6 K. would also suffice. R24 and R27 are not quite so critical, but too much departure is not recommended. R6, R11, R18 and R26 may be 20 per cent. tolerance, but R10 and R12 should preferably be matched to within 5 per cent. from the constructor's stock: this is more important than the actual value.

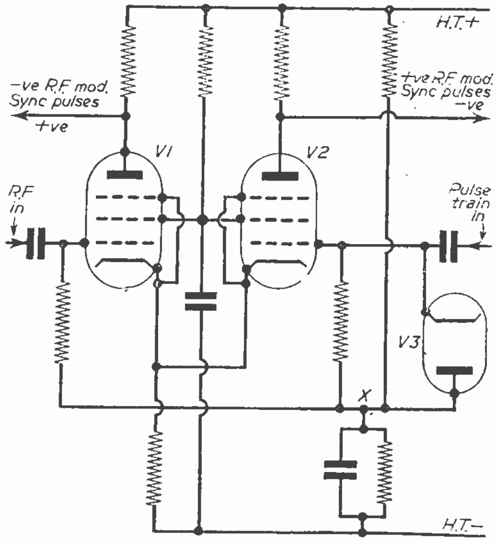
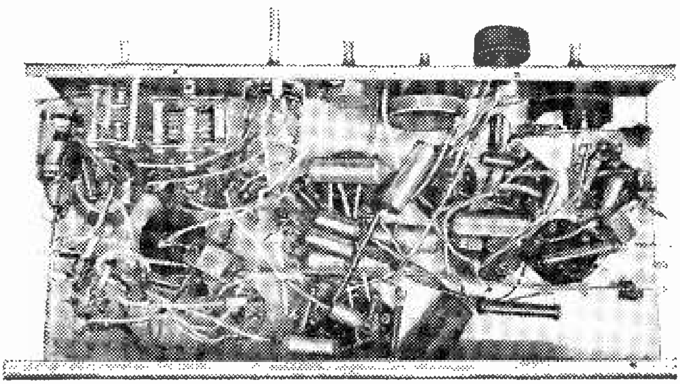


Fig. 10.—Pulse mixing stage.

R31 controls the size of the sync pulses and 1.8 K is the "design centre." It may need a little alteration depending on how good or how poor the X65's are. R39 and R42 should be matched from stock to within 10 per cent., but the actual value is not important within 20 per cent.

Capacitors C2, C7, C8, C9, C10, C13, C16, C19, C21, C23 may all be larger than that specified—by as much as 100 per cent. if convenient—but should not be much smaller. All the electrolytic capacitors may be of higher value if handy.



An underside view of the Generator.

Concerning valves, the query is certain to be raised whether miniature valves may be used instead to get a smaller apparatus. The 6J6 is an attractive possible substitute for the 6SN7, and if used might be even an improvement. If this is done, some change in R7 may be needed. Certainly a 6C4 could be used instead of the 6J5 without component change.

In the gating stage, the X65's have been used because they were available to the writer. X79's should be usable instead with little current change, apart from ensuring that the screen voltage is right. Pentode substitutes for the X65's are not recommended because this would entail major changes in the design of the gating stage. 6AM6 valves should be usable in stage (g) (V7 and V8), but R40 may need adjustment. A 6AM6 might be suitable instead of the EF50 in the final stage, though re-design might be needed; at all events the suppressor characteristic should be plotted and R47 altered if necessary to suit.

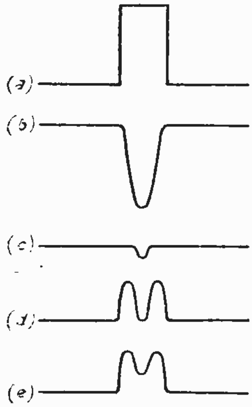


Fig. 11.—Variation of waveforms referred to in the text.

Setting Up the Circuit

This circuit is not difficult to adjust, providing an oscilloscope is available. The following procedure assumes one is being used.

(1) Remove the two X65 valves and the ECC81.

(2) Set the oscilloscope to "external sync" and inject 50 c.p.s mains.

(3) Apply mains input to the Y amplifier terminals, using 6.3 or 4 v. and adjust the timebase to display three or four complete cycles.

(4) Adjust the sync control until the trace barely locks. Remove Y input.

(5) Connect Y input to the point labelled GATE B2 on the circuit diagram, and adjust R21 until V4 is running at exactly 50 c.p.s. No sync, or very little, should be needed. If difficulty is found in getting an exact lock to 50 c.p.s use 100,000 ohms (R50) inserted as shown in the circuit diagram.

(6) Increase the oscilloscope timebase speed until just two V4 pulses are seen. Change sync from "external" to "work" and so allow V4 to control timebase synchronisation.

(7) Adjust sync control for a bare lock.

(8) Adjust R15 until 14 or 15 pips are seen between the 50 c.p.s pulses.

(9) Remove oscilloscope input from "Gate B2" and connect through 50-100 pF condenser to V3 second anode (R19). Adjust Y amplifier to get good amplitude, and reduce the connecting condenser as far as possible while still getting pips ½in. high.

TABLE 2—COIL CONSTRUCTION

L1—600 turns No. 34 s.w.g. enam. tapped at 300 turns. Windings pile-wound between cheeks ⅛in. apart. Aladdin former 0.4in. diameter with iron dust slug. Adjust iron core so that with 500 pF in parallel resonance indicator shows 100 kc/s.

L2—134 turns in 4 layers, 35, 34, 33 and 32 turns, centre tapped as nearly as possible. No. 34 s.w.g. enamelled wire. Iron core adjusted with 500 pF in parallel to give resonance at 500 kc/s. Same former.

L3, L4, L5—36 turns No. 36 gauge enam. close-wound (L4), one end inter-leaved with 15 turns No. 36 gauge wire (L3). Five turns No. 24 gauge wire spaced one diameter (L5) separated from "cold" (inter-leaved) end by 1/16in. Former 0.3in. dia. with "purple" iron core.

TABLE 3.—R.F. OUTPUT RANGES (APPROXIMATE)

Fundamental	2nd harmonic	3rd harmonic	4th harmonic	5th harmonic
7-16 Mc/s	14-32 Mc/s	21-48 Mc/s	28-64 Mc/s	35-80 Mc/s

(10) Increase oscilloscope timebase speed until two pips from V3 are visible, adjusting sync for a base lock.

(11) Adjust R1 until 15 or 14 pips are visible between the V3 pips.

The multivibrators should now be running at the correct speeds.

(12) Replace the ECC81, and remove V4.

(13) Connect oscilloscope Y amplifier input to V5-V6 anodes, and adjust timebase speed to about 50 per sec. Check that practically nothing is seen of pips at all. If large pips are seen, even at small Y amplifier setting, check the X65's for goodness. Small pips may indicate not quite equal amplification by the separate X65's, or small differences in the waveforms from the phase-splitter anode and cathode. These do not matter much, especially if they are in pairs, but whole pips of considerable amplitude indicate some fault. Fig. 11 shows what is acceptable generally; if (a) and (b) (derived from V2 cathode and anode respectively) are of slightly different amplitude, an output of (c), (d) or (e) may be obtained.

(14) Replace V4. Set oscilloscope timebase to about 10 sweeps per sec. (just flickering). Connect Y amplifier, set at low gain, to cathode end of R.F.C. (stage f, V9) through 50 pF condenser sync amplifier at minimum—the waveform now will only by a miracle give proper sync and it is not worth the trouble; careful adjustment of speed

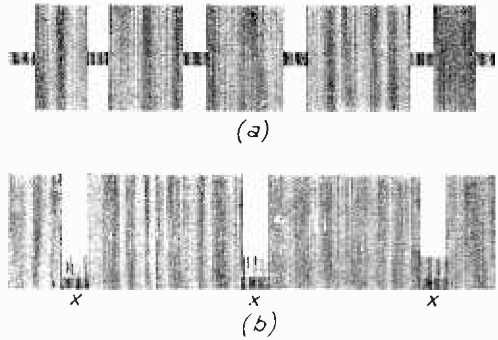


Fig. 12.—Final waveforms.

will keep the trace steady enough to see. Preferably set S1 to top frequency—about 1 Mc/s or more. Fig. 12 (a) shows the waveform produced.

(15) Transfer the oscilloscope Y input to anode of V7. Fig. 12 (b) should now be seen. Check that the R.F. occupies 70 per cent. and the sync pulses 30 per cent. of the vertical height of the trace. Adjust the value of R7 if necessary, but try adjusting VR2 first.

(16) Transfer the oscilloscope to V5-V6 anode. Set the oscilloscope to about 500 sweeps per sec. and check line pulses. Set sweep to 50 c.p.s. and investigate the width of the frame sync pulses (Fig. 12 (b) "x"): each should contain 6-10 line pulses inverted: to correct, adjust VR1.

(17) Connect output of C25 to the input of a TV receiver known to be good; tune C24 and C25 for raster. Set S1 to low frequency, and adjust VR2 for best definition of the vertical bars displayed. Check over all settings of S1 and C15. At this stage there is little to go wrong, and the generator should be found to "go like a bomb." Here it is worth while listening on a sound receiver to this "vision" signal; an exact audible lock to 50 c.p.s. can easily be obtained.

Besides its primary use as a pattern generator, this device can be used as a very stable source of accurate square pulses of a good range of frequency. These are often needed in the experimenter's laboratory, and for those who intend to use the multivibrators only for such a purpose only one word of advice is offered—use a cathode-follower after each multivibrator.

The amateur may also find the vertical bar generator circuit a highly stable master-oscillator for many purposes. The need here is to keep VR2 as high as will allow of oscillation at all. The keying stage is also recommended: if used with a morse key, closure of the key should connect the grid of the keying stage to about 20 volts negative.

Southern Television

TECHNICAL DETAILS

SOUTHERN TELEVISION studios are at the Television Centre, Southampton, formerly the Plaza cinema which has been very extensively modified. The transmitter, built on a commanding site on Chillerton Down, Isle of Wight, will be conveniently placed to give service to the 2¾ million inhabitants of the D-shaped reception area. The transmitter is a 4 kW Marconi Wireless Telegraph Co. design and construction fed to an aerial with a gain of x25 towards the land, and hence the E.R.P. will be approximately 100 kW. The aerial is erected on a mast 700ft. high at a point 550ft. above OD. Channel 11 is used. It is expected to cover beyond Weymouth in the west, Brighton in the east and Newbury in the north, at the extent of the service area. A standby transmitter of similar power will be installed, and the aerial is arranged for parallel feed by the two transmitters to separate halves should such an arrangement be ultimately required, which would double the power.

The Studios

The theatre building has been used as a shell and houses two studios of 3,250 sq. ft. and 600 sq. ft. respectively in what was formerly the auditorium. There is also a small booth for an announcer in picture. The former stage houses dressing rooms and offices, the foyer more offices.

The Main Stage

The main stage is equipped with four E.M.I. cameras (C.P.S. Emitron) and there are spacious control rooms.

The vision control room has a partition for segregating the camera control and lighting control area from the main vision control staff; it is elevated about 5ft. above the studio floor. A sound control room with a sliding partition is adjacent. M.W.T. sound equipment is provided, with echo and fold-back facilities.

Common studio equipment includes Mole Richardson microphone booms, Vinten "Pathfinders" and "Pedestals" and Cintel picture monitors. The announcers' booth will be equipped with a M.W.T. studio vidicon feeding direct to master control. The sound channel includes an advanced type of limiter amplifier (M.W.T.) to simplify sound control.

Telecine Facilities

A large telecine area will be ultimately equipped with four Cintel multiplexed flying spot, optically compensated scanners. These are flying spot machines and hence allow preview of associated sources during transmission. The total machines involved are four 35mm., and four 16mm. and two slide scanners, grouped as four units. The telecine area also houses a combined clock and caption device incorporating a M.W.T. industrial camera. When this is switched on an associated tape deck for sound is activated. Gramophone turntables are also provided in this area.

O.B. Facilities and Links

An O.B. vehicle of ample size is provided with E.M.I. cameras (C.P.S. Emitron) and their associated equipment, as it is expected to range widely over the area for O.B.s. Three modern E.M.I. (ML4a) Links are provided on a frequency in the 7,000 Mc/s range. Communications are by Pye "Ranger" 15 watt equipment. Owing to the situation of the studios in a saucer shaped depression, a M.W.T. BD 401 Link is available for the relatively short run home.

Film Handling

Film handling is carried on by a department with 16mm. and 35mm. projection facilities, cutting and editing equipment, magnetic striped 16mm. camera equipment and rapid processing plant.

Receiving Band V Signals

A 600MC/S OSCILLATOR FOR BAND V By D. R. Bowman

LAST November the BBC began V.H.F. television broadcasting experiments on the present 405 line standard; vision was on 654.25 Mc/s and sound on 650.75 Mc/s. In April this year the 625 line standard was due to be adopted, with vision on the same frequency and sound—frequency modulated at ± 50 kc/s—on 659.75 Mc/s.

Experimenters within the "optical" range of the Crystal Palace aerials will no doubt wish to attempt reception of these new broadcasts, and the oscillator here described may be of help to those who wish to "get started" in this direction.

It will be realised that reception of signals in the 650 Mc/s range represents about the limit at which more or less conventional valves will work. At higher frequencies disc-seal or "lighthouse" valves have to be used, while above about 1500 Mc/s the klystron is the device of choice as a local oscillator. This sort of thing gets rather far from the pocket of the average experimenter, even if his technical knowledge and skill —not to mention patience—are not too far stretched by such techniques. However, those bridges will no doubt be crossed when we come to them; for the present, conventional or near-conventional methods and apparatus may be used, even for the frequencies of the new transmissions.

The experimental receiver of choice at the moment will consist of a superheterodyne circuit comprising a "front end" of oscillator and crystal mixer. Following this will be either an I.F. amplifier operating at about 60 Mc/s or, using the double superheterodyne, a R.F. and mixer stage accepting input at about 100 Mc/s with a conventional I.F. amplifier at 10-40 Mc/s. The latter enables current V.H.F. (Band II) receivers to be pressed into service in preliminary work on Band V.

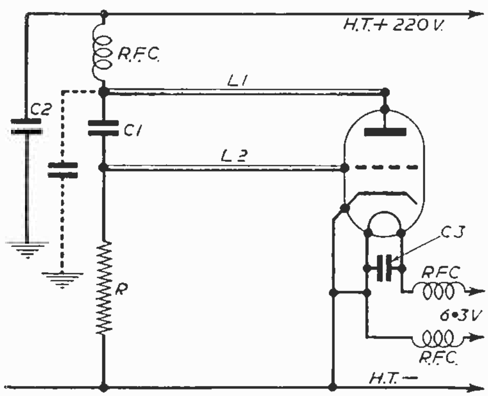


Fig. 1.—The theoretical diagram of the oscillator.

R.F. Amplification

R.F. stages are omitted because of the difficulty in amplifying at 600 Mc/s and over. Though some gain can be obtained by the use of suitable triodes in suitable circuits, one is unlikely to "get started" in this way. The silicon crystal mixer is entirely satisfactory as a first stage.

The oscillator stage is important, not only as the means of converting R.F. at 660 Mc/s to a manageable I.F., but also because it is the source of nearly all the noise generated by the receiver. It must be stable in frequency—not a simple matter to arrange.

In deciding on the source of oscillation more than one choice is open. For a received frequency of 659.75 Mc/s the requirement is plainly for a 600 Mc/s source rather than one above the signal frequency. It may be generated directly, or an oscillator may be run at 200 or 300 Mc/s using third or second harmonics respectively for supply to the mixer. In the interests of frequency stability a crystal-controlled oscillator working at 30 Mc/s or so, followed by several multiplying stages, has strong claims to consideration.

For simplicity—among other reasons—the oscillator chosen consists of a single triode operating at about 600 Mc/s. With due care its output is sufficient—over 3 volts—and its frequency stability good enough to enable the sound transmission to be heard without noticeable drift (after a ten minute "warm-up" period) when fed into the V.H.F. receiver described in *Practical Wireless*, December, 1955. For this purpose the receiver input was slightly re-adjusted to accept a lower frequency R.F. input. Since the oscillator works at a fixed frequency, the I.F. amplifier has in any case to be adjustable to receive whatever I.F. is produced.

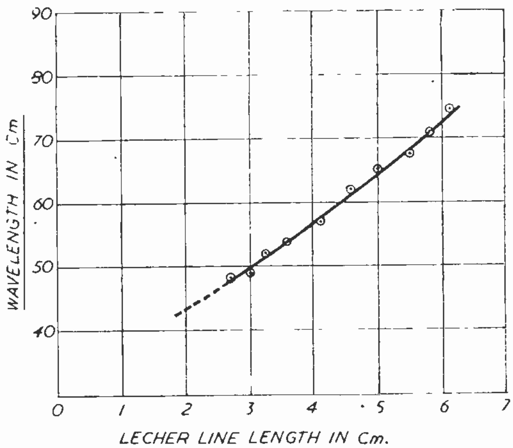
The Circuit

Fig. 1 shows the theoretical diagram. The valve is an Acorn, type 955, and the transmission lines L1 and L2 consist, in the final state of the oscillator, of pieces of 6 B.A. copper rod. C1 is 25 pF ceramic N700K, while C2 and C3 are 50 pF silver-mica. R is 22,000 ohms. The R.F. chokes consist of about 10 turns of No. 22 gauge tinned copper wire (bare), with turns spaced by the wire diameter. Three such chokes are needed: they are all self-supporting, and the former on which they are wound is a half-watt resistor 0.2in. diameter.

This is readily seen to be a conventional Lecher-line circuit. It oscillates readily and the important details are the constructional ones, which are now given.

Construction

The materials required are a piece of copper sheet 4½in. × 2in., about 3in. of 6 B.A. copper (or brass) rod, a three-tag board on feet for mounting at right-angles to a chassis, a soldering tag, an insulated tag (chassis mounting) and the components given above. In addition, silver-plating apparatus, as described in PRACTICAL TELEVISION, August, 1957, is needed, and some No. 22 s.w.g. and 20 s.w.g. tinned copper wire, together with a piece of Perspex sheet 1¾in. × 1in. 10-12 cm. of tinned copper wire, No. 20 s.w.g., are straightened carefully. This is best done by fixing one end of a much larger piece to a firm support, such as a door-knob, and pulling hard on the other end until it "gives" a little. The 12 cm. length is then snipped into halves.



(This length includes valve pins, up to the glass, connections to lecher lines, and length of connecting leads of condenser C_1)

Fig. 2.—Graph compiled by the author.

An Acorn valve, type 955, is then prepared as follows. If the electrodes are already brightly tinned, only burnishing is needed. If they are dull or not tinned they are scraped carefully with a sharp knife until bright. An instrument-type soldering iron is brought to as high a temperature as possible without "burning"; auxiliary heating is necessary and this is supplied by a gas jet or a small blowlamp. The end 5mm. of one of the Lecher wires, 20 s.w.g. wire, prepared as above, is next tinned.

Have ready a piece of cotton-wool soaked in water. With the tinned end of one of the Lecher wires still in contact with the hot iron, bring it up to the *inside* of the anode pin of the 955 and solder on. This should take half a second or less, and the wet cotton-wool is then placed on to the join to give instant cooling. Repeat the process with the other Lecher wire, soldering this time to the *inside* of the grid pin of the Acorn. Before these operations are performed sufficient practice needs to be had with oddments of wire: the valve only needs to be cracked once to be useless.

