MAKING A LOFT AERIAL

Practical Television

1'3

JANUARY 1959

AND TELEVISION TIMES

EDITOR: F.J. CAMM

Tube Substitution

CONTENTS

BENTLEY ACOUSTIC CORPORATION LTD.

THE VALVE SPECIALISTS

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PHONE OR WIRE THAT URGENT ORDER FOR IMMEDIATE DESPATCH C.O.D. ALL POST ORDERS ARE CLEARED SAME DAY AS RECEIVED.

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

0Z4	6/-	6AQ5	8/6	6L7GT	12/6	12AH7	8/-	35A5	11/-	DAC32	11/-	ECC85	9/6	EZ81	9/-	PCL83	11/6	UBC41	10/-
1A3	3/-	6AT6	8/6	6L18	13/-	12AH8	10/6	35L6GT	9/6	DAF91	8/-	ECC91	5/6	FW4/800		PEN40DD		UBF80	9/6
1A5	6/-	6AU6	10/6	6N7	8/-	12AT6	10/6	35W4	8/6	DAF96	10/-	ECF80	13/6		10/-		25/-	UBF89	10/6
1C5	12/6	6B4G	6/6	6Q7G	10/-	12AT7	8/-	35Z3	10/6	DF33	11/-	ECF82	13/6	GZ30	10/6	PEN45	19/6	UCC85	10/6
1D6	10/6	6B7	10/6	6Q7GT	11/-	12AU7	7/6	35Z4	7/6	DF91	6/6	ECH35	9/6	GZ32	12/6	PEN46	7/6	UCH42	11/-
1H5GT	11/-	6B8G	4/6	6R7G	10/-	12AX7	10/-	35Z5GT	9/-	DF96	10/-	ECH42	9/6	GZ34	14/-	PL81	16/-	UCH81	11/6
1L4	6/6	6B8GTM	5/-	6SA7GT	8/6	12BA6	9/-	41MTL	8/-	DH63(C)		ECH81	9/-	H30	5/-	PL82	10/-	UCL82	15/6
1LD5	5/-	6BA6	7/6	6SC7GT	10/6	12BE6	10/-	50C5	12/6		10/-	ECL80	14/-	H63	12/6	PL83	11/6	UF41	9/-
1LN5	5/-	6BE6	7/6	6SG7GT	8/-	12C8	15/-	50L6GT	9/6	DH63(M)		ECL82	12/6	HABC80		PM2B	12/6	UF80	10/6
1N5	11/-	6BJ6	7/6	6SH7GT	8/-	12E1	30/-	61SPT	15/-		17/6	EF36	6/-		13/6	PM12	6/6	UF85	10/6
1R5	8/-	6BR7	11/6	6SJ7GT	8/-	12J5GT	4/6	72	4/6	DH76	7/6	EF37A	8/-	HK90	10/-	PM12M	6/6	UF89	10/6
1S5	8/-	6BW6	9/6	6SK7GT	8/-	12J7GT	10/6	77	8/-	DH77	8/6	EF39	6/-	HL23	10/6	PY80	8/-	UL41	10/6
1T4	6/6	6BW7	8/-	6SL7GT	8/-	12K7GT	7/6	78	8/6	DK91	8/-	EF40	15/-	HL41	12/6	PY81	9/-	UL46	15/-