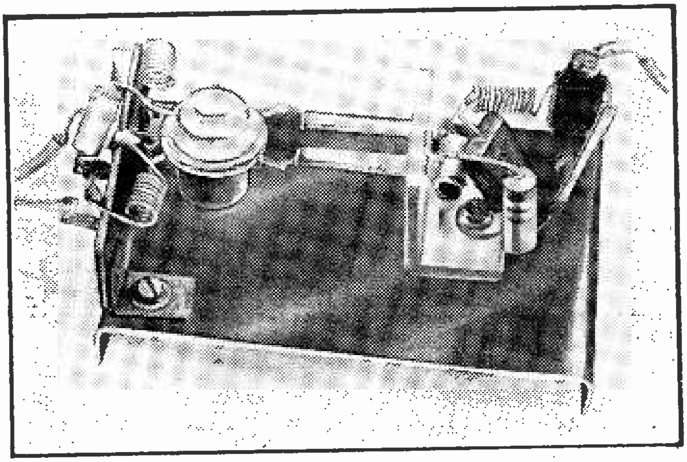
Holding the anode and grid pins, in turn, with a pair of pliers, bend the Lecher wires so that they run parallel. They should now be about 1 cm. to 1.5 cm. apart.

Next, polish the copper sheet with metal polish and bend the ends over to form a chassis 3½in. × 2in. Wash the chassis now very thoroughly in detergent and hot water, swabbing firmly with cotton-wool. After a light pickling in dilute nitric acid (1 part acid to 3 parts water) silver plate heavily. At the same time, and in the same way, silver plate 7 cm. of No. 6 B.A. copper or brass rod. If preferred, after the plating operation, polish both chassis and rod with *plate* polish (*not* metal polish).

Fix the 3-tag strip to one end of the chassis and, using the technique described previously, solder the cathode terminal of the Acorn to the middle tag. Solder R.F. chokes from each heater pin to the outer two tags, connecting one heater pin direct to the middle tag also. Connect one 50 pF condenser between the other heater pin and the cathode tag. The leads to the condenser must be cut so that the total length of condenser and leads is as short as possible and not over 1in. Connect heater supplies to the outer tags and check that the valve heater lights up.

Using gentle heat—about 100 deg. C.—bend the Perspex so as to form a bracket standing 1¼in. off the chassis. Drill holes to take fixing bolts and the ends of the Lecher wires. Do not fix yet; but pass the Lecher wires through the holes and solder C1 directly across the ends, leaving ¼in. of the condenser leads for attaching the R.F. choke and R.

Attach the other end of the choke to an insulated tag; connect C2 across from this end to the nearest earth point and connect a lead for H.T.+. Solder R between the end of the other Lecher wire (the grid wire) and the same



A photograph of the completed unit.

earth point. Switch on the power supplies and touch one end of a miniature neon lamp on the anode or grid end of one of the Lecher wires. A characteristic bluish-red glow indicates that the oscillator is working.

Adjustments

Adjustment to the required frequency is obtained by snipping down the Lecher wires, about 3 mm. at a time, and re-soldering C1 in position, meanwhile measuring the wavelength. This technique will be described shortly. When the Lecher wire length has been adjusted, the length right up to the glass of the Acorn is found by measurement. Snip off the wires, leaving about ¼in. attached to each valve pin. Next enlarge the holes in the Perspex bracket to take the 6 B.A. rod, a smooth fit without forcing. Cut two lengths of 6 B.A. rod such that when soldered to the wires left on the valve pins the length is about 2 mm. less than the previous Lecher wires. Solder the rods into position as new Lecher wires. Push the holes in the Perspex bracket over the free ends of the Lecher rods, solder C1 across these ends and attach R and the R.F.C. as before. Fix the Perspex bracket to the chassis so that C1 is right up against the Perspex. Check the wavelength of the oscillator once more; it should be very nearly the required value.

Measuring Wavelength

To measure wavelength, proceed as follows. Across the room stretch two parallel bare wires, 18 or 20 gauge, about an inch apart, to form a transmission line. These wires need to be very securely fixed and stretched taut. About 8ft. will be needed, but a longer line is better than a shorter. One end is short-circuited—in fact, the transmission line is best made from a single length of wire 16ft. or more in length. Using a piece of twisted flex (the shorter the better) fashion a loop which can be coupled inductively to the Lecher wires by placing it about 1in.-1½in. above them. The other ends of the flex are connected to one transmission line wire, one to the other, about 15 cm. from the short-circuited end.

Plotting a Graph

Using a valve-voltmeter with V.H.F. probe attached, find the position of the standing waves on the transmission line and adjust the position of the flex coupling connections to get a good voltage. Move the probe along the line and, with a strip of gummed paper as a "rider," mark the position of voltage minima. Plot about three or four minima near the middle of the line—avoid the ends and do not use paper-clips to mark the minima; they affect the measurements at these frequencies. The distances between the minima are measured carefully with a metre rule. The distance between minima is half a wavelength.

Careful snipping down of the Lecher wires, with measurement each time, will result in an increase in frequency of the oscillator, which is shown by the minima getting nearer together. When the distance is 25 cm., the oscillator is running at 600 Mc/s.

The graph (Fig. 2) shows the results achieved by the author with one particular 955. In its final form it oscillated at a frequency of 606.1 Mc/s—corresponding to a wavelength of 49.5 cm. when the Lecher wires were 3.0 cm. in length. This particular Acorn oscillated well, with H.T. supply of 220 volts, at a frequency of 636 Mc/s. and might have gone higher.

Harmonics

With the Lecher lines about 5-6 cm. long as first installed, and before the cutting down operation is completed, spuriously "short" standing waves may easily be obtained on the transmission line. This is due to harmonics and the fact of their occurrence can be recognised by the minima being poor as well as close together. As shortening of L1 and L2 proceeds however, the oscillator output diminishes and the harmonic content of the R.F. decreases greatly. As a result, voltage minima suddenly seem to be farther apart. At this stage the oscillator, though producing a good output still, cannot be greatly increased in frequency; care is needed now to shorten L1 and L2 by only a very small amount each time.

Harmonics on the line, and the poor minima mentioned above, can be eliminated if correct matching of the oscillator to the line is arranged. This is, however, unnecessary here, since the purpose of the oscillator is not to feed a transmission line but to supply R.F. to a crystal mixer. A very small loop inductively coupled to L1, L2 will readily give the energy transfer needed.

Note.—In the photograph an extra condenser is connected between the end of the anode Lecher line (at the R.F.C. end) and the nearest earth point. This is of 50 pF and was used to prevent standing waves appearing on the H.T. lead. It may not be necessary; try it without first. If required, it is shown dotted in the circuit diagram.

ITV in Difficult Areas

SOME PRACTICAL HINTS ON COPING WITH DIFFICULT RECEPTION

By B. L. Morley

TRANSMISSIONS in Band III have provided a new set of problems from the viewers' point of view. Generally speaking it can be said that the coverage of the transmitters is greater than was at first anticipated, but one of the major disappointments has been the fact that at some places quite near to the transmitters reception can be very difficult.

The latest transmitter to be brought into operation—the TWW transmitter at St. Hilary, South Wales—has followed this general pattern, but in spite of the fact that it is the most high-powered Band III station in the world, there are many places quite close to it where reception is well-nigh impossible. This is in part due to the rather difficult terrain; the hills and the valleys of South Wales cause obstruction and ghosting, and even in near-by Bristol we have certain areas where reception is almost impossible.

It has been found that the signals from Band III transmittters are not refracted to the same extent as those on Band I. They tend to keep to straighter lines and to throw deep shadows. We then have the situation where houses on one side of the street obtain perfect reception with the simplest of aerials, while houses on the other side find things very difficult.

Pre-amplifiers

One of the most important things to realise is that an amplifier cannot amplify nothing, and if no signal is received with the usual aerial array, then it is useless fitting a pre-amplifier. The golden rule is always to attend to the aerial system first, and then to think about pre-amplifiers.

There is also a limit to the usefulness of pre-amps. In Band III valve noise is the predominant factor. In many cases a pre-amplifier will boost up the signal but at the same time produce so much noise that the picture is useless due to "snow" effects.

If first-class pre-amplifiers of the grounded grid type (cascode circuitry) are used then about two complete stages is roughly the limit which can provide useful amplification.

A good guide on the utility of a pre-amp can be judged from the existing picture. The first point to note is the amount of snow present. (By snow we mean the speckled white dots which appear on the screen superimposed on the picture.) In mild cases it makes the background of the picture appear "dirty" and in severe cases it makes the picture appear as though action is taking place in a severe snow-storm.

Where an existing receiver is working to the limit, yet the Band III picture is weak but free from snow, then a pre-amplifier can be of real help. Where the receiver is working to the limit and the weak picture is troubled with snow then it is likely that a pre-amplifier will increase the snow to such an extent that the receiver is better without it.

Generally speaking, cascode type pre-amps are better than the straightforward R.F. type in Band III.

Let me repeat this important fact: always try to improve the aerial system first. When the limit has been reached in this direction, then consider fitting a pre-amp.

Mast-head Pre-amplifiers

In some cases the fitting of a pre-amplifier at the mast-head may be of value, but its functions must be understood clearly. A mast-head pre-amp will not give greater gain than a pre-amp at the receiver.

Its main function is to provide an increased signal to the feeder. Where the feeder is long and passes through an area of high interference, then a mast-head pre-amplifier can be used. It will then give a high signal-to-noise ratio at the receiver, so far as the noise picked up in the feeder is concerned.

If conditions are such that the aerial has to be sited at some distance from the receiver (at the bottom of the garden, for instance) then a pre-amp at the mast is a good investment.

Bearing this fact in mind, we can exercise a much greater freedom in positioning the aerial, and where this necessitates a long feeder, then a pre-amp can be fitted, not necessarily at the mast-head, but as near the mast end of the feeder as can be conveniently managed.

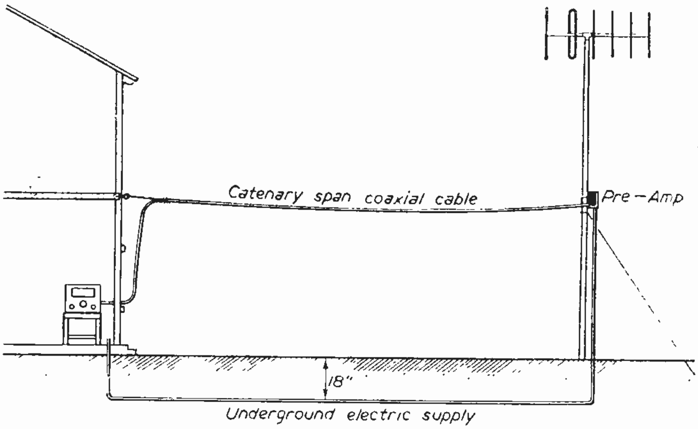


Fig. 1.—Remote aerial with pre-amp.

If a pre-amplifier has its own power supply then all that is necessary is to arrange an underground feed for this supply.

Remote Aerial System

Fig. 1 shows a typical layout for a remote aerial. The aerial has been fitted on a tall mast

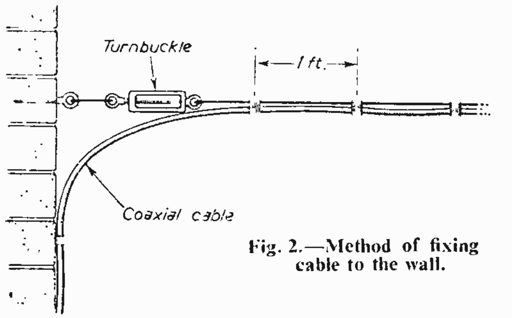


Fig. 2.—Method of fixing cable to the wall.

at the bottom of the garden. At a convenient height a catenary span has been erected to carry the cable to the television receiver. The height of this span will depend upon local circumstances, but it is a wise thing to ensure it is erected above the height of the washing line.

The line supporting the cable can be galvanised iron or steel such as is used for clothes lines, or any strong wire which will take the strain.

In judging the height of the span it is important to realise that there is likely to be a considerable dip in the wire, the amount of dip depending upon the length of the span. If the span is very long then a small post can be erected at the centre point so that the dip can be taken up, and the strain on the supporting wire eased.

The fixture on the mast will be determined by the wire used and the nature of the mast. Precautions must be taken to avoid slipping of the wire. If the mast is of wood then the loop of wire round the pole can be kept in place by a strong staple. If the pole is metal then a bolt can be inserted to prevent the loop slipping up or down.

If stranded wire is used, then two turns should be taken round the mast, and then the wire unstranded at the free end, winding each strand tightly, one by one, over the main wire.

A turnbuckle should be inserted so that the wire can be made taut.

At the house end the fixture will again depend upon the length of the span and the pull likely to be exerted. In the simple case a screw-eye can be driven into the brickwork by means of a plugged hole and the wire terminated on this. However, it is always best to avoid a direct pull if possible and if the screw-eye can be mounted round the corner of the house so that the pull of the wire is at 90 deg. to the fixture, then a much stronger termination is achieved.

A turnbuckle should be inserted at this end also, so that the wire can be stranded and made taut

Having erected the wire the cable can be fastened to it by use of insulation tape at intervals of about 1ft. It is very important to avoid acute bends of the cable at each end. Don't bring the cable off at an acute angle but make a gradual bend as shown in Fig. 2.

It is a wise precaution to fit an additional guy from the point of the mast where the catenary wire is attached to the ground using a good anchorage buried deeply.

The pre-amplifier can be fitted in a ventilated but weather-proof container on the mast at the point where the catenary span is fitted.

The power supply can be run directly underground: it is preferable not to fit this cable to the catenary wire but to run it entirely separately. The cable can be run in conduit buried at about 18in. deep where it will be free from normal digging operations. If polythene cable is used it could be buried directly in the ground without the conduit if low voltage (*not* mains voltage) is used by employing a transformer at each end.

In either case it is a wise precaution to cover the cable with tiles, bricks or half-round asbestos guttering.

The supply should be fused at the house end in each leg of the supply using ½ amp fuses, and a double pole switch employed. All mains voltage wiring should be fitted by a competent electrician. It is unwise to take risks. All installations must be up to the standards laid down by the electricity regulations.

The Standard Installation

In most cases where television is installed an aerial system is erected on the chimney. This is normally the highest convenient point for an aerial to be fitted. It is not always the best.

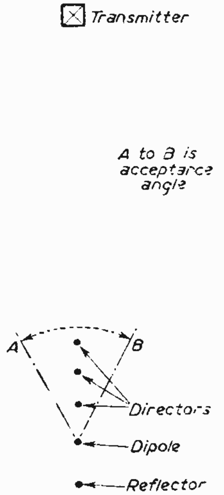


Fig. 3.—Showing the narrow acceptance angle of a five element array.

Under normal conditions where adequate signal strength is available it answers very well but where signal conditions are difficult some other position may prove to be better.

However, at this stage let us consider producing the best results from this popular aerial position.

The most notable difference between Band I and Band III aerials is in the size of the individual elements. A dipole for Channel 1, for instance, is over 10ft. long, while a dipole for Channel 10 is less than 2½ft. The net effect of this is that there is less element area presented to the signal by the Band III aerial than is the case with the Band I aerial and, apart from all other considerations, the pick-up quality of an aerial depends to some extent upon the amount of element area in it.

To achieve a similar pick-up from a Band III aerial to that of a Band I aerial we must therefore employ more elements.

This is one of the basic reasons for the increased number of elements and greater complexity of the Band III system. Where a simple "X" type of aerial is sufficient for Band I it is probable that a five-element aerial is required for Band III.

Fortunately so far as the physical considerations are concerned the shorter length of the individual elements of the Band III aerial enables us to construct high-gain arrays which are not unwieldy.

The popular five-element array consists of three directors, folded dipole (for accurate matching) and reflector.

The normal method of erection is with the directors facing the direction of the transmitter. It is surprising to note that aerials fitted by novices are often fitted in reverse, with the directors pointing away from the transmitter.

The directors are, of course, the shortest elements of the array.

The standard five-element array has a fairly narrow acceptance angle. By "acceptance angle" we mean the angle through which the aerial can be rotated without the signal falling off appreciably. A simple dipole will receive signals at equal strength from all points of the compass; a yagi array such as the five-element array will also receive signals from all points of the compass, where signal strength is adequate, but the strength of the signal rapidly falls off as the aerial is turned away from the direction of the transmitter.

This is shown in Fig. 3. As an average figure it can be said that if the aerial is rotated through

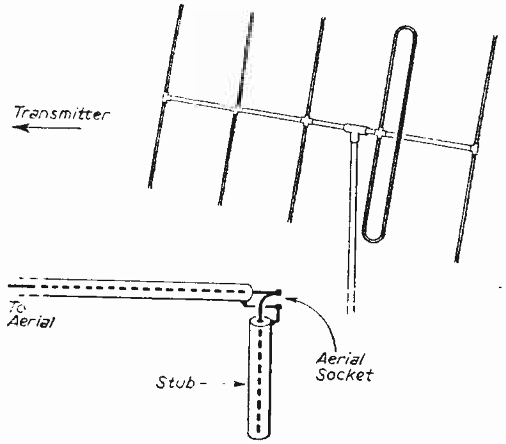


Fig. 5 (Top).—Tilting the aerial. Fig 6 (Bottom).—Using a stub.

an angle of plus or minus 20 deg. there will be little change in observable signal strength. We thus have an arc of 40 deg. to play with.

Where signal conditions are good it is not necessary to align the aerial accurately by compass on the transmitter.

This fact enables us to tackle one of the difficulties of Band III reception. That is the reception of ghost signals. A ghost signal is one which produces a second image on the television screen slightly displaced from the first and to the right of it (looking at it from the front of the screen). In the simple case the aerial can be rotated until the ghost is reduced to negligible proportions.

In cases where the signal picked up by the aerial is weak then it is worth while rotating

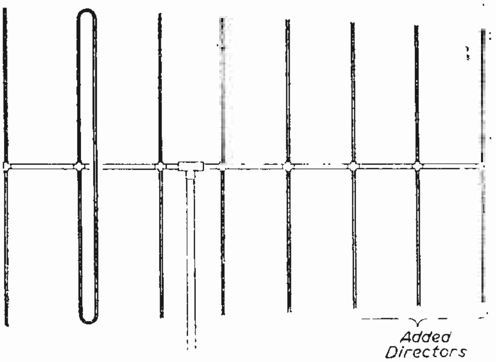


Fig. 4.—Adding directors to a yagi array.

the aerial round all points of the compass to try to find a stronger signal. Band III signals are very prone to reflect from solid objects and it is quite possible to produce a stronger signal with the aerial pointing away from the transmitter. It is well worth trying.

If a standard five-element array proves to be not quite strong enough, then it is possible to add up to three further directors without appreciably spoiling the matching, where the aerial is constructed on the 0.2 wavelength spacing principle. Make the first new director of the same diameter material as the existing and make it 5 per cent. shorter than the front director. Mount it at exactly the same distance in front of the front director as the front director is from its mate.

This process can be repeated making the next new director 5 per cent. shorter than the first new one, and repeat the process once again with a third new director, as shown in Fig. 4.

A limit is set to this process by the amount of mismatch introduced. Where signals are weak then an array with more directors may be required.

With a multi-director array the acceptance angle is very narrow and the aerial must be aligned on the point from which the strongest signal is obtained quite accurately. This in itself poses some problems which will be dealt with later.