1U5	10/-	6BX6	8/-	6SN7GT	7/6	12K8GT	14/-	80	9/-	DK92	10/6	EF41	9/6	HL133DD		PY82	9/-	UL84	11/6
2A7	10/6	6C4	7/-	6SQ7GT	9/-	12Q7GT	7/6	83V	12/6	DK96	10/-	EF42	12/6		12/6	PY83	9/6	UY41	8/6
2D13C	7/6	6C5	6/6	6SS7GT	8/-	12SA7	8/6	85A2	15/-	DL2	15/-	EF50(A)	7/-	HVR2	20/-	QP21	7/-	UY85	10/6
2X2	4/6	6C6	6/6	6U4GT	12/6	12SC7	8/6	90AG	32/6	DL33	9/6	EF50(E)	5/-	HVR2A	6/-	QP25	15/-	V1507	5/-
3A4	7/-	6C8	12/6	6U5G	7/6	12SG7	8/6	150B2	15/-	DL66	15/-	EF54	5/-	KF35	8/6	QS150/15		VLS492A	£3
3A5	12/6	6C9	12/6	6U7G	8/6	12SH7	8/6	220P	10/6	DL92	7/6	EF73	10/6	KL35	8/6		10/6	VMP4G	15/-
3B7	12/6	6C10	12/6	6V6G	7/-	12SJ7	8/6	807	7/6	DL94	9/-	EF80	8/-	KT2	5/-	QVO4/7	15/-	VP2(7)	12/6
3D6	5/-	6CH6	12/6	6V6GTG	8/-	12SK7	8/6	956	3/-	DL96	10/-	EF85	7/6	KT33C	10/-	R2	10/-	VP4(7)	15/-
3Q4	7/6	6D6	6/6	6X4	7/-	12SQ7	12/6	1203	7/-	DLS10	10/6	EF86	14/-	KT44	15/-	R12	12/6	VP13C	7/-
3Q5GT	9/6	6E5	12/6	6X5GT	6/6	12SR7	8/6	4033L	12/6	DM70	8/6	EF89	10/-	KT63	7/-	SD6	12/7	VP41	6/6
3S4	7/6	6F6G	7/-	6Z4/84	12/6	12Y4	10/6	5763	12/6	E80F	20/-	EF91	7/6	KTW61	8/-	SP4(7)	15/-	VR105/30	
3V4	9/-	6F6GTM	8/-	6Z5	12/6	14R7	10/6	7193	5/-	EA50	2/-	EF92	5/6	KTW62	8/-	SP41	3/6		9/-
4D1	7/6	6F8	12/6	6/30L2	10/-	19AQ5	11/-	7475	7/6	EA76	9/6	EL32	5/6	KTW63	8/-	SP42	12/6	VR150/30	
5R4GY	17/6	6F12	7/6	7A7	12/6	19H1	10/-	9002	5/6	EABC80	9/-	EL34	17/6	KTZ41	8/-	SP61	3/6		9/-
5U4G	8/6	6F13	12/6	7B7	8/6	20D1	16/-	9006	6/-	EAC91	7/6	EL41	11/-	KTZ63	10/6	SU61	10/6	VT61A	5/-
5V4G	11/6	6F17	12/6	7C5	8/-	25L6GT	10/-	AC6PEN	7/6	EAF42	10/6	EL42	11/6	L63	6/-	TP22	15/-	VT501	5/-
5X4G	12/6	6F32	10/6	7C6	8/-	25Y5	10/6	AC/HL/		EB34	2/6	EL81	15/-	LZ319	9/-	TT15	20/-	W76	7/6
5Y3G	8/-	6F33	7/6	7H7	8/-	25Y5G	10/-	DDD	15/-	EB41	8/6	EL84	10/6	MH4	7/-	U16	12/-	W81M	6/-
5Y3GT	8/6	6G6	6/6	7R7	12/6	25Z5	10/6	AC/P4	8/-	EB91	6/6	EL91	5/-	MHL4	7/6	U18/20	10/-	X61	12/6
5Y4	12/6	6H6GTG	3/-	7S7	10/6	25Z4G	10/-	AC/VP1	15/-	EBC33	7/6	EL95	10/6	MHLD6	12/6	U22	8/-	X63	10/-
5Z3	12/6	6H6M	3/6	7V7	8/6	25Z6G	10/-	AL60	10/-	EBC41	10/-	EM34	10/-	ML4	12/6	U26	14/-	X65	12/6
5Z4G	10/6	6J5G	5/-	7Y4	8/-	28D7	7/-	AP4	7/6	EBF80	10/-	EM80	10/6	ML6	6/6	U31	10/-	X66	12/6
5Z4GT	12/6	6J5GTG	5/6	8D2	3/6	30	7/6	ATP4	5/-	EBF89	9/6	EM81	10/6	MSP4(7)	15/-	U43	10/6	XD(1.5)	6/6
6A8G	10/-	6J5GTM	6/-	8D3	7/6	30C1	9/-	AZ31	10/-	EC52	5/6	EN31	34/9	MU14	10/-	U45	10/6	XFG1	18/-
6AB7	8/-	6J6	5/6	9D2	4/-	30F5	8/-	BL63	7/6	EC54	6/-	EY51		OA70	5/-	U50	8/-	XFY12	6/6
6AB8	14/-	6J7G	6/-	10C1	15/-	30FL1	10/-	CK506	6/6	EC70	12/6	(Small)	10/6	OA71	5/-	U52	8/6	XH(1.5)	6/6
6AC7	6/6	6J7GT	10/6	10F1	19/6	30L1	9/-	CK523	6/6	ECC31	15/-	EY51		OC72	30/-	U76	7/6	XSG(1.5)	
6AG5	6/6	6K6GT	8/-	10F9	11/6	30P12	12/6	CV63	10/6	ECC32	10/6	(Large)	12/6	P61	3/6	U78	7/-		15/6
6AJ8	9/-	6K7G	5/-	10F18	12/6	30P16	10/-	CV85	12/6	ECC33	8/6	EY84	17/6	PABC80	15/-	U251	15/-	Y63	7/6
6AK5	8/-	6K7GT	6/-	10LD3	10/-	30PL1	12/6	CV271	10/6	ECC35	8/6	EY86	14/6	PCC84	9/-	U404	10/6	Z63	10/6
6AK8	9/-	6K8G	8/-	10LD11	16/9	31	7/6	CV428	30/-	ECC81	8/-	EZ35	6/6	PCC85	12/6	UABC80		Z66	20/-
6AL5	6/6	6K8GT/G		10P13	17/6	33A/158M		D1	3/-	ECC82	7/6	EZ40	8/-	PCF80	9/-		10/6	Z77	7/6
6AM5	5/-		11/-	11E3	15/-		30/-	D42	10/6	ECC83	10/-	EZ41	10/-	PCF82	12/6	UAF42	10/6	Z719	8/-
6AM6	7/6	6L6G	9/6	12A6	6/6	35/51	12/6	D77	6/6	ECC84	10/-	EZ80	9/6	PCL82	12/6	UB41	12/7	Z729	14/-