Double Arrays

The question is often asked, "What is the advantage of the double array?" In the first instance an array which has been doubled usually provides about an extra 3db gain. There is sometimes the thought that if an aerial gives, say, 10db gain, then two of them mounted together will produce twice this amount, that is 20db. This is far from the truth; the extra gain is about 3db.

Double arrays, however, beside giving an extra 3db are also helpful in discriminating against ghost signals, particularly those coming from an angle of 90 deg. to the main signal. A very useful array for this purpose is one which combines the features of the double array together with a slot aerial. Greater gain can often be obtained from a multi-director array, but greater gain is not always preferred to better discrimination against ghost signals.

There is a limit set to the gain obtainable with a double array. Adding more directors means an increase in the overall length of the array and a point is reached where the two arrays side by side will affect each other. Two eight-element arrays mounted side by side are about the practical maximum which can be achieved. If more gain is required, then it is best to use a straight yagi array with more directors.

Aerial Alignment

To get the best from Band III it is necessary to align the aerial to the strongest signal point. This involves some difficulties when the aerial is remote from the televisor as, for example, when it is erected on the chimney.

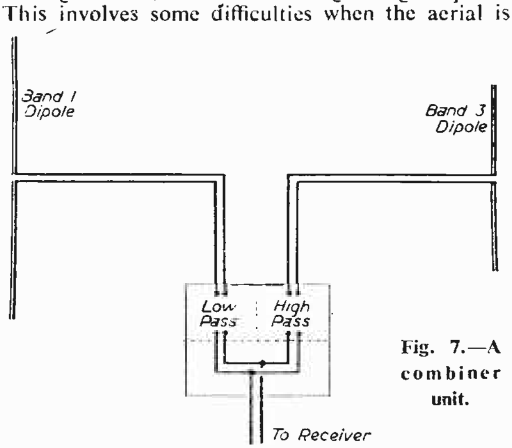


Fig. 7.—A combiner unit.

Undoubtedly the best solution to the problem is the establishment of two-way communication between the man on the aerial and one at the receiver. Dealers and aerial-riggers may find it worth while to invest in a pair of headphones and breastplate transmitter for the man on the roof, and an ordinary telephone for the man at the receiver. The man on the roof can then be kept accurately informed of the results of his movements.

One snag which must be taken care of is the operation of the A.G.C. in the receiver, and it is as well for this to be made inoperative until the aerial has been accurately aligned.

Where fading is experienced great care must be taken to distinguish between a signal varied in strength by a natural fade, and one varied in strength by movement of the aerial.

Simple two-way communication is not at all difficult for the amateur to contrive and use can be made of mikes and phones and even amplifiers. When on the roof all sorts of extraneous noises are heard which are not apparent in the room below, and even a slight breeze will whistle round a pair of phones, howling like a small gale. Phones should sit tightly on the ears and there should be plenty of flex available to allow easy movement.

Tilting the Aerial

When passing over rugged terrain it is possible for the vertically polarised signals to become tilted and it may be possible to obtain a stronger signal by tilting the aerial up slightly, see Fig. 5. About 5 per cent. is the limit of useful tilt but in town areas it may be worth while to give a greater tilt than this. Further consideration should be given to tilting sideways as well as in the upward direction. With two operators checking the signal as described, then it should be possible to arrive at a position which gives the maximum signal.

It can be noted that where indoor aerials are used the effect of tilt is very pronounced and can be employed to obtain an improvement in signal level.

Search for the Signal

Under difficult situations the chimney may not always be the best position on which to erect an aerial. For those who have the patience then a real search can be instituted to find the best signal.

For this work it is almost essential to have two operators equipped with telephonic communication.

In built-up areas particularly the signal can become distorted and twisted out of its normal path and a difference of only a few feet in the position of the aerial can often produce large differences in the signal.

Contrary to accepted opinion, the highest position of the aerial is not always the best in these cases. The writer has known cases where the lowering of an aerial by 6ft. produced a worth-while signal. If the aerial can be erected at a great height well above the influence of near-by buildings, then, of course, we expect to obtain a greater strength of signal, but in built-up areas—especially those where houses have been built on hills and the surrounding area is of a hilly nature—then the normal accepted laws do not appear to apply.

In dealing with Band III we have found that shadows can be thrown for a considerable distance and at times it almost seems that the signal can be bent round corners!

If, in an accepted good-signal area, difficulty is experienced with the normal type of installation, then alternative situations must be sought. Try another chimney; try making the aerial higher; try fixing it lower; try on the eaves of the house; try on the apex; try to get away from the house entirely and erect the aerial on a pole in the garden. The further the aerial is from near-by objects, the more likely is the signal to conform to the accepted standard. An aerial erected on a 30ft. pole in the garden will often produce better results than one erected 40ft. from the ground on the chimney.

Don't always accept the orthodox, try unorthodox methods. A dipole moved about the house in different positions in different rooms may produce a worth-while signal. An aerial in the attic may get a signal where an aerial on the chimney has failed.

(To be continued)

Heater-cathode Tube Shorts

OVERCOMING A COMMON FAULT, OR NEW TUBES FOR OLD

By T. Deakin

A HEATER-TO-CATHODE short in a television tube need not necessarily imply that a new tube is automatically required. In fact any remedy that can prolong the life of a partially unserviceable tube is welcome, bearing in mind the prohibitive cost of such a component.

Shorts of this nature, whether temporary or permanent, are embarrassing because most set manufacturers arrange that the cathode of the tube is the element to which the picture information is applied. The grid, normally used for this purpose in valve circuitry, is merely employed as a beam current, or brilliance, control. Thus when the thin insulation between heater and cathode breaks down, or provides an intermittent contact between the two electrodes, the video signal (and the sync as well as a rule) is fed to the low impedance heater chain via the short. The net result is loss of signal and sometimes sync.

Now this arrangement is not obstinacy on the part of set manufacturers, nor is it a ruse, as imagined by some, to sell more tubes.

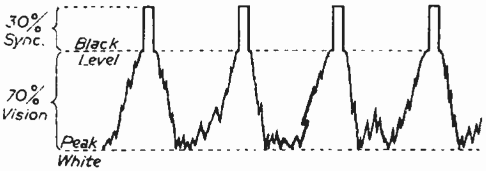


Fig. 1.—Video and sync waveform at the tube cathode.

At the video output stage the signal consists of both video and sync, and in a video stage feeding the cathode of a tube will appear as shown in the waveform of Fig. 1.

This waveform is also coupled to the sync separator which, at its simplest, is of the leaky-grid detector variety. The waveform charges up a condenser so that the positive peak of the waveform is at earth potential at the grid of this type of separator. If the signal amplitude is large enough (which of course it will be if the same signal is also driving the tube), then only the sync part of the signal is amplified, the remainder being beyond the cut-off bias level of the sync separator. By this means a series of negative-going pulses appear in the anode circuit for integration and differentiation in frame and line timebase circuits respectively.

This arrangement economises on the number of stages required and is widely used by set manufacturers.

Cures for the Trouble

One popular remedy for the fault with which this article deals is well known and involves the use of an isolating transformer with a special low-capacity winding.

The tube heater is then supplied separately from the rest of the heater supplies and though the heater-cathode short still remains, very little of the signal developed at the video anode is lost as a result of the good degree of isolation that the low capacity winding provides from earth.

Such transformers are readily available from radio component suppliers.

They are not easily wound by the constructor, however, and an electronic rather than electromagnetic solution is more easily and cheaply available to the reader with the usual kit of radio spares.

In its simplest form the circuit requires three diode additional stages and the assembly can either be mounted as a neat sub-unit at the back of the receiver cabinet or suspended as a "gorse bush" type of construction from the neck of the tube. This latter method will appeal to the reader with the least time at his disposal, either by his own inclination or the demands of the rest of the household.

Tube Modifications

The first step consists of changing the role of grid and cathode of the tube. Because the cathode is held at the voltage level of the heater, all further attempts at control of this electrode must be abandoned.

Instead, the functions of brilliance control and modulation of the tube must be combined at the grid, and both involve some additional circuitry.

A large proportion of television sets are wired with the heaters of the valves and tube in series for A.C./D.C. operation. Step No. 1 involves moving the tube to the earthy end of this line up. (If the set is a superhet receiver using an X78 frequency changer, the latter stage must always be at the earthy end of the heater chain, and the tube heater must be connected immediately before

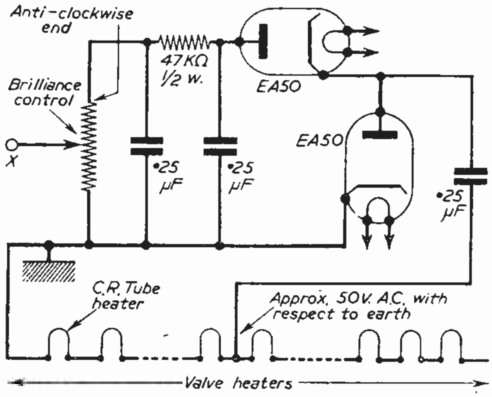


Fig. 2.—Bias line derived from the heater chain for brilliance control.

this stage.) In the worst case (i.e., a dead short) the cathode will be at approximately earth potential.

For control of brilliance the grid must be negative with respect to the cathode (and hence earth) and this involves supplying a bias rail.

This is easily achieved on A.C./D.C. sets working on A.C. and Fig. 2 gives the necessary details. Here it will be seen that a voltage doubling rectifying system gives a negative bias rail. The A.C. supply is taken from a tapping on the heater chain. Its level should not be critical and will be governed in the final instance by the effectiveness of the brilliance control on the picture. Obviously if the brilliance cannot be decreased sufficiently, the tapping level on the heater chain should be increased.

If EA50 diodes are used in the voltage doubling circuit then some space can be saved by wiring them in directly by their valve pins rather than using the appropriate valve holders. The heaters should be connected in parallel, and then included in series with the main heater chain, assuming the latter is a 0.3A line up. Alternatively a double diode of the D77 or EB91 variety can be used. The heater is 0.3A and is wired in series directly.

With the tube grid being modulated rather than the cathode, the video waveform must be inverted so that, at the grid, peak white level is now the positive limit of the waveform.

The grid waveform, in fact, must look like that of Fig. 1 inverted. There are two ways of doing this and some experimentation may be necessary to determine the best results.

Inverting the Waveform

Fig. 3 shows a typical video output circuit from the final R.F. stage, through the detector and interference limiter. It will be seen that normally the output is direct coupled via the 68K and 100K divider resistors to the cathode of the tube. The 0.22 μF condenser couples the A.C. component of the video waveform with no attenuation, while the direct coupling provides the correct D.C. level for the signal.

The interference limiter is simply a diode whose cathode is maintained at a controllable level set by the 0.1M potentiometer.

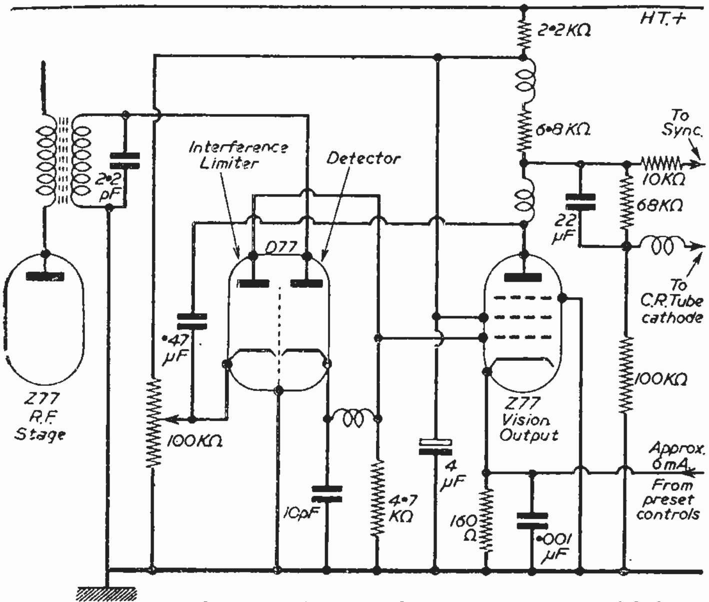


Fig. 3.—A circuit of a typical detector and video output stage modulating tube cathode.

When interference transients appear on the signal they appear at and above the peak white level of the signal at the grid. At some particular setting of the limiter control, these positive-going excursions of interference will cause the video output stage grid level to exceed the control potential and the diode will conduct. On conduction the .047 μF capacitor is now connected between grid and anode of the video stage, and the interference is very effectively degenerated due to integration by feedback.

Now the simplest way of inverting the waveform is to reverse the connections to both the detector diode and the interference limiter diode. That is, connections made formerly to the cathodes of the diodes must now be made to the respective anodes, and vice versa.

This solution entails a certain amount of work under the chassis, changing valve base connections, and as this circuitry is generally screened and is somewhat inaccessible as a result in the average set, the alternative solution may appeal to some readers, particularly as certain types of set may not function so well with the first solution.

Large Screen Sets

Large screen sets fall into this category where the amplitude of the drive feeding the cathode of the tube is excessively large.

The circuit of Fig. 3 shows how the video output stage cathode is maintained at an artificially high positive level by current from the brightness and frame and line hold and height controls being fed through the cathode resistor. Bias for this stage therefore is not entirely due to the cathode current alone.

Now the grid waveform of the video stage in a set in which cathode tube modulation is employed is the reverse of that shown in Fig. 1. That is, the peak white signal level is positive-going while the sync is negative-going.

As only a limited amount of gain is available in a video output stage, the large amplitude of output signal demands a fairly high input level at the grid.

(To be continued)

THE CUBICAL QUAD AERIAL

AN AERIAL THAT IS BECOMING POPULAR IN AMATEUR TRANSMITTING CIRCLES

By S. A. Money

IN recent years a new and rather interesting type of aerial, known as the Cubical Quad, has become popular in amateur transmitting circles. This aerial, which is compact, has quite high gain and is simple to construct, and seems to have great possibilities as a television aerial. Its size and shape make it highly suitable for use as a loft aerial when lack of space prevents the use of conventional dipole or slot aerials.

The original version of the quad aerial is believed to have been developed and used by the broadcast station HCJB in Quito, Ecuador, and first came into prominence in 1948.

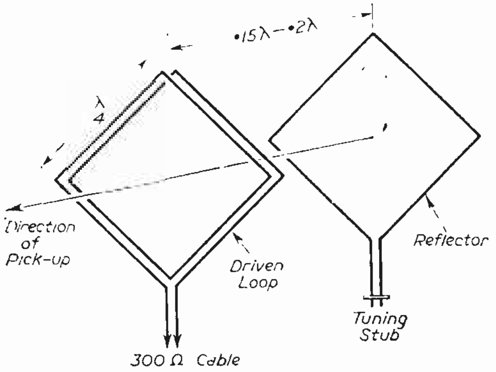


Fig. 1.—The original quad aerial.

In its original form the quad aerial consisted of two diamond-shaped loops, one acting as the driven element and the other as a reflector. The sides of the loops were made a quarter of a wavelength long and the feeder cable was connected to one of the corners of the driven loop. The reflector was placed about 0.2 wavelength behind the driven loop and was usually fitted with a shorted stub for tuning. In order to match the driven loop to a 300 ohm feeder it was usual to make it with two turns to step up the impedance.

A later development of the quad aerial, known as the cubical quad, made use of two square loops with the feeder line connected at the centre of one of the sides of the driven loop. This arrangement is much better for matching to the feeder since the impedance is found to be about 75 ohms. This type of aerial was also found to have slightly higher gain. Power gains of up to 10dB over a simple dipole have been claimed for this aerial, though a gain of 8dB seems to be a more reasonable figure.

The space required for a cubical quad aerial is a cube with sides of a quarter wavelength. For Band I the sides would be about 4ft. to 5ft. long and for Band III about 15in. long. The loops are made from coaxial cable and the supports are of wood. Total cost of a Band I aerial should not be more than about 20s. and the aerial can be built and fitted in a couple of hours.

Principle of Operation

The driven loop behaves approximately as a pair of half-wave dipoles spaced a quarter of a wavelength apart. If the loop is fed at the centre of one side, as shown in Fig. 2, the current distribution will be as shown by the dotted lines and the direction of flow as shown by the arrows. It is seen that the peaks of current occur on the vertical sides of the loop and that the currents in these sides flow in the same direction. Radiation will therefore be mainly from these two sides. Since the currents cancel on the horizontal sides there will be little or no radiation from them. This loop will therefore be vertically polarised. For reception maximum pick-up will occur on the vertical sides of the square and the loop will act as two vertical dipoles spaced a quarter wave apart, one being fed at the centre and the other at the ends. Maximum pick-up will be in a direction perpendicular to the plane of the loop.

If the loop is fed at the centre of the lower side, the aerial will become horizontally polarised with maximum pick-up on the horizontal sides of the square.

By placing another loop at a distance of 0.2 wavelength behind the first, as shown in Fig. 3, a two-element array is formed. If the second loop is made about 5 per cent. larger than the first it will act as a reflector, in the same way as the reflector of an H aerial, and the gain and directivity of the aerial will be increased.

Gain and Impedance

The power gain of a single loop, fed at the centre of one side, is about 1dB over a simple dipole. If the aerial is close to the ground, or the roof of the building, the gain drops to about zero and in some cases the aerial may be worse than a dipole.

(*Continued on page 579*)

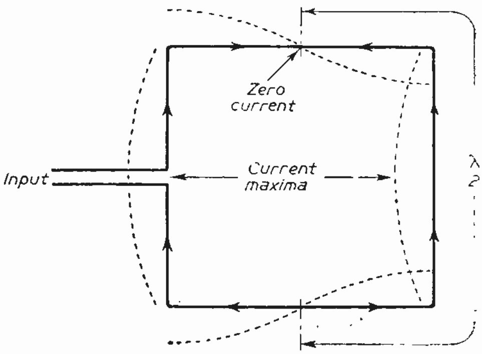


Fig. 2.—Current distribution around the loop.

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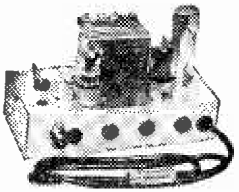

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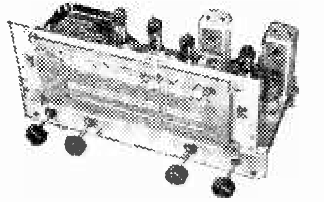

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For a square loop the input impedance is about 100 ohms, which would give some mismatch if used with 80 ohm cable. This type of aerial has been tried at some 20 miles from the Rowridge

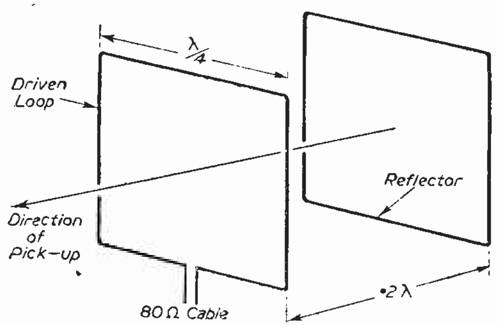


Fig. 3.—The cubical quad aerial.

transmitter and gives about the same performance as a dipole. The power gain, in this case, was probably lost due to mismatching of the cable.

When a reflector is added the power gain over a simple loop is about 7dB, and over a dipole about 7dB to 8dB. This is an unusually large increase in gain for the addition of a reflector and is probably due to the type of elements used.

With a reflector spaced 0.2 wavelength behind the driven loop the impedance becomes about 75 ohms, which gives a good match into 80 ohm coaxial cable. For correct matching the cable should be of the balanced twin type, but the use of coaxial cable does not appear to affect the performance of the aerial unduly.

If the spacing between the reflector and the driven loop is reduced the impedance falls, becoming about 50 ohms for a spacing of 0.1 wavelength. The gain also falls off slightly as the spacing is reduced.

If the driven loop is made up with two turns the input impedance is increased by a factor for four, in the same way as for a folded pipe. Using a two-turn loop also increases the bandwidth of the aerial. The reflector need not be altered since the object of doubling the turns is merely to alter the impedance of the driven loop.

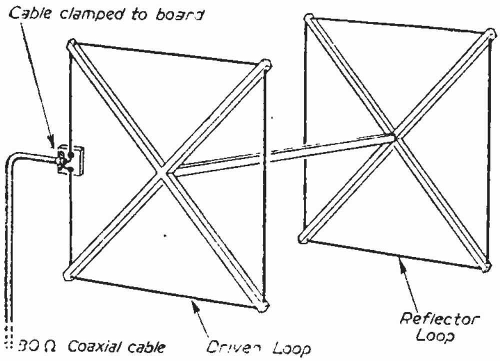


Fig. 4.—Constructional details.

Dimensions

The length of wire in the driven loop is made about 0.97 of a wavelength at the frequency for which the aerial is designed to work. The reflector loop is made about 5 per cent. longer, in the same way as the reflector in an H aerial. The dimensions for the two loops and the spacing between them for each of the television channels are given in Table I. These dimensions have been calculated for frequencies at the centre of each channel. The table also gives the diagonal length of each of the loops since this dimension is very useful when constructing the support for the aerial.

Construction

The aerial elements are mounted on a wooden framework consisting of two X-shaped frames, to support the two loops, and a cross-beam to give the desired spacing between the loops. This is shown in Fig. 4.

The frames supporting the loops are made from

TABLE I

Dimensions for the Television Channels

Channel	Driven Loop		Reflector		Spacing
	Side	Diagonal	Side	Diagonal	
1	5′ 6″	7′ 9½″	5′ 9½″	8′ 2½″	4′ 1½″
2	4′ 9″	6′ 9″	4′ 11″	6′ 11″	3′ 7″
3	4′ 4″	6′ 1½″	4′ 7″	6′ 5½″	3′ 3″
4	4′ 0″	5′ 7½″	4′ 2″	5′ 11″	3′ 0″
5	3′ 8″	5′ 2½″	3′ 10″	5′ 5″	2′ 9″
6	16″	22½″	16¾″	23½″	12″
7	15½″	22″	16¼″	23″	12″
8	15¼″	21¼″	16″	22¼″	11″
9	14¾″	20¾″	15½″	21¾″	11″
10	14½″	20¼″	15¼″	21¼″	11″
11	14″	19¾″	14¾″	20¾″	10½″
12	13¾″	19¼″	14½″	20¼″	10½″
13	13½″	19″	14¼″	20″	10½″

1in. × 1in. wood. Two lengths are cut to about 1in. greater than the required diagonal for the loop. At a point ½in. from each end a hole is drilled to take the wire of the loop. The size of this hole will depend upon the thickness of wire used. A half-lap joint is made at the centre of each length of wood and the two are fitted together to form a right-angled cross.

The cross-beam is made from 2in. × 1in. wood and its length is made the same as the desired spacing between the two loops. The two cross elements are then screwed to the ends of this beam. At least two screws should be used at each end, to prevent rotation of the cross relative to the beam, and the screws are driven through the halved joint so that this is also made secure.

Coaxial cable is used for the loops, with the outer screen connected as the loop element. This gives larger diameter elements and tends to improve the bandwidth of the aerial. Quite good results can, however, be obtained when using ordinary flexible wire for the loops.

The wire is threaded through the holes drilled

(*Continued on page 586*)

A Universal Alignment Method

A FORM OF ALIGNMENT PROCEDURE SUITABLE FOR THE MAJORITY OF SETS

By H. Peters

LET it be said at the beginning that this article is not intended to supplant or disparage the official alignment instructions which have been carefully worked out by the manufacturers for their individual receivers and wherever practicable these should be rigidly followed.

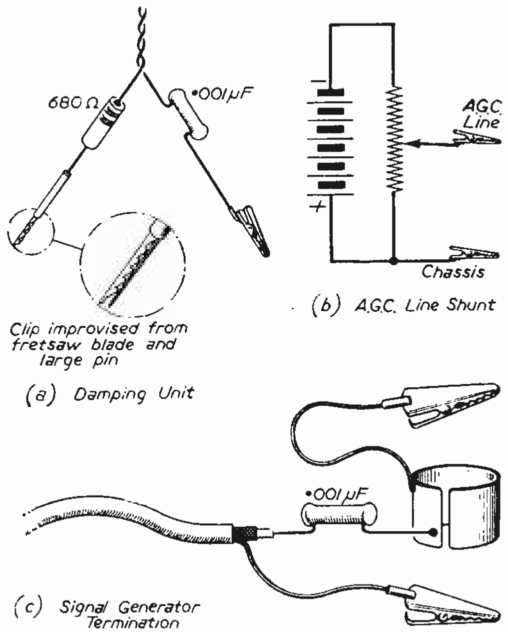


Fig. 1.—Extra equipment required.

There are, however, several occasions when this is not possible, either because the instructions are not available, or because they involve using special equipment which is not to hand. On older receivers the specified sensitivity and bandwidth will probably be impossible to achieve without replacing so many valves and components that the job becomes uneconomic. It has been the writer's experience that the average viewer is far more contented with a nice creamy noise-free picture with a bandwidth of between 2-2.5 mc/s which is not riddled with sound on vision and which doesn't drift noticeably, rather than resolve an outstanding 3 megacycle grating and have to continually adjust the fine tuner and hold controls.

To this end, and to save time when dealing with unfamiliar equipment, a form of alignment procedure has been devised which has so far produced satisfactory results on the majority of sets aligned.

Equipment Required

The equipment required is simple. A modulated signal generator covering 7 to 40 megacycles and Band I. A multimeter with 1,000 ohm-per-volt sensitivity, or an oscilloscope. A damping unit, constructed from a large and small crocodile clip, a 680 ohm resistor, and a .001 mfd. (or greater) ceramic condenser. For receivers with vision A.G.C. the control line must be tied down to a steady value, and this can be done with a battery and a 10 to 50 K. ohm pot. as in Fig. 1(b). A grid bias battery is suitable, but a discarded 7.5 v. block from the portable radio is just as good.

Injection Points

To save time in finding the correct injection point the signal can be applied from the generator by means of a clip slid over the valve instead of the screening can (Fig. 1(c)). A greater signal is naturally needed than for direct injection, but it does simplify the equipment needed and is particularly useful where the set to be aligned works after a fashion (which is usually the case). The signal generator clip can then be pushed over the mixer valve and left in this position throughout the alignment. If the set is faulty or hopelessly out of alignment the signal will need to be injected at each successive grid starting at the last I.F. and working forward. As most modern sets have the chassis connected to the mains it is essential to ensure that the polarity is correct before connecting the signal generator. The chassis connection should be made to a soldered chassis point in preference to the chassis itself which may have oxidised to give poor contact.

Meter Points

As long as the meter can give a good clear indication of maximum signal there is no objection to attaching it to any of several points in the circuit. A.G.C. and A.V.C. lines should be avoided, however, as the sound and vision A.G.C. systems are usually connected and this gives rise to misleading results.

On the sound I.F. strip the simplest place to insert the meter is across the loudspeaker

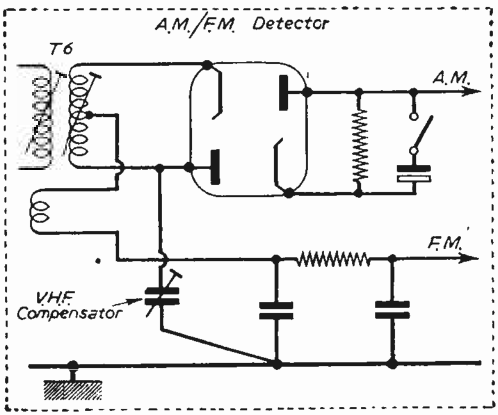


Fig. 2a.—Details of AM/FM detector.

terminals, on the lowest voltage A.C. range. Alternatively the meter can be connected across the D.C. side of the demodulator where a negative reading of between 1 and 10 volts should be expected. On the vision strip a suitable place to attach the meter is on the tube cathode or video amplifier anode (usually connected together). Here a standing positive voltage of between 60 v. and 120 v. is usual, which decreases with the applied signal. Thus when indicating maximum the meter needle moves backwards.

Another vision take-off point is at the output from the detector diode, where about 6 positive volts is to be expected.

Sound.—Assuming the majority case (i.e., where the set works up to a point), remove the aerial, or change to a vacant channel position, turn up sensitivity and contrast and inject a strong modulated signal at sound I.F. frequency using the clip pushed over the mixer valve. With the meter set to give a useful sound output indication and using a non-metallic trimming tool (see " Word of Warning " farther on) tune T6 Fig. 2 secondary, T6 primary, T5 secondary, T5 primary, T4 secondary, and T4 primary (if tunable) in that order for maximum sound reducing the sig. gen. output progressively to prevent A.G.C. action. If this produces instability it denotes a fault in the strip such as a cracked ceramic decoupling condenser, or overcoupled coils in the I.F. transformers designed to give bandpass tuning. Eliminate faulty decouplers by bridging each in turn with a known good one before retuning the sound I.F.'s for bandpass as follows:

Bandpass Sound I.F.'s.—Connect the damping unit across T6 primary and tune T6 secondary for maximum. Transfer the damping unit to T6 secondary and tune T6 primary for maximum. Repeat with T5 and T4, damping the primary and tuning the secondary and then vice versa. To make this operation easier a condenser is fitted in series with the damping resistor and this can be taken to a central chassis point.

(To be continued)

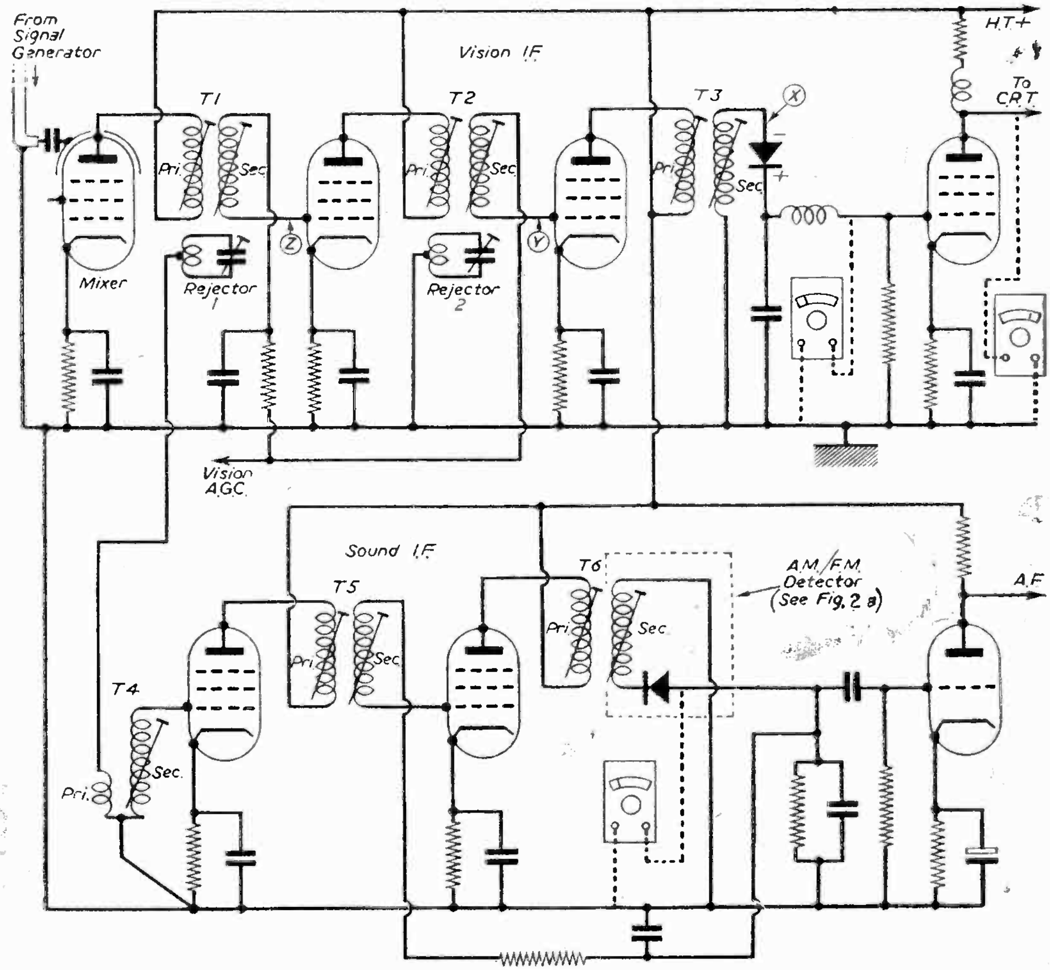
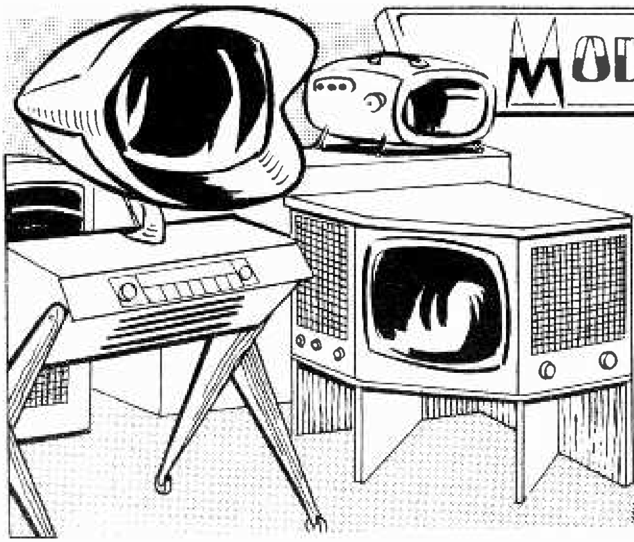


Fig. 2.—The circuit to which the text refers. (Typical but not practical.)



MODERN TELEVISION

THIS ARTICLE, REPRODUCED FROM OUR FRE
RECEIVER DESIGNED BY M. CH. BAUD. A FI

General Conception

THE ideal television set, like the ideal woman, does not exist. Nevertheless, in what follows, I will describe an apparatus that has been specially built for personal requirements. The set is built on a triangular chassis, and is a corner cabinet.

The feature that stands out is the F.M. amplification, vision and sound, designed to avoid clouding on band 10, which is used on some Continental transmissions. For this we have a F.M. circuit for sound on 36 Mc/s, and for vision F.M. on 47.15 Mc/s. The F.M. vision circuits are super-coupled transformers, the coupling regulated so as to obtain a total band of about 9 Mc/s. There is no tendency to cloud (a fault found in most commercial television sets), because the M.F. harmonics fall outside the band received, that is, between 189 and 200 Mc/s.

The erasing is done on anode 1 of the tube, which is a 43 cm., so that the modulation electrode becomes free for the application of anti-parasites by inversion of the signal, and possibly for push-pull operation of the tube, which may be tried later.

Correction of the video stage has been reduced to avoid all tendency to "silhouette." The response curve of this stage, verified by spot wobbler, is practically linear to near 12 Mc/s

The L.F. part has been carefully studied and is furnished with a selective back-reaction to improve the response curve. The two speakers (Gego, type high fidelity sub-cone) are placed on each side of the screen and ensure excellent sound.

In the H.F. part there is a fine tuner, but only to obtain maximum gain from the oscillator section.

The controls shown are: fine tuning contrast, brilliance, volume of sound. The four small adjustable buttons correspond to concentration, tonality, line and image frequence. Finally, inside the chassis, there are two potentiometers for linearity and the one controlling the height of the image.

The cabinet consists of two triangular panels 20 mm. thick, of white oak lined with black and attached to the base with screws. The speakers are mounted on Isorel baffles, covered with tissue and also fixed to the base. Four chrome fillets, masking the joints of the angles, are arranged vertically between the two wood panels. Two black plastic plates conceal the chassis under the buttons and complete the assembly.

Circuit Details

The entry circuit is of the symmetrical type, the aerial coil being coupled to the centre of the grid coil. The first stage, cascode, is neutrodyned by capacity, a solution which allows saving of a coil. The connecting circuit between the plate of the first triode and the cathode of the second is by a series coil, as is usually the case. The connection between the cascode and the frequency changer is by a classical band filter.

The oscillator is a Colpitts, fed with H.T. by means of a stop-coil with centre connection. The means of selecting vision and sound frequency have been mentioned above.

A sound rejector is placed in the cathode circuit of each of the three EF80 medium frequency vision amplifiers, the first rejector allowing selection of sound and controlling the grid of the first corresponding F.M. amplifier.

Video detection is by means of a diode crystal type G60 (Westinghouse) placed, together with the load resistance and the stop-coil, in the F.M. case.

The video stage comprises a single series correction coil, strongly damped, in the anode circuit of the EL83, together with a load resistance coil of 1,500Ω (diameter 7 mm., length 50 mm.). A series correction coil with the load resistance has been suppressed to avoid unpleasant super-oscillation. This is a matter of taste, but we prefer a light degrading to a super-oscillation, however mild it may be.

The second F.M. sound stage has been largely "dampened." This stage required, at all costs, to detect by the grid and the C.A.V., and has been installed merely to stabilise it.

The L.F. detection and pre-amplification are done by a EABC80, one of whose diodes is not used. The diode with separate cathode is used to obtain negative tension, as will be seen later.

Tone Control

Tone control is obtained by varying the scale of a selective back-reaction. The two speakers (17 cm.) are connected in parallel, giving an assembly with impedance of the order of 2.75 Ω. An output transformer for 2.5 Ω on the secondary suits very well.

The conversion of the H.T. is done by two PY82 valves, heated by a separate secondary giving 19 volts, one end of which is earthed. This potential of 19 volts is also converted, to "negative," by the separate cathode diode of the EABC80, then filtered and used as stabilised potential for the grid of the

RECEIVER DESIGN

CH CONTEMPORARY "TELEVISION" DISCUSSES A SPECIAL
THER ADVANCED FRENCH DESIGN IS SHOWN OVERLEAF

6BQ6, and also for control of vertical linearity by displacement of the operative point of the pentode ECL80.

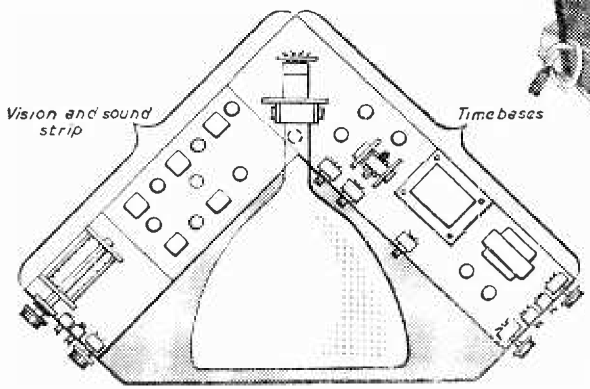
The separator stage uses a pentode ECF80, the triode of which acts as a vision detector and amplifier. The frame blocking oscillator uses the triode of the ECL80 and, with the mounting used it is practically impossible to detach the vertical timebase. There is nothing special to say about the vision power amplifier (pentode ECL80), which operates without fatigue with a high tension of 250 volts and includes a linearity correction by means of feed back.