VOLUME CONTROLS

All with long spindle and double-pole switch,

10K.	25K.	50K.	100K.
¼ meg.	½ meg.	1 meg.	2 meg.

4/6 each.

ELECTROLYTIC CONDENSERS

Standard Can.	
32 x 32 mfd., 450 V.	5/9
64 x 120 mfd., 350 V.	8/3
60 x 250 mfd., 275 V.	9/6
100 x 400 mfd., 275 V.	12/6
100 mfd., 275 V.	2/6
200 mfd., 275 V.	3/6
100 x 200 mfd., 275 V	6/6

Tag or Wire-ended Tubular	
8 mfd., 450 V.	1/9
16 mfd., 450 V.	2/9
32 mfd., 450 V.	3/9
8 x 8 mfd., 450 V.	3/-
16 x 16 mfd., 450 V.	3/9
32 x 32 mfd., 350 V.	4/-
8 x 16 mfd., 450 V.	4/-

NEW METAL RECTIFIERS, FULLY GUARANTEED

DRM1B	15/4	RM-2	7/6	W6	3/6	14A97	25/-	14B261	11/6	16RE 2-1-8-1	8/6
DRM2B	16/2	RM-3	9/6	WX3	3/6	14A100	27/-	14RA 1-2-8-2	19/-	18RA 1-1-8-1	4/6
DRM3B	23/3	RM-4	18/-	WX4	3/6	14A124	28/-	14RA 1-2-8-3	23/6	18RA 1-1-16-1	6/6
RM-0	7/11	RM-5	24/-	WX6	3/6	14A163	38/-	16RC 1-1-16-1	8/6	18RA 1-2-8-1	11/-
RM-1	7/-	W4	3/6	14A86	18/-	14B130	35/-	16RD 2-2-8-1	12/-	18RD 2-2-8-1	15/-

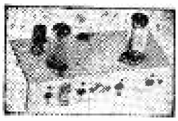
Metal rectifier technical leaflet free on receipt of S.A.E.

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

ALL VALVES NEW, BOXED AND SUBJECT TO MAKERS' FULL PERIOD GUARANTEE. FIRST GRADE GOODS ONLY. NO SECONDS OR REJECTS. LATEST CATALOGUE OF OVER 1,000 DIFFERENT VALVES, INCLUDING MANY SCARCE TYPES, WITH FULL TERMS OF BUSINESS, PRICE 6d.

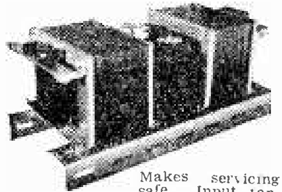
PLEASE ENQUIRE FOR ANY VALVE NOT LISTED. 3d. STAMP, PLEASE.

Band III Converter



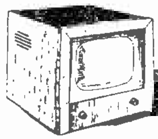
Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra.) Price only **19 6.** plus 2/6 post and insurance. Data free with parts or available separately, 1/6.

Mains Isolation Transformer



Makes servicing safe. Input tapped 200-250 v., output tapped 200-250 v. Rated at 500 watts, intermittent rating 2,000 watts. Screens for suppressing mains interference. Size 14in. x 6in. x 6in., weight 40lbs. Price **£5 12 6.** Carriage 7/6 (up to 250 miles).

14" T.V. Cabinet



14" T.V. cabinet of the latest styling made for one of our most famous firms—beautifully veneered and polished—limited quantity—**15/-** each. Carriage and packing 3/6 extra.

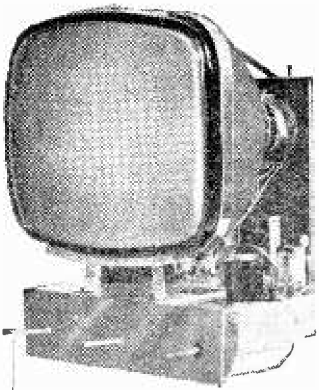
A.C./D.C. Multimeter Kit

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. Measures A.C./D.C. volts, D.C. current and ohms. 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 19/6, plus 2/6 post and insurance.

Avo Prodclips

The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price 15/- pair.

BUILD THIS 17" TV FOR 22 GUINEAS

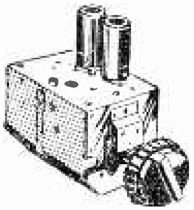


This is a very modern circuit and when you have completed it, it will be equal to any factory made model. Note these special features:

- Miniature valves and metal rectifier.
- 12 channel turret tuner.
- Ferrox E.H.T. and scan coils.
- A.G.C. and A.V.C.