On the side of the lines, one of the triodes of the 12AU7 amplifies and defines the synchronisation tops, while the other is mounted as a blocked oscillator. In regard to the final stage, using a 6BQ6, the E.H.T. and the deflection system, the arrangement is quite standard practice and we have not found it necessary to reproduce it entirely. The equipment used is of the brand OREGA. The screen tension of the 6BQ6 has been adjusted so as to have a T.H.T. of 14 kV.

A resistance of 10Ω, placed on the earth return of the 6BQ6 cathode, allows the measurement of the cathode output of the tube without modifying its operation and without disconnecting anything.

The erasing impulse is applied to the anode A1 of the tube-images. This impulse is selected with appropriate amplitude, and phase, at the "foot" of the roller grid of the blocked image oscillator.

It should be noted that the output sound transformer, firstly located on the F.M. plate, near the final valve EL84, has had to be taken off and placed much further away because its presence caused "sound on vision" by induction on the last F.M. vision transformer as soon as the level of sound was increased. Also, the image output transformer, placed under the tube, distorted the image by magnetic radiation.



Plan view of the receiver.

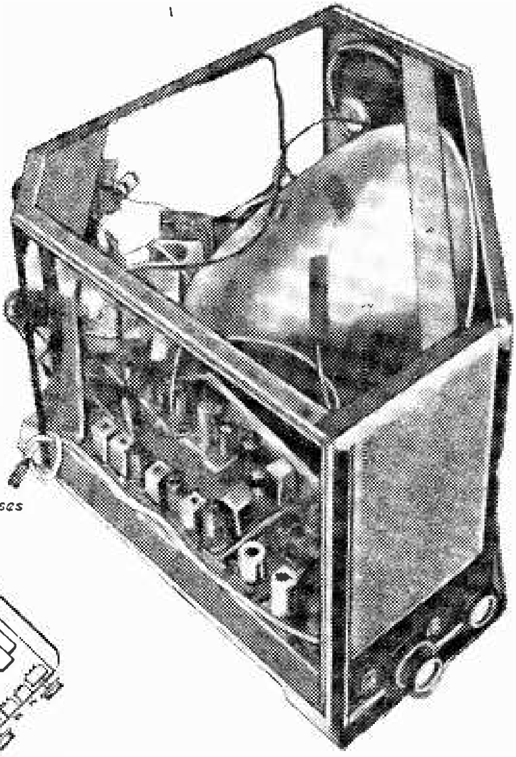
F.M. Coils

The super-coupled M.F. vision transformers are made on LIPA formers of 8 mm. diameter, normal model. The primary L1 comprises 15 turns, whereas the secondary L2 has about 12. The two rollers are arranged in "bees nests," and the coil L2 is arranged by interposing a layer of paper to slide along the tube.

The number of turns indicated above has been voluntarily fixed at a too high value, adjustment for the frequency of the F.M. band transmitted being done by progressive uncoiling of the turns, to allow for correct trimming.

At the beginning of the adjustment operation coils L1 and L2 are separated by at least 8-10 mm. Then they are brought together progressively, while adjusting agreement by the nut L2, until the desired curve is attained, and without touching the nut of L1. The spacing between L1 and L2 is normally of the order of 1 to 3 mm.

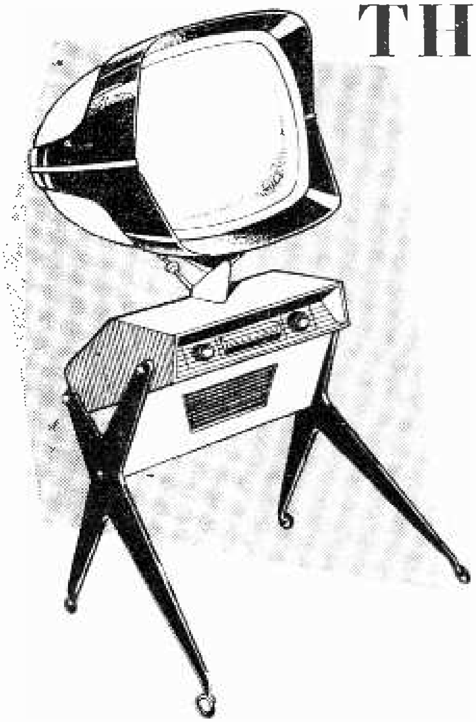
This operation, which sounds complicated on paper, is relatively easy if use is made of a spot wobbler or a wobble-scope. The same result can be achieved with a non-wobbled generator and an output voltmeter by the point to point method, but more time is required. One should, of course, begin with the pre-detection transformer and move towards the input.



A side view showing the interior.

THE TELEAVIA

ANOTHER FRENCH RECEIVER DESCRIBED IN OUR FRENCH CONTEMPORARY



A French design with panoramic screen.

THE French firm of Teleavia which has already upset aesthetic preconceptions in regard to television cabinets with its visiered case has now produced the Teleavia with panoramic screen.

What are the real arguments in favour of this product, compared to table cabinets? Should the console be moved as easily as the tables on castors on which television cabinets are often placed? The shape of these pieces of furniture, their size and weight, are major obstacles to their mobility, even though they are on castors. Is the sound reproduction better? For table cabinets, the argument is that the loudspeaker, or loudspeakers are situated on the actual axis of the image. But this advantage is paid for dearly because it must not be forgotten that, to reach up to the axis of the screen, nowadays situated at some 80 cm. from the floor, one would practically need to have a cupboard.

This makes it necessary to look at television while seated in a low armchair. This requirement can be very inconvenient, and not even always possible.

These were the ideas that caused "Teleavia" to solve the problems posed, and they have done it in a particularly audacious way.

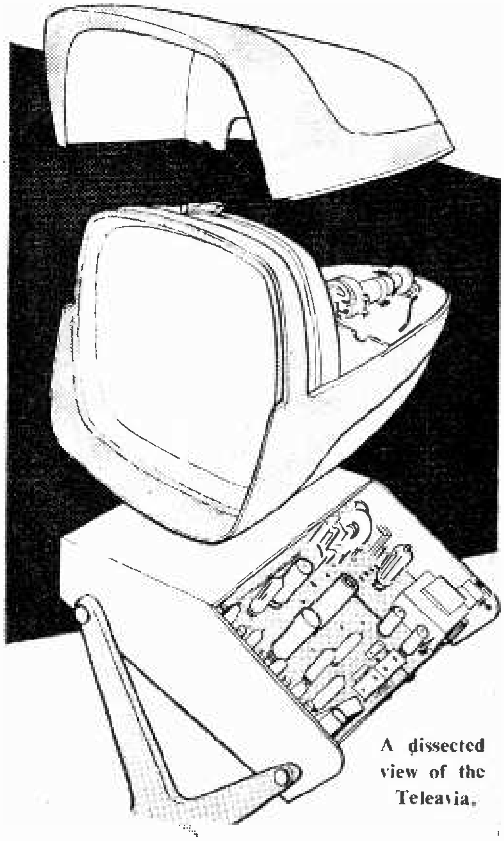
The thing that strikes one at once, in examining the "Teleavia" cabinet, is the large 54 cm. cathode tube, totally enclosed in truly aerodynamic fashion by two plastic half-shells. This assembly rests on a very low cabinet containing the chassis, connected to it by an articulated system allowing the screen to be aimed in all directions.

The cabinet itself is supported by two legs equipped with semi-spherical rollers. On the front face of the cabinet an attractive gold instrument panel groups together all the control buttons. The loudspeaker is mounted on a large baffle located between the legs. The ensemble is very harmonious in appearance and comprises two tints.

Let us examine the advantages of this assembly: the most important of these is the mobility of the screen both horizontally and vertically. As the screen is at an average height of 1.15 metres from the ground, it can be adjusted perfectly towards spectators, whatever may be their position in relation to the apparatus. Now here is a sensible thing. Furthermore, this directional movement allows the screen to be adjusted, if necessary, so as to eliminate undesired reflections impairing view. The mask of the tube discretely emphasises the surround of the screen, without excessive heaviness, so giving the impression of a much larger image.

The centre of gravity of the console has been particularly carefully studied, and movement is very easy. The sound comes from the axis of the picture, which reinforces the effect of presence.

It should also be noticed that by this arrangement the cathode tube is particularly well protected from dust.



A dissected view of the Teleavia.

Servicing TELEVISION RECEIVERS

No. 39—A SELECTION OF MODELS IN THE G. E. C. RANGE

By F. E. Apps

THERE are many other models marketed by the G.E.C. that have an identical chassis, with some minor modifications, to the 1746. They are the BT4743, which is a console model with a 14in. tube, the BT5643, which has a 16in. tube and has a different valve line-up. Here V11, V13, V15 and V17 are PL82, KT36, U25 and PL82. Some components have different values. They are R49 the cathode bias resistor of the sound output valve, which now becomes 270 ohms and the line output valve screen feed resistor which is now 1.8K ohms. Also C79 and R71 across L32 width coil become a single 12K ohm resistor only, and a 50 pF 5Kv P.S.M. capacitor is fitted from V14, booster diode, cathode, to chassis.

Model 2745 has a 7401A, 17in. tube, and the differences in circuit from 1746 are R51, C68 and C96 which are missing. The first two are in brightness circuit and the other C96 from heater of EHT rectifier U43 to ground. R50 22K now goes direct to the slider of brightness control. R55 to vision interference limiter becomes 100K and R58 connected to hot end of brightness control becomes 56K. Some 2745 receivers have a Mullard 43-64 tube, in which case pins 7 and 11 of the tube are connected.

Model 8640 has a 16in. 6901A tube. With this model R51 and C68 are missing. R50 is connected to slider of brightness control. R55 is 100K and R58 is 56K ohms.

Model 1252 has a 14in. tube, 7203A, and although the chassis are similar the I.F. frequency is different from the 1746, which is 35.625 Mc/s. In the 1252 it is 36.15 Mc/s. In some of these sets the video amplifier cathode bypass is 1200 pF or sometimes two 815 pFs in parallel.

Models 5248, 5347 and 8245 are all consoles with 17in. tubes but with a different style of cabinet. The Band III A and B core adjusting screws on the tuner units are fitted with slotted plastic knobs. Vision may be troublesome to eliminate, especially as oscillator setting is very critical. In cases of this sort a slight adjustment of L18, auto transformer to grid of V3, will cure the trouble. L18 is directly behind sensitivity control on the sub deck.

Additional Notes on Models BT1746 and BT4743

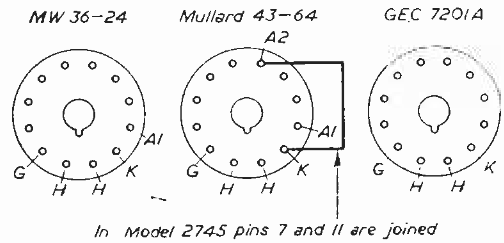
Some of these models are fitted with G.E.C. 7201A tubes and others with Mullard 36-24 tubes. Besides having different bases there are several other points that should be noted if tubes are changed over. The Mullard tube has an ion trap whereas the G.E.C. use a magnet to correct neck cut-off, i.e., corner shadowing. Should a Mullard tube be fitted in place of a G.E.C. the following circuit corrections should be made. Delete C73 and C96.

Adjustment of Beam Centering Magnet

The adjustment of this magnet (on G.E.C. tubes 6901A and 7201A only) is different from that of an ion trap. The magnet should be positioned not for maximum brightness but for freedom from neck shadowing. The magnet should be positioned as near the cap of tube as possible and then rotated and, if necessary, moved slightly forward along the neck with further rotation until best position is found. Do not go too far forward, otherwise it will be impossible to centre the picture. The brightness should not be affected if magnet is correctly positioned. The arrow on magnet should point towards the screen.

Changing of Valve V2

This valve, the frequency changer, may be either a PCF82 or an LZ319. If a PCF82, C23 is 16 pfd, but if an LZ319 it should be 10 pF.



Cathode ray tube base connections.

Alignment Notes for Model BT1252

For Band III channels adjust oscillator trimmer for maximum sound. Adjust aerial and R.F. trimmers for maximum picture brightness. Readjust oscillator for maximum sound on vision. Readjust aerial and R.F. trimmers for optimum picture.

For Band I Channel

Adjust gauged tuning control to give best sound with optimum picture. When making last adjustment turn control in anti-clockwise direction and then a slight turn clockwise. Number of turns in a clockwise direction for any Channel 1 to 5 are as follows, starting from Channel 1 as zero, i.e., as when despatched. Channel 2, 4¼ turns: Channel 3, 6¾ turns: Channel 4, 9¼ turns: Channel 5, 11¾ turns. The Band I core adjusting screws are connected together by a bar. This bar is controlled by a fourth screw at the end of the gauging mechanism. Thus all three tuning cores are operated together. The screw is accessible through a hole in side of base board assembly near the fine tuner control. The oscillator core for Band I should not be touched. This has been pre-set in the factory and normally will remain O.K.

The I.F. Link in Model 1252

This "link" consists of L12 and L18, is very critical and normally should not be touched or adjusted. Should they, however, be altered accidentally, readjustment can be made as follows. Connect a D.C. voltmeter to anode of video valve and chassis. Connect an A.C. voltmeter across primary winding of output transformer. Feed an unmodulated signal of 36.15 Mc/s into I.F. input socket of I.F. sub deck and adjust L18 for maximum vision response. Reconnect the I.F. "link" between tuner and I.F. subdeck and feed an unmodulated signal at I.F. vision frequency, i.e., 34.65 Mc/s, to control grid of V2A (pin 2), then adjust L12 for maximum vision response.

CLOSED CIRCUIT TV

To Make Passenger Announcements at West London Air Terminal

FOR the first time in Europe television is to be used to make passenger announcements at an air terminal. West London air terminal, the London air terminal of B.E.A. and most other European air lines, has installed a closed-circuit television system so that flight announcements and general information can be presented to passengers in a more personal manner. Attractive announcers will be seen giving details of flight departures, which will be followed by a caption repeating the information for the assistance of passengers.

When the screens are not required for announcements they will be used for advertising purposes. Mr. I. C. Pannaman, of Audio and Video Rentals, Limited, the firm which is providing and operating the system, said today: "Other air terminals have already shown an interest in the use of television for making passenger announcements, and it is expected that several other places in the British Isles will follow the lead given by Air Terminals, Ltd., who run the terminal for B.E.A." The installation consists of eight 21in. contemporary Pye receivers—five in the upstairs passenger lounge, and three in the main hall on the ground floor. A small studio with a miniature Pye television camera will be staffed by one camera operator and an announcer. The "station" will be in use from six o'clock in the morning until 10 o'clock at night.

Revolutionary Results

Although television is already firmly established in industry and research, it is as a public relations and advertising medium that some revolutionary results are likely in the near future. Already, for example, Madame Tussaud's in Blackpool have installed a TV system to show holiday makers on the promenade the attractions inside the waxworks. Pictures of the controversial Epstein statue, "Genesis," as well as a wide variety of figures, are displayed on screens in the window to entice the public into the establishment.

The new West London air terminal installation provides another example of how the scope of "poster" advertising may well be widened in the near future to include a second and third dimension of sound and movement.

CUBICAL QUAD AERIAL

(*Concluded from page 579*)

in the support arms and in the case of the reflector loop the ends are soldered together. For the driven loop the two ends are supported on a small board and connected to the feeder cable. A small perspex or paxolin board is used to support the cable joint, and the two ends of the loop and the end of the feeder cable are clamped to this board with cable buckles or some similar form of clamp. The two ends of the loop are then soldered to the core and screen of the cable with the lower end of the loop connected to the screen. In the case of vertically polarised aerials the joint to the cable is made exactly halfway up one of the vertical sides of the aerial. For horizontally polarised aerials the joint is made at the centre of the bottom side of the aerial loop.

For indoor installations the cable should be taken off at right angles to the loop. In the case of outdoor installations the cable is taken back to the centre of the boom and clamped there before it runs down the mast.

After the cable joint has been soldered the join should be covered with wax to keep out moisture. If the aerial is to be used outside, the woodwork should be painted to protect it against the weather.

An alternative method of construction which may be used in the loft is to support the two loops at their corners by means of cords fixed to the rafters and joists in the loft. The two loops must be placed at the correct spacing and must be aimed in the right direction.

The aerial should be positioned with the cross beam pointing in the direction of the station and the driven loop nearest to the station. In cases where ghosting or ignition interference are present the position of the aerial may have to be altered to reduce these effects, provided there is sufficient signal available.

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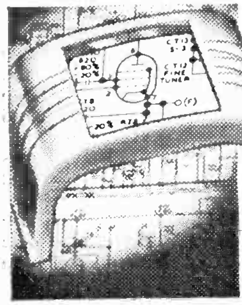

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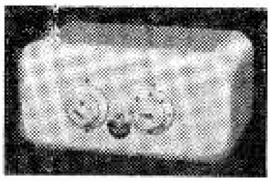

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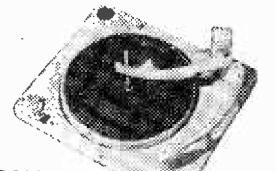


COLLARO 4-SPD. MIXER AUTO-CHANGERS

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

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

B.S.R., type UA8, 4-spd., with latest B.S.R. ful-fi P.U., **£7.19.6.** Post paid.

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

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

R.S.C. TRANSFORMERS

Fully Guaranteed
Interleaved and Impregnated.
Primaries 200-230-250 v. 50 c/s screened

TOP SHROUDED DROP THROUGH

260-0-260 v 70 ma. 6.3 v 2 a, 5 v 2 a ... 16/9
350-0-350 v 80 ma. 6.3 v 2 a, 5 v 2 a ... 18/9
250-0-250 v 100 ma. 6.3 v 4 a, 5 v 3 a ... 23/9
350-0-350 v 100 ma. 6.3 v 4 a. 5 v 3 a ... 23/9
350-0-350 v 150 ma. 6.3 v 4 a. 5 v 3 a ... 29/9

FULLY SHROUDED UPRIGHT

250-0-250 v 60 ma, 6.3 v 2 a. 5 v 2 a Midget type 2½-3-3in. 17/9
250-0-250 v 100 ma, 6.3 v 4 a, 5 v 3 a ... 26/0
250-0-250 v 100 ma. 6.3 v 6 a. 5 v 3 a for R1355 Conversion 31/-
300-0-300 v 100 ma, 6.3 v 4 a. 5 v 3 a ... 23/9
350-0-350 v 100 ma. 6.3 v 4 a, 5 v 3 a ... 23/9
350-0-350 v 150 ma. 6.3 v 4 a. 5 v 3 a ... 33/9
425-0-425 v 200 ma, 6.3 v 4 a, C.T. 6.3 v 4 a, C.T. 5 v 3 a 49/9

FILAMENT TRANSFORMERS

All with 200-250 v 50 c/s Primaries : 6.3 v 1.5 a. 5/9 ; 6.3 v 2 a. 7/6 ; 0-4-6.3 v 2 a, 7/9 ; 12 v 1 a, 7/11 ; 6.3 v 3 a, 8/11 ; 6.3 v 6 a, 17/9.

CHARGER TRANSFORMERS

200-250 v 0-9-15 v 1½ a. 11/9; 0-9-15 v 3 a, 16/9; 0-9-15 v 5 a, 19/9 ; 0-9-15 v 6 a, 22/9.

OUTPUT TRANSFORMERS

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

SMOOTHING CHOKES

250 ma 5 h 50 ohms 11/9
100 ma 10 h 250 ohms 8/9
80 ma 10 h 350 ohms 5/6
60 ma 10 h 400 ohms 4/11

SELENIUM METAL RECTIFIERS

250 v 250 ma. 11/9 ; 120 v 40 ma, 3/9 ; 6/12 v 1 a F.W., 4/11 ; 240 v 50 ma, 4/11 ; 6/12 v 2 a F.W., 8/9 ; 6/12 v 4 a, 14/9 ; 250 v 80 ma, 7/9 ; 6/12 v 6 a F.W., 19/9 ; 6/12 v 10 a, 25/9 ; 6/12 v 15 a. 35/9 ; 24 v 2 a, 14/9.

CO-AXIAL CABLE ¼in.

75 ohms 14/36 ... ... 8d. yd.
Twin-screened Feeder ... ... 11d. yd.

BATTERY SET CONVERTER KIT

All parts for converting any normal type of Battery Receiver to A.C. mains 200-250 v 50 c/s. Supplies 120 v, 90 v or 60 v at 40 ma. Fully smoothed and fully smoothed L.T. of 2 v at 0.4 a to 1 a. Price, including circuit, 49/9. Or ready for use, 9/9 extra.

ALL DRY RECEIVER BATTERY ELIMINATOR KIT.—All parts for the construction of a unit (metal-case 5½-4½-2in.) to supply Battery Portable receivers requiring 90 v and 1.5 v. Fully smoothed. From 200-250 v 50 c/s mains. Price, inc. point-to-point wiring diagrams, 39/9. Or ready for use, 45/9.

EX-GOVT. DOUBLE WOUND STEP UP/STEP DOWN TRANSFORMERS

10-0-100-200-220-240 v to 5-0-75-115-135 v or REVERSE. 80-100 watts. Only 12/9, plus 2/9 post. 10-0-100-200-220-240 v to 9-0-110-122-136-148 v or Reverse. 200 watts, 35/9, plus 7/6 carr. Both 50 c.p.s.

EX-GOVT. CASES. Well ventilated, black crackle finished, undrilled cover. Size 14 x 10 x 8½in. high. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage. Size 13½ x 8½ x 6½in. with undrilled perforated cover finished stoved grey enamel, 7/9, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1R5	7/9	6J6	4/9	6AT6	7/9
1T4	7/9	6K7G	3/9	DF96	8/9
1S5	7/9	6Q7G	9/11	EBC33	6/9
3S1	8/9	6X5GT	7/9	EB91	8/9
5Y3G	7/9	6SN7GT	8/9	ECC91	4/6
5U4G	8/9	6L6G	11/9	EF80	8/9
6J5G	4/9	807	7/9	EF50	4/9
6K8G	9/9	12A6	7/9	EL32	3/9
6S7JGT	6/9	25Z4G	9/9	EL81	10/6
6V6G	7/9	35Z4	6/9	EL91	5/9
6U5G	3/9	MH4	4/9	KT66	11/9
				SP61	2/9

EX-GOVT. MAINS TRANSF.

Removed from New ex-Govt. units. Primary 0-200-130-250 v. Secs 275-0-275 v 100 ma, 6.3 v 7 a, 5 v 3 a **21/9**

All 200-250 v 50 c/s input.

230-0-230 v 80 ma, 12.6 v 1.5 a, 5 v 2 a ... 11/9
250-0-250 v 150 ma, 5 v 3 a 16/9
350-0-350 v 160 ma, 6.3 v 5 a, 5 v 3 a ... 27/9
400-0-400 v 250 ma, 5 v 2 a, 5 v 2 a ... 18/9
450-0-450 v 150 ma, 6.3 v 5 a, 6.3 v 1 a, 5 v 3 a 29/9
450-0-450 v 250 ma, 6.3 v 3 a, 6.3 v 1 a, 5 v 6 a 49/9
12.5 v 3 a, 5 v 3 a 12/9

EX-GOVT. SMOOTHING CHOKES—

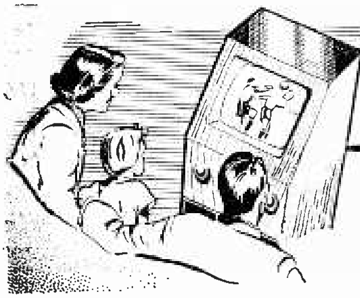
80 ma 10 h 150 ohms 3/11
100 ma 5 h 100 ohms Tropicalised ... 3/11
100 ma 8-10 h 100 ohms Parmeko ... 6/-
120 ma 12 h 100 ohms 9/9
150 ma 6-10 h 150 ohms. Trop. 6/9
150 ma 10 h 150 ohms 11/9
100 ma 20 h 200 ohms 19/9

ELECTROLYTICS (NEW)

Tubular		Can Type	
8 mfd 450 v	1/9	8-8 mfd 450 v	2/11
16 mfd 450 v	2/9	8-16 mfd 450 v	3/11
8-16 mfd 500 v	4/11	16-16 mfd 450 v	4/11
25 mfd 25 v	1/3	32-32 mfd 350 v	4/9
50 mfd 12 v	1/3	32-32 mfd 450 v	5/9
50 mfd 50 v	1/9	150 mfd 450 v	5/9
100 mfd 25 v	2/3	100-100 mfd 350 v	5/9
3,000 mfd 6 v	3/9	100-200 mfd 275 v	6/11
6,000 mfd 6 v	3/11		

BATTERY CHARGERS.—For mains 200-250 v 50 c/s. Output for charging 6 v or 12 v at 1 amp. In strong metal case. Only 27/9. Above can also be used for electric train power supply.

D.C. SUPPLY KIT.—Suitable for Electric Trains. Consists of mains trans. 200-250 v 50 c.p.s. A.C. 12 v 1 a Selenium F.W. Bridge Rectifier. 2 Fuseholders, 2 Fuses, Change Direction Switch, Variable Speed Regulator. Partially drilled Steel Case, and Circuit. **29/9**



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

The George Mitchell Glee Club

ONE of the brightest and slickest musical half-hours of the week is the George Mitchell Glee Club. This is notable for its professional polish in all departments, particularly the very original production work of Russell Turner and the dance arrangements of Dennis Bettis. The producer is not afraid of playing with technical tricks, such as "inlay" and "overlay," which are cleverly introduced into some of the musical numbers. I particularly liked the electronic trick which gave the effect of little figures, cut out of newspaper, dancing and singing. But, of course, the backbone of the show is the fine singing of the George Mitchell vocalists, whether in a straight number or in a speeded-up comedy sound effect.

Versatile Engineers

THE Wales and West I.T.A. Station is now running very smoothly, steadily gaining "customers" both in the number of viewers and the lengthening of the queue of advertisers wishing to book space. Walter Kemp, the genial young engineer who did such a lot of development work for the BBC and for High Definition Films on telerecording, combines the job of Chief Engineer with that of General Manager of the studios. Assisted by a first-class engineering team, he selected and installed what he considered to be the best equipment for each particular job in the electronic chain rather than give the technical equipment contract to one firm as a "package" deal. Thus, when I visited the station recently I was interested to see a mixture of Marconi, Pye and E.M.I. television cameras and control equipment, with E.M.I. and Cintel telefilm apparatus, all operating together in a first-class manner. Kemp has added a small 16mm. film department, which secures news shots, puts them through an automatic developing apparatus about the size of a large home washing machine, and adds them as a local supplement to the Independent Television News. The main studio, 60ft. × 80ft., is first-class, too, with about 40 dimmed lighting circuits controlled through one of those fascinating Strand Electric organ controls. Here the lighting engineer sits and does his job by pressing keys and pushing pre-set memory tabs of lighting arrangements. He is the equivalent of the lighting cameraman of the film studios, a man who must have a feeling for composition, tonal values and artistic expression, backed up by sound knowledge of electronics. There aren't many of this type of arty-crafty engineers about.

Telecine Equipment

I WAS agreeably surprised at the quality of the telecine transmissions I saw, both of 16mm. and 35mm. film. The Cintel flying-spot scanner was excellent as usual, but I was particularly interested in the highly satisfactory results on the E.M.I. Vidicon telecine equipment, of which there are two at this studio. It now appears to me that, given a really good print, first-class quality and sharpness can be obtained with 16mm. film. The major difference seems to be in a slight unsteadiness which seems to haunt the 16mm. picture. This is probably due to the fact that almost all the 16mm. projectors used for telecine in this country are designed for occasional home or classroom use, not for heavy duty professional operation, hour after hour, week after week.

Jack Hylton

JACK HYLTON, famous impresario and ex-dance band leader, has certainly gone into television in a big way. His various live and filmed television features have steadily grown in popularity, particularly his *Monday Show* and *Thursday Show*. Hughie Green achieved a terrific come-back in the *Double Your Money* programmes, and Jack Hylton, always a shrewd judge of top-talent, recently starred him in *The Monday Show*. Hughie is a fine commentator and interviewer, able to draw the best out of his interviewees and ever ready with the impromptu "ad-lib" line or gag, if the interview shows signs of flagging. This was hardly the case when he was interviewing that grand old actor, A. E. Matthews, or the taxi-driver Fred Borders. The rapid exchange of observations and opinions was an exposition of the television interview at its liveliest best. Jack Hylton has gradually built up a fine programme organisation of script writers, producers and production personnel and his influence in the I.T.A. field will continue to grow. It is significant that he is one of the largest shareholders in T.W.W., a programme company which is quite independent but has an arrangement for interchange of programmes with Granada.

Television Society

THE Television Society's annual dinner at the Dorchester was one of the pleasantest social events of the year, attended by professional and amateur television engineers and their ladies, who mingled with guests from the stage, screen, art, advertising and equipment worlds. Sir George Barnes, the new President, introduced the speakers, which included Sir Charles Wheeler, President of the Royal Academy, Sir Harold Bishop, the BBC's Director of Technical Services and Sir Donald Wolfit.

One of the high-spots of the evening was the presentation of the Society's medal to Cliff Michelmore, as the television personality of the year. As was to be expected, Cliff responded with an "off the cuff" speech given in that pleasant relaxed manner which has won for him such a large circle of viewers for *Tonight*. Not many interviewers —or actors, for that matter— succeed in achieving the blessed state of complete relaxation in front of the television camera, and at the same time do their particular job in hand. Ludovic Kennedy, Perry Como, Tony Hancock and Mac Hobley are a few of the people who have achieved it. Notice that they are all men!

This television function formed a suitable prelude to the first European Television Exhibition, which commenced a day or so later, not far away, in Park Lane House.

The I.T.A. Network

IT is quite natural that advertisers prefer to book commercial "slots" with the provincial area programme companies at peak viewing times, when they expect their commercials to be fitted into slots in well-established programmes, known to have high audience ratings by the Nielsen or TAM organisations. The Independent Television Authority keeps a fatherly eye on the activities of the provincial programme companies and insists that the quota of programmes of local origin shall not be less than 15 per cent. of the total programme time each week. This means that Cardiff, Manchester, Glasgow and the other provincial I.T.A. centres must put on at least 5½ hours of local material a week. It doesn't sound much, but it is not easy to achieve without a large staff, plenty of equipment and adequate stage space for rehearsals as well as the actual shows. Week after week, top viewing ratings have been taken by "The Army Game" (Granada), "Take Your Pick" (A-R) and "Emergency Ward 10" (A-TV), and it is only natural that these and similar programmes should be largely sought—and bought—by the other programme companies.

Regional News

SINCE the Independent Television News started operations, its popularity has grown and the average weekly time allocated to it has increased from 160 minutes to 185 minutes. In the Midlands, Northern and Welsh areas, the local programme companies add about five minutes a day of local news supplement, a popular item which contributes about half-an-hour a week to the 15 per cent. local programme quota. This is either locally shot 16mm. film or live news or interviews in the local studio. 16mm. film, processed in the local studio, with its sound recorded on a magnetic strip on the same film, opens up great possibilities for increasing local news coverage and providing "open air" items for regional non-advertising magazines. It is a very economical operation, since only negative picture is required—positive pictures being obtained from transmission, merely by a phase reversal switch.

The Provincial Touch

BOTH the BBC and the I.T.A. programme organisations have taken practical steps to reduce the near-monopoly of the television programmes by their London Studios. Almost every month, the BBC or I.T.A. seem to be announcing the opening of new television studios in provincial centres. Nevertheless, the regional influence is not often felt, especially during the peak hours of viewing. Local contributions seem to be principally confined to the day or early evening, restricted to the area of origin and rarely networked to the nation.

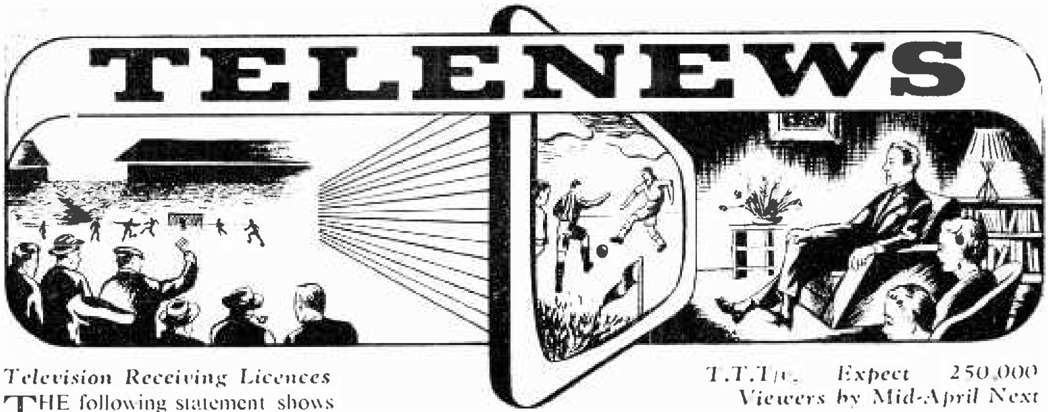
As might be expected, the I.T.A. programme companies in provincial regions "rubber stamp" the London network programmes less than the BBC provincial centres. Indeed, quite a lot of Granada, A-TV and ABC-TV network presentations come from their studios in Manchester and Birmingham. It is significant, however, that Granada's London "branch" studio at the Chelsea Palace is often used for "Granada From the North" programmes, and this important theatre studio has also been hired by ABC-TV. Programmes from T.W.W. and Scottish Television are not often seen in the London area, though some of them are highly popular in their own areas.

Developing Machine

A very simple developing machine has been designed by Newman and Guardia Limited, which develops, fixes, washes and dries either 35mm. film or 16mm. film at the rate of 40ft. per minute. There is a special 16mm. only model which does the job at double this speed. Called the "Lawley Junior," it is the 1958 model of a type of processing machine which has been used in cinema film laboratories for many years. Its automatic temperature control of developing solution and drying compartment, its continuous recirculation of the developing solution to provide agitation and a compressed air device to prevent carry-over of solutions from tank to tank, make this a simple device to operate. Making prints from the negative, if they are required, is a much more complicated operation, requiring additional equipment and a highly skilled technician. Printing is, therefore, usually handled by one or other of the established film laboratories.

"Spectacular" Shows

THE word "spectacular," used as a noun, is a product of the American television world. It is the ambition of many artistes, male and female, to be engaged for one of the American networked "Spectaculars," particularly if it carries their own name in the title. A spectacular implies elaborate staging, precision dancing by a large troupe, top-class script writing, experienced stooges suitable for building up the star and—most important of all—a specially orchestrated musical background, with a fine orchestra and possibly a choir. How wonderful it is for a performer to "lean back" and wallow, completely relaxed, in the luxury of all this dressing.



Television Receiving Licences

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

Region	*Total*
London Postal	1,589,544
Home Counties	1,002,897
Midland	1,308,321
North Eastern	1,312,820
North Western	1,140,843
South Western	632,285
Wales and Border Counties ...	469,814
Total England and Wales ...	7,456,524
Scotland	604,068
Northern Ireland	86,741
Grand Total	8,147,333

Subliminal Messages

PLANS to test subliminal perception have been announced by an independent television station in Los Angeles. During the next three months it will flash "public service" messages such as "Drive Safely" on screens at speeds impossible to see consciously.

If it is found that viewers absorb the messages similar experiments will be made with commercial advertisements. The three major television networks have said they will not allow this technique at least until the Federal Communications Commission has given its verdict.

Television Relay for Hawick

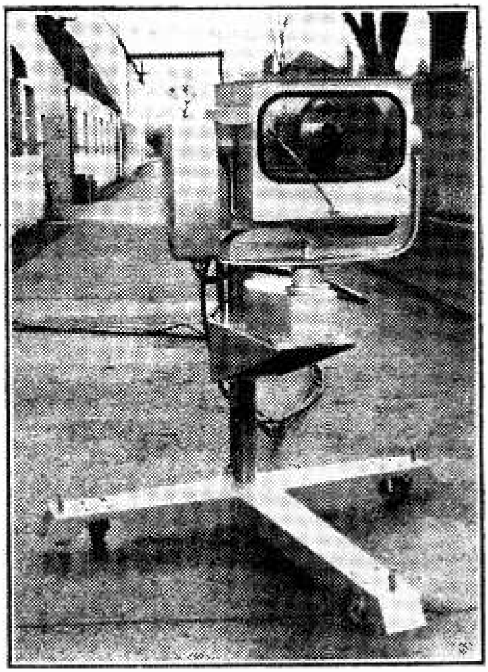
AT Hawick, in Scotland, a radio and television relay system has recently been completed by Relay Systems (Hawick) Ltd. This installation gives subscribers in Hawick, previously regarded as a poor area for television reception, a choice of BBC and Commercial television programmes and two alternative sound broadcast programmes. All the cables for the system were supplied by British Insulated Callender's Cables Limited and were manufactured in their plastic-cables factory at Helsby.

The first cable to be erected was the main feeder from the mast-mounted aerial array sited on a hill outside the town, where good signal strengths were available, to an amplifying and distribution station near the centre of the town.

Pye Industrial TV Camera

THE Pye industrial TV camera, which has a specially sealed housing, has been designed for outdoor observation at an explosives factory. The camera and its various attachments are remotely controlled.

Some of the facilities with which the camera is provided include a weather-proof housing that is also explosive dust-proof, a remotely controlled lens change unit, and a demisting device which blows warm air on to the polished plate-glass window.



The special Pye industrial camera.

T.T.Tv. Expect 250,000 Viewers by Mid-April Next Year

A POTENTIAL audience of 250,000 for Tyne Tees Television transmissions is expected by mid-April next year, states Mr. Peter Paine, sales controller, in a letter to leading advertising agents.

It is estimated that the Tyne Tees transmission area contains 2.66 million people (approximately 880,000 homes), of whom 2.5 million live in the primary service area, and that 20 per cent. of all homes will be able to receive the transmission on opening night, January 15, 1959.

Southern Television

WHEN Southern Television, the new independent TV station for the south goes on the air from August 30, its transmissions will cover an area of more than 3,500 square miles and a population of between two-and-three-quarter and three million.