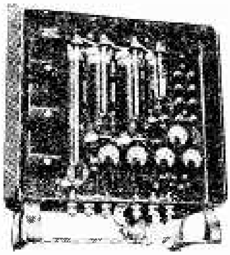
Supplied in component form with all metal work prepared and supplied with pictorial layout and theoretical wiring diagram (these are available separately, price 3/6). Total cost is only **£23.2.0.**

Now 2 Models Turret Tuner



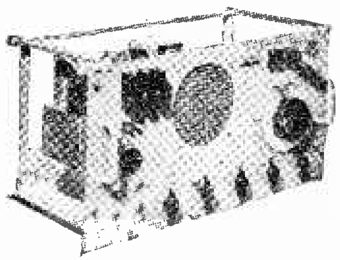
Brand new stock not surplus, with coils for Band I and III complete with valves. Model 1 I.F. output 33/33 Mc/s. Series heaters Model 2 I.F. output 16/19 Mc/s. Parallel heaters. With instructions and circuit diagram, **79/6.** With knobs 3/6 extra, post and insurance 2/6.

Charging Switchboard



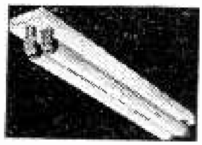
Offered at about one-twentieth of original cost. This is an ex-Government switchboard. It contains three reverse current relays, one voltmeter, one main ammeter, two secondary ammeters and three variable resistors for controlling circuits. These are original cases. Price **£2 15/-.** Carr. 10/-.

Short Wave Communications Receiver R208. 10/- Down.



This is a super short wave receiver covering 5-30 metres (10-60 Mc/s). Uses 6 valves. Has R.F. stage, 2 I.F. stages B.F.O., etc. Muirhead instrument drive, two internal power packs, mains and battery vibrator pack. Complete with own P.M. speaker. Provision for phones and speaker muting. Complete in metal transit case; size approx. 24 x 18 x 12in.; weight 70lb. Suitable A.C. mains, 100-250 and 6 volt battery. In perfect condition, practically unused. Tested before despatch and guaranteed. Handbook free with each. Price **£6/19/6,** carriage and insurance 15/-. Or 10/- deposit plus 15/- carriage, and 15 fortnightly payments of **10/-.**

Fluorescent Lights



These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations.

Single 40. 4 ft. 3 in. long, uses a 40 watt tube.

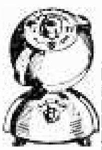
Twin 20. Uses 2 20-watt standard tubes.

Price for either type **39/6,** with tubes.

Inductor 80. Uses one 5 ft. 80 watt tube. **59/6.**

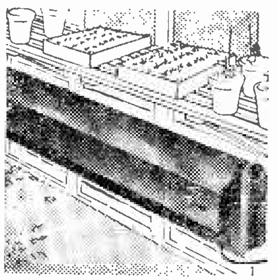
Carriage and ins. up to 150 miles 5/6, up to 250 miles 7/6.

Novelty Radio



Completely wired tunable medium and long wave, originally intended for B7G valves and external batteries but could easily be converted for transistors with internal batteries. Less valves and speaker, otherwise complete. **15/-,** plus 1/6 postage.

Instantus Heater



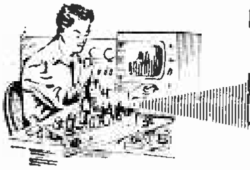
Convector heater made from heavy gauge sheet steel (galvanised). For greenhouse, workshop, aviary, etc. 500 watt, **£1.12.6**; 1,000 watt, **£2.10.0.** 1,000 watt with wired but separate thermostat, **£3.17.6.** 2K watt free standing or wall mounting, **£3.19.6**; 2K watt with built-in thermostat, **£4.19.6.** Carriage and insurance 5/- per heater. ALL ARE GUARANTEED FOR 5 YEARS.

For convenience of callers all items advertised may be obtained by the following companies:

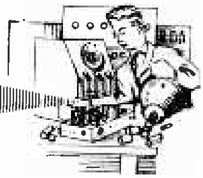
Electronics (Ruislip) Ltd.
42-46, Windmill Hill, Ruislip, Middx.
Phone: RUISLIP 5780.
Half day, Wednesday.

Electronics (Croydon) Ltd.
266, London Road, Croydon.
Phone: CRO 6558
Half day, Wednesday.