The expected area of coverage stretches from Weymouth in the west to Brighton in the east and northwards to Newbury in a rough D-shape.

Already television dealers are reporting good reception of test signals in towns throughout the region, from Brighton to Bournemouth, and Swanage to Southampton. This early test signal is at a very low power, of one kilowatt from a temporary mast only 75ft. high. Full power test signals of 100 kilowatts from the main 750ft. high mast are due to go out from August 1.

The signal now going out is designed to help dealers adjust sets and align aerials ready for Southern Television's opening night programme on August 30.

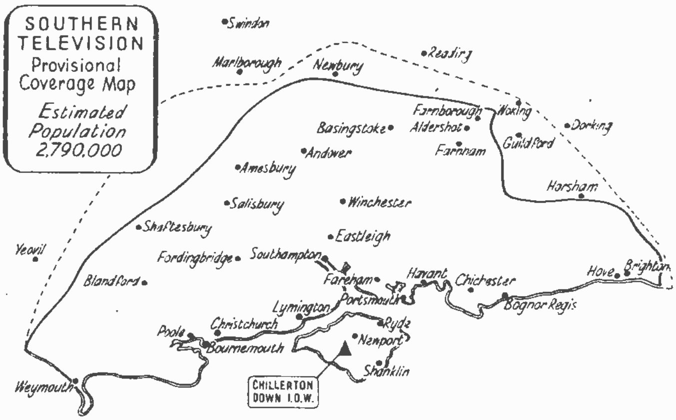
First European Television Exhibition

SEATED at his desk in Post Office Headquarters, Mr. Ernest Marples, the Postmaster General, opened the first European Television Exhibition, which was being held several miles away, without even moving from his chair. He was using a system of closed circuit television.

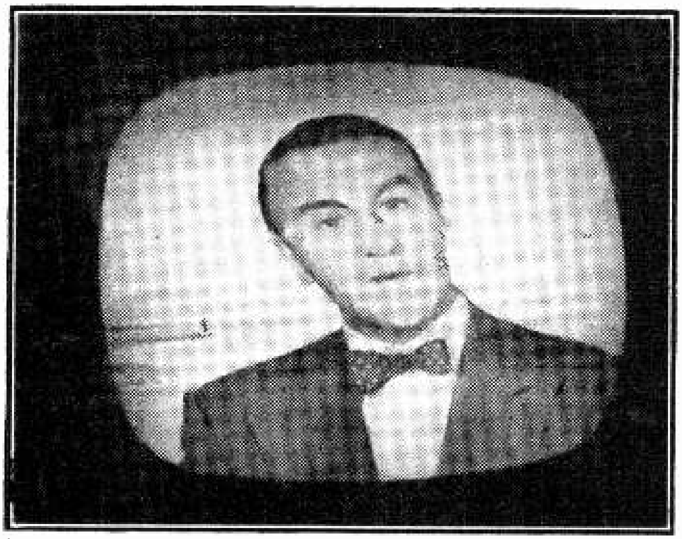
At the exhibition which was held at Park Lane House, the guests saw Mr. Marples on nine TV monitor sets placed in key positions in the various sectors of the exhibition.

The closed circuit equipment was installed by Pye. In recent months there has been an increasing demand for closed circuit television from industry. It is already being used for observation of radioactive materials, guided missiles at the moment of launching, for traffic control at crossroads, and the control of unattended level crossings.

Exhibitors from several European countries took part in the exhibition, including a Finnish company that makes TV films for Russia.



A map showing the coverage of Southern Television.



Mr. Marples as seen on the monitor sets at the First European Television Exhibition.

19 Million Can Watch TV

FOURTEEN MILLION more people can watch ITV programmes to-day than two years ago, reports Television Audience Measurement Limited. To-day's total is over 19 million, compared with 12 million this time last year and only five million in May, 1956.

Extended Hours For Test Signals

SOUTHERN TELEVISION arranged with the Independent Television Authority to increase the hours of transmission of the test signal from Chillerton Down, Isle of Wight.

It came into operation on May the 19th, and signals now go on the air for 12 hours daily from 10 a.m. to 10 p.m. from Monday to Saturday inclusive. (There will be no transmission on Sundays.)

This major extension from 37½ to 72 hours each week has been made to help retailers within the Southern Television region during what will be an extremely busy time, and it is hoped that they will be able to take full advantage of it.

These hours of transmission will continue during the broadcasting of the full-power signals of 100 kilowatts E.R.P. scheduled to begin in August.

CORRESPONDENCE

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

PROJECTION TV

SIR.—You have rightly said on a number of occasions that the TV tube looks wrong, and that a thing which looks wrong is wrong. Yet many of the firms who market projection television receivers have discontinued them. From this, I must conclude that it is a failure, and I am wondering whether you have had second thoughts on the matter. The disadvantage that the picture becomes blurred when side viewing and is only clearly visible to those who are looking square on to the picture is, I know, one of the greatest disadvantages, but I should have thought that it would not be beyond the ability of our designers to overcome this. I am also aware that, as you increase picture size, brilliance is diminished because it has not yet been found possible to amplify light as we can amplify sound. The greater cost of projection TV receivers is a further disadvantage but I cannot believe that this is the main reason for its decline since hire purchase terms would make its purchase fairly easy. Friends of mine who have owned such receivers have told me that they were frequently in trouble with them and that maintenance and replacement cost were frequent and high.—E. N. (Enfield).

[We have not changed our views on this matter and we think that when it is possible to produce a projection TV set at a price comparable with that of, say, a 21in. direct vision receiver, it will regain its popularity. The recent announcement that a method of amplifying light has been discovered may eliminate the criticism that the pictures are less brilliant and improvements in the optical system may eliminate the side viewing dimness. The optical system in its present form is the main drawback. A more compact design of receiver is possible by means of projection TV than with direct vision TV, and although many receivers have been withdrawn from the market, experiments continue.—ED.]

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.

BEGINNER'S GUIDE TO TELEVISION

SIR.—I became a reader of PRACTICAL TELEVISION after reading an announcement of your new series, now completed, entitled "A Beginner's Guide to Television." I was fascinated by the simplicity of that series because I had previously read a series for beginners in your companion journal *Practical Wireless*. That series was later reprinted in book form and I treasure my copy of it. Is there a possibility of the TV series being produced in similar form?—A. S. T. (Ipswich).

[As announced last month, "A Beginner's Guide to Television" will be published on July 17th at 7s. 6d., by post 8s. 3d.—ED.]

COLOUR TV

SIR.—Having recently visited America and watched some of the colour TV programmes, I can only say that, unless we can do something better, colour TV receivers in this country would be a flop, especially in view of the expense involved. It seems to me as crude as the Baird 30-line system of TV, and I certainly would not pay the very high price asked for one. The colour was crude and rather resembled some of the coloured horror comics published in America. I was told by dealers that the demand for them was practically non-existent, and those they had sold had been a continuous source of trouble. One dealer said that it had been marketed too soon. I know that experiments are continuing in this country, but the BBC is not yet ready for it, and I do not think the public is either. Most people seem satisfied with a monochrome picture. Personally, I should like to see the BBC spend its money on improving the programmes, and some of them are in need of it, rather than waste thousands of pounds on colour TV. It is my view also that colour TV will not depend upon a mechanical system as at present.
A. H. (Rotherham).

HOME-BUILT TV RECEIVERS

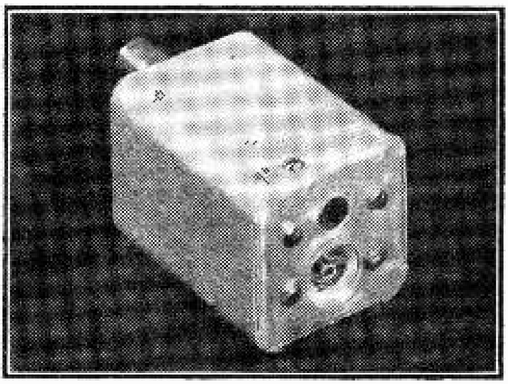
SIR.—I recently looked in on a home-constructed receiver installed in a friend's house and I was so astonished at the perfect results that I enquired the source of his design. My friend informed me that he had built it from the pages of your journal, and that it was called the "Supervisor." I was filled with a desire to build one myself and as a result I have become a regular reader of your paper and intend to build one of your receivers myself this autumn. I have been a reader of your companion journal *Practical Wireless* from its first issue, when it was a weekly, and I have every volume bound. I often browse through them with great interest. I also took your pre-war monthly publication, PRACTICAL TELEVISION, until it ceased publication owing to the war. I also have several of Mr. Camm's books on radio and television, and one which intrigues me at present is his "Television Principles and Practice" from which I learned all I know about television. His output seems so tremendous that at one time I thought he was a mythical character, until I met him at the Caxton Hall last year at the showing of the Mullard films. More power to you.—A. J. B. (Harrow).

News From the Trade

Picture Equaliser Unit

THIS is a small tunable filter unit which provides adjustable attenuation to Band I signals with only a very small loss on Band III. The unit plugs directly into the coaxial aerial socket on the receiver, the aerial feeder lead then being plugged into the socket provided on the equaliser.

When setting up the procedure is to insert the unit and then adjust the controls on the receiver for normal Band III reception. The receiver is then switched to Band I and the screw core on the



The Labgear picture equaliser unit.

equaliser adjusted until Band I reception is similar to that obtained on Band III. No further adjustment is required and the set can be switched from BBC to I.T.A. without needing any readjustment of the sensitivity or contrast controls.

In many areas the Band I signal is so strong that patterning interference results and, in addition to its normal function, the Labgear PE13 frequently removes this form of trouble.

The retail price of the unit is 10s. 6d. and initial supplies should be available this month.

13-Channel Turret Tuner

TWO Bakelite resins have played an important part in the development of the Fireball 13-channel turret tuner being used in many of the new television sets. The tuner is made by A. B. Metal Products Ltd., Abercynon, Glamorgan.

Based on an American patent the circuits, selectors and other components were specially designed and chosen for British television by Mr. J. K. Brown, the company's Chief Product Engineer, to make the Fireball, the first British tuner with 13 channels—the maximum number so far announced; nine being in daily use. It is less than a third of the size of earlier turret tuners developed to meet the rapid expansion of BBC and ITV services.

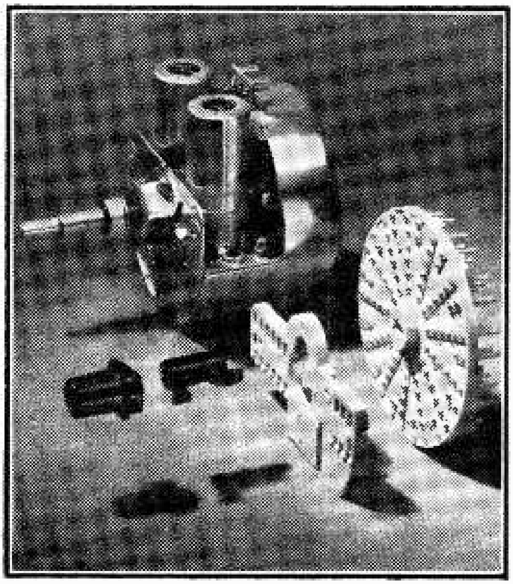
The tuner assembly is only 2in. deep and a fraction over 3in. in diameter; the control spindle projecting a further 2in. to the front and the valve shields and terminal lugs another ⅝in. to the top. The terms "top" and "front" are relative as the tuner may be installed in any position.

The heart of the tuner is a circular, white plate moulded from Bakelite alkyd DX18926 through which are mounted 104 metal pins. Between these lie the selector coils. On the reverse side the pin heads are arranged radially in sixes and pairs to mate with the selector arm, also moulded from Bakelite alkyd DX18926 which carries the corresponding eight metal contacts.

A feature of the manufacture of the plastic disc, apart from its high electrical stability and resistance to heat, frequency loss and tracking, is its intrinsic strength and lack of brittleness necessary for the insertion of the 104 pins. Raised identifying channel numbers 1-13 are part of the moulding.

Two further components made of Bakelite material, Phenolic Black X17165 form the fine adjustment mechanism of the tuner. The first moulding is a collar bearing a cam-shaped rear face, rigidly fixed to the outer "fine tuning spindle." The second is a spring-loaded ferrule carrying two teeth, one of which bears on the cam surface of the first moulding causing it to move in and out of the tuner by the rotation of the spindle, while the second tooth engages with the moving plate of a book condenser to give the fine tuning adjustment.

Three firms are manufacturing the mouldings, Kent Mouldings, of Footscray, Sidcup, Kent, and Cosmocord Ltd., Waltham Cross, Herts, making the Bakelite alkyd DX18926 parts, and Prestmare Ltd., of Raynes Park, London, making the X17165 Phenolic parts.



An exploded view showing the positions in the Fireball tuner occupied by the mouldings.

Your PROBLEMS Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 605 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

H.M.V. 1804

My main fault is line tearing. Instead of a perfect outline of an object I simply get a zig-zag, also my frame begins to close up from the bottom leaving approximately three-quarters of a full screen.—H. Smith (Salford).

On the front end of the chassis are situated the valves associated with the timebases. The KT61 at one end should be replaced. If this does not cure the bottom cramping check the associated .1 μF linearity capacitor for leakage. The line tear is usually caused by leakage through the .047 μF (replace with .05 μF) capacitor feeding the top cap of the centre Z63 (or KTZ63) sync separator.

EKCO T141B

These last five years when anything has gone wrong with the set I have taken all the valves out to be tested and had replacements needed, but it has now given trouble beyond me which I feel is concerning the contrast. When the set is first switched on it has an unusual "sizzling" noise. When the brightness control is turned up the screen becomes blank and bright with lines moving across it diagonally and it has no picture. If the contrast knob is turned up completely and then back again to normal the picture will right itself, but will repeat its blank and bright appearance for ten to fifteen minutes until the set is warmed up. After a short time the picture will go completely out of focus and will close in slightly about an inch from the right-hand side of the screen. Throughout a programme I have to continually refocus the set and adjust the brightness and contrast controls. After about two hours the picture seems to fade in quality and to lack contrast. Finally, twice recently the picture has closed completely, leaving a thin white line horizontally across the screen.—J. Underhill (Meir).

We cannot imagine one single fault which would give rise to all your symptoms at once, so we expect that it is a general ageing of components. Since your sound is not affected we suggest you look for your contrast fault in the vision I.F. stage, where it may be due to a faulty .001 ceramic decoupler (check by bridging with a known good one). Another possible symptom is grid cathode leakage on the tube, but the brightness will not be controllable if this is so. We suspect your 6P28 for lack of width and focus, and the 6K25 and SP61/41 next to it for intermittent frame collapse.

MURPHY V200—1952

When I switch on, "wicker-work" forms with gradual picture formation after approximately 20 to 30 minutes. Frequent adjustment is required to line hold due to (a) herring-bone effect across screen; (b) pulling to right at top of picture; (c) picture moves to left and right with eventual break-up; (d) picture will remain clear and steady for frequent intervals. I have changed pot 20 KΩ res. 39 KΩ, 47 pF capacitor. Had PL38 tested, found O.K. Would possible coil adjustments have any effect as above on picture?—M. E. Rooney (Liverpool).

You have described the common symptom of a faulty video amplifier anode load. This is a 10 K ohm 1 watt resistor and is underneath the I.F. chassis between the double diode and a coil. This normally overheats and goes low. Other possible causes of your trouble are overloading of the R.F. stages and a low H.T. rectifier.

BUSH TV22

I wish to add a turret tuner to the above set covering channels 3 and 11. Being within eight miles of both transmitters there is no need for any increase in gain. So could you please advise whether there is a type of tuner available with leads to tuner terminated with plugs, to plug straight into R.F. stage with no modifications to set.

Also, for future reference, is there available at present a replacement for the tube MW22/16?—R. Beale (Gosport).

Suitable plug-in tuners are available in the Cyldon and Brayhead range. As an example we would quote the Brayhead 16s with B7G R.F. plug and 16BA6 I.F. adaptor. Full fitting instructions are provided. When ordering quote channels required. The MW22-16 CRT is still available.

PHILIPS 1236-U-15

My ability in radio engineering is limited to replacement of faulty valves, C.R.T., mechanical parts and, if clearly indicated, replacement and fixing of other electrical parts. Sound is good; height and vertical hold controls at mid-position giving correct performance; interference limiter at "minimum effect" position; sensitivity at maximum; mains voltage 230v. but carousel on receiver set at 220v.; contrast control about one-third on; brightness about two-thirds on; width control extended only 20 per cent.; horizontal hold about 50 per cent.; loft aerial properly directed for maximum reception; ion trap magnet set correctly for maximum brightness. On switching on: after one minute the sound comes on; after one and a

quarter minutes a very faint picture consisting of broken or torn patterns on an almost circular raster; a few seconds later a complete picture offset 2in. to the right, still faint and raster gradually extending towards oblongity and with slightly folded edges at left; after two minutes picture jerks to correct position but only slightly brighter and still not oblong picture. After five minutes or more picture has filled screen with only a fairly acceptable picture which perhaps brightens a little more after an hour or two. Any adjustment of contrast or brightness controls progressively blots out picture and eventually turns it negative. In a darkened room the picture detail is quite good, perhaps a little fuzzy, with reasonable vertical and horizontal linearity and interlace. All above effects worsened by setting voltage carousel at the 245v. setting. After an hour or two viewing picture tends to "twitch" at the top, necessitating a small outward extension of the horizontal hold control.—W. Forrest (Romford).

We would advise you to replace the PL81 line oscillator-output valve situated in the perforated screening box on the left side chassis as viewed from the rear. We would also suggest that the cathode ray tube be replaced as the emission of the existing tube is apparently very low. Before carrying out any of the above, however, check glow of valve and tube heaters, if very low in comparison to what could normally be expected, check heater circuit thermistor associated with upstanding left side mains dropper.

SOBEL T121

The line output transformer has been rewound owing to no EHT at top cap on tube or cathode of EY51 except when condenser C42 is removed from H.T. line connection. A faint picture was seen at a critical setting of either brightness or contrast. PL81, EY51 and PY80 have been replaced. Sound is O.K. Oscillations on line and frame seem O.K. with your advice concerning headphones in Practical Television. ECL80 have been switched around. The line whistle is also audible when C42 is removed from H.T. line. This condenser has also been replaced. EY51 filament shows part current, but not with C42 connected. The line O.P. transformer was rewound by "Forrest" transformer of Solihull. Is it possible that this is still faulty?—F. White (Great Barr).

We doubt whether the fault is due to the line output transformer, this having been rewound by a reputable company. It could be wrongly connected, but you have no doubt checked this. We would suggest you disconnect R25 as the tube may be at fault with an internal short which only shows up when the boosted H.T. line is raised by the connection of C42. Also check R53 (7.5 KΩ) which may have risen in value.

DECCA DM17

In the last three months the EY51 valve has been replaced four times. The last replacement lasted only three weeks and when an attempt to remove it was made it was found too firmly fixed to the plastic cup in which it rests.

It had obviously overheated as it had turned the anode brown, and the heaters were found to be open-circuit on all the faulty ones. It has also burnt (melted) a hole through the bottom of the plastic cup. Could you please advise me what tests I could make to find just what is causing this?—M. O'Connell (Watford).

The fault is probably due to an intermittent short in the tube. Sometimes this can be overcome by reducing the A.1 voltage to that of the normal H.T. line, in others by rewiring the C.R.T. base as follows: Remove connection to pin 7. Remove lead to pin 10, solder to pin 7. Remove lead to pin 2, solder to pin 10. Strap pin 2 over to pin 11. Readjust ion trap magnet—maximum brilliance.

H.M.V. 2815

Originally picture closed down to bright horizontal line. KT33C and B36 were tested and found O.K. These were replaced and it was found that resistor from cathode of KT33C to chassis was getting very hot, colour coding burned off. The reason for this appeared to be a U.S. condenser on strip just by holder of KT33C, value uncertain, could be 8,200, 3,200 or 5,200 pF ± 1 per cent.

Local dealers suggested value of resistance 210 ohm and condenser 8,200 pF. I replaced both these and now have a picture considerably elongated and folded over at bottom. No amount of adjustment will correct this.

Could you, therefore, please advise the correct values of components and offer any suggestions *re* other possible causes of faults described? I have no service sheet to hand.—G. Small (Wolverley).

The capacitor referred to is, as stated, 8,200 pF. The resistor from pin 8 of the KT33C to chassis should be 2.2 kΩ. With the correct value installed, normal working should be regained. If the resistor again overheats and the KT33C is in order, check .1 mfd connected to 8,200 pF capacitor and 1 KΩ resistor.

EKCO T161

I get a perfect picture and intermittently it seems to jump to the left about 1/16in. and becomes all smeared, i.e., in a change from dark to light, instead of being a definite line or change the dark spreads into the light, and vice versa the light spreads into the dark. Sometimes I get a broad band of interference about 1½in. wide which clears the picture on that 1½in.—J. Nelson (Eastbourne).

You have a heater-cathode leakage on your C.R.T. This can be overcome by fitting a 2 volt low capacity isolating transformer and the easiest one is the plug-in "Nuray" which also has optional boost tappings.

MURPHY V240

I have a cross aerial which has given good reception of BBC and I.T.A. for the past two years. Now I find that I.T.A. has a broken picture on certain days but BBC stays perfect. The sound is good on both stations. I find that if I turn down the contrast the picture steadies

(Continued on page 605)

EDUCATIONAL

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(Continued overleaf)

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(Continued from previous page)

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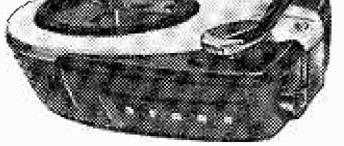

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itself up to normal but is too faint to view in comfort. I have checked and re-tuned I.T.A. coils in drum switch but to no betterment. Also there is sound on vision (on I.T.A. only) when the contrast is turned up. I suspect a 10F1 or the 20L1 (frame oscillator). Can you help to diagnose the fault as my children prefer I.T.A. The set is nearly four years old. The signal strength is good on BBC and I.T.A.—J. Thackeray (York).

We would suspect the 20L1 turret valve or a low emission tube, the latter needing so much drive as to overload the previous stages. We suggest that before you buy any new components, however, you balance up the two sensitivity controls at the back by the aerial panel and check the setting of the ion trap under the focus dome. The rejectors are the upper cores in the two coils at the back of the row nearest the scancoils.

EKCO TC138

My set has failed to give either picture or sound. The raster and line whistle are both evident. All valves have been checked and are O.K., although three of the SP61s are weak. Valves are set firmly and there are no obvious loose connections, also I have tried a separate aerial rig-up, still without any signal.—F. Finbow (Sutton).

We suggest you check the local oscillator and R.F. stages. These are the 6C9 (or 6F1) and 6F1 in the front of the R.F.-I.F. strip. The local oscillator trimmer is the airspaced condenser in the largest can in that section and is best tuned with a 4BA plastic tool. Check also that you have no break in the "contrast" wiring as this feeds the R.F. valve.

EKCOVISION T164

I can obtain no picture unless the permanent magnet on the C.R.T. is brought further back on the neck than the makers allow for. Upon switching off the beam assumes a hazy circular form instead of a clearly defined spot before disappearing. There has recently been a breakdown of insulation on the line transformer. Is this the origin of the trouble? The sound is perfect.—C. Bentley (Derbyshire).

If your picture is the right size you have a low emission C.R.T. If it swells up with increase of brightness or contrast we suggest you change the U25 EHT rectifier. Your tube may take a boost transformer if it has not already got one.

PYE LV30C

An intermittent reverberant roar has appeared on sound. It is unaffected by volume control changes and either completely drowns sound or else replaces it. Sometimes the fault is present when set is first switched on but on other occasions sound is quite normal when first switched on and may continue so for an hour or more when suddenly without warning the roar appears. Picture is normal all the time but vertical hold control has to be kept fully anti-clockwise (viewed from the rear) in order to lock picture, but for the first five minutes or so it cannot do so even in that position. Can you help, please?—R. C. Mould (Whetstone).

Your sound trouble is either a faulty ECL80 sound output valve or 12 mfd condenser on the H.T. side of the output transformer. Your frame trouble could be either a faulty ECL80 or the frame blocking oscillator transformer. The former valve is second from the back on the row alongside the R.F. strip, the latter valve is down near the volume control. Mullards are having trouble with this type of valve, which accounts for their early failure and scarcity.

FERGUSON 306T

The other day the picture of my set died away in two or three seconds until the screen was blank. I advanced the brilliance and the tube lit up with a dark and hazy picture. The sound was normal. I would like to mention one point which may have some bearing on the cause. During the time I have had the set I occasionally hear a sharp crack as though arcing was taking place (this may happen twice in a night or once in a week or so). It has been suggested to me that it was probably an ill-fitting aerial socket, or, on too low a mains tapping (it is on 240/250 volt). This cracking noise occurred, incidentally about 20 seconds before the picture faded. For some months past a ½in. black band has been at the bottom of the picture when warmed up.—J. Tee (Peterborough).

We suggest you check the EY86 EHT rectifier. This is probably not connected with your gap at the bottom, which is undoubtedly due to a faulty PCL83 frame output valve. This latter is the one over the top of the C.R.T. neck and can be changed with the sound output valve on its left.

PYE LV20

My set is eight years old and it has given excellent service until recently. Now I get a black band at the bottom of the picture. I would be very grateful if you could advise me what is wrong.—C. J. Watts (Hornchurch).

We suggest you change the EF50 frame output valve, which is the one nearest the volume control (with the little diode in between). The EF50 which is between the volume control and the PZ30 is the frame oscillator and this can sometimes cause the same trouble. Check also the 25 mfd from the cathode of the frame output valve to chassis.

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NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

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RESISTORS, Preferred values. 10 ohms to 10 meg., ¼ w., **4d.**; ½ w., **4d.**; 1 w., **6d.**; 1½ w., **8d.**; 2 w., **1/-.**
HIGH STABILITY. ½ w., 1%, **2/-.** Preferred values. 100 Ω to 10 meg. Ditto, 5%, 100 Ω—5 meg. Ω **9d.**

	WIRE-WOUND RESISTORS 25 ohms—10,000 ohms........	
5 watt		1/3
10 watt		1 6
15 watt		2/-

15,000 ohms—50,000 ohms, 5 w., **1 9**; 10 w., **2/3.**

12 6 PURETONE RECORDING TAPE
1,200 ft. on standard 7" Metal reels. Spare Reels 7" plastic 4 -, 7" metal, 2 3.
SUPERIOR 1,200ft. Plastic Tape on 7" Plastic Reels, 21/-.

O.P. TRANSFORMERS. Heavy Duty 50 mA., **4 6.** Multiratio, push-pull, **7 6.** Miniature, 384, etc., **4 6.**
L.F. CHOKES 15-10 H. 60/65 mA., **5/-**; 10 H. 80 mA., **8 6**; 10 H. 150 mA., **12/6.**
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v. 4 a., 5 v. tapped 4 v. 2 a., ditto 250-0-250, **22/6.** Bargain 300-0-300 65 mA., 6 v. 4 a., 4 v. 2 a., **15/-.**
HEATER TRANS. Tapped prim., 200/250 v. 6.3 v. 1½ amp., **7/6**; tapped sec. 2, 4, 6.3 v., 1½ amp., **8 6**; prim. 230 v. Sec. 6.3 v. 3 amp., **10/6.**
ALADDIN FORMERS and core, ¼in., **8d.**; ⅜in., **10d.** 0.3in. **FORMERS 5937/8 and Cans TV1/2.** ⅜in. sq. x 2in. and ⅜in. sq. x 1 in., **2/-** ea., with cores.
TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v., **16 9. Solon Instrument Iron, 24/-.**
MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders. 0.3 amp. 750 ohms, **4/3.** 0.2 amp., 1,000 ohms, **4 3.**
LINE CORD. .3 amp., 60 ohms per foot, .2 amp., 100 ohms per foot, 2-way, **6d.** per foot, 3-way, **7d.** per ft.
LOUDSPEAKER P.M. 3 OHM. 2½in. square, **17 6.** 5in. Goodmans, **17 6.** 7in. x 4in. Goodmans, **21 -.** 5½in. square. Elac. **21/-.** 8in. Plessey, **19 6.** 6½in Goodmans, **18 6.** 10in. R. & A., **30 -.** TSL Tweeter, LSH75, **8,6.** 12in. Plessey, **30 -.** 8in. M.E. 2.5k. field, tapped O.P. transf., **24 6.**
15 ohm Plessey 10 wt. 12in. with Tweeter, 97 6.
CRYSTAL DIODE G.E.C., **2 -. GEX34, 4 -.**
HIGH RESISTANCE PHONES. 4,000 ohms, **16 6** pr.
MIKE TRANSF. 50 : 1, **3 9** ea.; 100 : 1, Potted, **10 6.**
SWITCH CLEANER Fluid squirt spout, **4 3** tin.
TWIN GANG TUNING CONDENSERS. 365 pf. miniature 1in. x 1½in. x 1⅝in., **10 -.** .0005 Standard with trimmers, **9 -**; less trimmers, **8 -**; midget, **7 6**;
SINGLE, 50 pF., **2 6**; 100 pF., **7 -**; 150 pF., **8 6.** Solid dielectric 100, 300, 500 pF., **3 6.**
SPEAKER FRET. Expanded Metal Silver. 15in x 9½in., **2 -** each.
GOLD CLOTH. 17in. x 25in., **5 -**; 25in. x 35in., **10 -.** Tygan 4ft. 6in. wide, **10 -** ft.; 2ft. 3in. wide, **5 -** ft.

All Boxed VALVES New & Guaranteed

1R5	8 6	6K8	8 6	EB91	6 6	HABC80	12 6
1S5	8 6	6L6	10 6	EBC33	8 6		
1T4	8 6	6Q7	10 6	EBC41	10 6	HVR2A	7 6
2X2	3 6	6SA7	7 6	EBF80	10 6	MU14	10 6
3S4	8 6	6SN7	8 6	ECC84	12 6	P61	6 6
5V4	8 6	6V6G	7 6	ECF80	11 6	PCC84	12 6
5U4	8 6	6V6GT	8 6	ECF82	11 6	PCF80	11 6
5Y3	8 6	6X4	7 6	ECH42	10 6	PCF82	11 6
5Z4	10 6	6X5	7 6	ECL82	12 6	PCL82	11 6
6AM6	8 6	12A6	7/6	EF39	7/6	PEN25	6 6
6B8	5 6	12AH8	10 6	EF41	10,6	PL82	10 6
6BE6	7 6	12AT7	9 6	EF50	5 6	PY80	10,6
6BH6	10 6	12AU7	9 6	EF50 Sylv.	8 6	PY81	10 6
6BW6	10 6	12AX7	9 6			PY82	10 6
6BW7	8 6	12BE6	10 6	EF80	10 6	SP61	5 6
6CH6	10 6	12BH7	10 6	EF92	5 6	UBC41	10 6
6D6	7 6	12K7	8 6	EL32	5 6	UCH42	10 6
6F6	7 6	12Q7	8 6	EL84	10 6	UF41	10 6
6H6	3 6	35Z4	9 6	EY51	12 6	UL41	10 6
6J5	6 6	80	10 6	EZ40	10 6	UY41	10 6
6J6	7 6	954	1 6	EZ81	11 6	U22	10 6
6J7	8 6	EA50	1 6	EZ81			
6K6	6 6	EABC80	10 6	E1148	1 6	X79	10 6
6K7	5 6						

1958 RADIOGRAM CHASSIS

THREE WAVEBANDS. FIVE VALVES
S.W. 16 m.—50 m. LATEST MULLARD
M.W. 200 m.—550 m. ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. EL41, EZ40,
12-month guarantee.
A.C. 200/250 v. 4-way Switch; Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass dial 10 x 4½in. horizontal or vertical available. 2 Pilot Lamps, Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolated from mains.

10 gns. Carr. & Ins. 4/6.

TERMS: Deposit £5.5.0 and six monthly payments of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in., **17/6**; 10in., **25 -**; 12in., **30 -.**

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HIGH-FIDELITY AUTOCHANGER
Mixer Model RC456
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With Studio "O" pick-up
BRAND NEW IN MAKER'S BOXES

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Suitable Player Cabinets, **49/6.**
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AUDIO PERFECTION

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Famous Maker's surplus stocks. 4-speed Collaro Junior Gram. pick-up unit, **£4 12 6.**
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ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4in., **4 6**; 9 x 7in., **5 9**; 11 x 7in., **6 9**; 13 x 9in., **8 6**; 14 x 11in., **10 6**; 15 x 14in., **12 6**; 18 x 16 x 3in., **16 6.**

TRANSISTORS. Audio, **10 -.** R.F. 2.6 Mc/s. **21/-.** Mullard OC71. **20 -.**

HANDY VOLT METERS. 2in. Twin Range. 0-25 v., 0-250 v., D.C. with leads and leather case **12 6** complete.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1⅞in. x 3/16in. Bargain Price **6 6.** No transformer required.

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HI-GAIN BAND 3 PRE-AMP KIT. Cascode circuit with valve ECC84. Price **29 6.** With Power Pack, **49 6.** Instructions only **1 6.**

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SUPERHET MODEL 527 X FOR ALL-DRY BATTERY OPERATION
S.W.1 13.6 to 43 metres, S.W.2 42.8 to 136 metres, Medium 187 to 575 metres.
A fine All-wave receiver giving world-wide reception on three wavebands. 6in. speaker. The cabinet is maroon and beige with gold trimmings. Valves: 1K92, DF96, DAF96, DL96.
SIZE 9½in. x 6¾in. x 4½in. Leaflet S.A.E.
OUR PRICE £6.6.0. (Battery **17 6** extra.) carr. & ins. 4/-.

Volume Controls
Long spindles. Guaranteed 1 year. Midget 10,000 ohms to 2 Meg.
No Sw. **3/-** D.P.Sw. **4/9**
Linear or Log Tracks.

80 ohm CABLE COAX
Semi-air spaced Polythene insulated ¼ in dia. Stranded core **9d.** yd. Losses cut 50% Fringe Quality Air Spaced **1/6** yd

COAX PLUGS ... **1/-** **DOUBLE SOCKET** .. **1 3**
SOCKETS ... **1 -** **OUTLET BOXES** .. **4 6**
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1 -, 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min-T.V. Type. All values 25 ohms to 30 K., **3 -** ea. 50 K., **4 -.** (Carbon 50 K. to 2 m., **3/-.**)
WIRE-WOUND 4 WATT. Pots 2½in. Spindle Values, 100 ohms to 50 K., **5/6**; 100 K., **6/6.**
CONDENSERS. New Stock. .001 mfd. 7 kV. T.C.C., **5,6**; Ditto, 20 kV., **9/6**; 100 pf. to 500 pf. **Micas 6d.**; Tubular 500 v. .001 to .01 mfd., **9d.**; .05, .1, **1 -**; .25, **1 6**; .5 350 v., **1/9**; .1 350 v., **9d.**; .01 2,000 v., **1 9**; .1 mfd., 2,000 volts, **3 6.**
CERAMIC CONDS. 500 v., .3 pf. to .01 mfd., **10d**
SILVER MICA CONDENSERS. 10% 5 pf. to 500 pf., **1 -**; 600 pf. to 3,000 pf., **1,3.** Close tolerance (± 1 pF.) 1.5 pF. to 47 pF., **1/6.** Ditto 1% 50 pF. to 815 pF., **1 9**; 1,000 pF. to 5,000 pF., **2 -.**

I.F. TRANSFORMERS 7/6 pair.
465 Kc/s Slug tuning Miniature Can. 2⅛in. x 1in. x 1in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.
Wearite M800 I.F. 465 Kc/s 12/6 per pair
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NEW ELECTROLYTICS. FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350 v.	2/-	100/25 v.	2/-	8+16/500 v.	3 6
2/450 v.	2 3	8+8/500 v.	4/6	16+16/450 v.	5 6
4/450 v.	2/-	16+16/500 v.	6/-	25+20/450 v.	5 6
8/450 v.	2 3			32+32/350 v.	4 6
8/500 v.	2 9	**CAN TYPES**		32+32/450 v.	6/6
16/450 v.	3 6	Clips	3d.	50+50/350 v.	7/-
16/500 v.	4 -	16/450 v.	3 6	60+100/350 v.	11/6
32/450 v.	5 6	32/350 v.	4 -	100+200/275 v.	12/6
25/25 v.	1 9	64/350 v.	5/6	1,000+1,000/6 v.	6 6
50/25 v.	1 9	500/12 v.	3/-		
50/50 v.	2 -	8+16/450 v.	5/-		

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGE. K3/25 2 kV., **5 -**; K3/40 3.2 kV., **7 -**; K3/45, 3.6 kV., **7/6**; K3/50 4 kV., **8/-**; K3/100 8 kV., **14 6.** 50 c.p.s. voltage, 30% above.
MAINS TYPE SELENIUM 300 v. 85 mA., **7/6.**
CONTACT COOLED 250 v. 50 mA., **7 6**; 60 mA., **8/6**; 85 mA., **9 6.**
COILS Wearite "P" type, **3/-** each. Osmor Midget "Q" type adj. dust core, from **4 -.** All ranges.
TELETRON. L. & Med. T.R.F., with reaction, **3 6.**
FERRITE ROD AERIALS. M.W., **8 9**; M. & L., **12 6**
T.R.F. COILS A/HF **7 -** pair. **H.F. CHOKES, 2 6**
FERRITE ROD 7in. x 3/8in. dia., **2 6.**

JASON F.M. TUNER COIL SET, 26 -. H.F. coil, aerial coil, Oscillator coil, two I.F. transformers 10.7 Mc/s. Detector transformer and heater choke. Circuit book using four 6AM6, **2 -,** supplied free with Kit.
With Jason superior calibrated dial, **£6.15.0**
Fringe area kit, **22/6** extra.

FULL WAVE BRIDGE SELENIUM RECTIFIERS: 2, 6 or 12 v. 1½ amp., **8/9**; 2 a., **11 3**; 4 a., **17 6.**
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., **15 6**; 2 amp., **17 6**; 4 amps., **22 6.** Circuit included.
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TOGGLE SWITCHES. S.P. **2 -.** D.P. **3 6.** D.P.D.T. **4 -.**
WAVECHANGE SWITCHES
5 p. 4-way 2 wafer long spindle **6 6**
2 p. 2-way 3 p. 2-way short spindle **2 6**
2 p. 6-way 4 p. 2-way 4 p. 3-way long spindle **3 6**
3 p. 4-way, 1 p. 12-way, long spindle **3 6**
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