Electronics (Finsbury Park) Ltd.
29, Stroud Green Rd., Finsbury Park, N.4.
Phone: ARChway 1049
Half day, Thursday.



Practical Television



& TELEVISION TIMES

Editor : F. J. CAMM

Vol. 9 No. 102 EVERY MONTH JANUARY, 1959

Editorial and Advertisement Offices :
PRACTICAL TELEVISION
George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Phone : Temple Bar 4363.
Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

SUBSCRIPTION RATES
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Inland	19s. per annum
Abroad	17s. 6d. per annum
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CONTENTS :

TELEVIEWS

THE FUTURE OF TELEVISION

THE present BBC financial agreement comes to an end on March 31st, 1960, and very soon decisions will have to be taken which will affect the future of television. The first item which will undoubtedly have to be decided is whether the present 405-line system will be replaced by the 625-line standard which is used by all the European countries running a television service. Another problem will concern the introduction of a Third Programme. The present BBC charter comes to an end on June 30th, 1962. The Television Act which controls ITA has to be renewed after July 29th, 1964. There is also the question of colour television, and the date of its introduction. This question is somewhat urgent, for the trade must be given ample time to tool up for colour receivers. It seems reasonably certain, however, that the date will be some years ahead. The line standard is the first consideration since it affects all others. The present 405-line system is an anachronism, an unwanted heritage from the early haphazard days of television. No one quite knows why such a frequency was adopted, for there is no sound technical reason for it and many reasons against it. The committee which decided on the system had the choice of the alternative Cossor system, employing velocity modulation and a higher line frequency. It was demonstrated to be far superior.

Programmes on the 625 system are vastly superior to ours, and its adoption would greatly simplify the problems of Eurovision. It is not a complicated matter to change the line standard. No doubt, if a change is made, programmes will be put out on the present as well as the new frequency for a period.

Regarding the much wanted Third Programme, will it be handled by an entirely new authority, or by the BBC or by ITA ? These are problems of policy. We favour the BBC handling such a programme because of its longer experience, not only in television but of sound broadcasts.

THE "P.T." FILM SHOW

THE P.T. Film Show, organised by this journal in collaboration with Mullard Ltd., takes place at the Caxton Hall, Westminster, on January 22nd, 1959, at 7.30 p.m. prompt. Three most interesting films dealing with transistors, the manufacture of junction transistors, and a colour film entitled "The Conquest of the Atom," will be shown, with an interval for refreshments, which are provided free.

The meeting will be under our chairmanship. Mark applications for free tickets "Caxton Hall Lecture" in the top left-hand corner. You are entitled to bring a friend, but you must, of course, make application for an extra ticket.—F. J. C.

Our next issue, dated February, will be published on January 21st

Transistors in TV Receivers

THE FIRST ARTICLE OF A SHORT SERIES DEALING WITH THE USE OF TRANSISTORS IN MODERN TELEVISION EQUIPMENT

MANY readers write to ask for details of a TV tuner or receiver using transistors, and the number of inquiries has increased considerably since the Radio Show. It is apparently thought that the design of this type of equipment is now fairly simple, and that an all-transistor TV set is "just round the corner." Unfortunately, this is far from true, and although transistors may replace valves in some parts of the equipment, there are many sections where their use has not yet been satisfactorily developed. To answer the many problems which have been raised the following notes have been taken from a Paper read before the Television Society, and detail the many problems which have to be overcome, and show how they have been tackled in very well-equipped research laboratories. In view of the power which is required for scanning, not the least important of the notes will be those covering the magnification of the scan in the tube itself.

The information given in this short series is taken, with permission, from a Paper read to the Television Society by B. R. Overton, B.Sc.(Eng.), A.M.I.E.E., and published in the Journal of that Society.

The use of diffusion techniques has already produced practical high frequency transistors, but an H.F. transistor for television receivers has not yet been produced commercially. However, the new technique of alloy diffusion holds out some hope of being stretched to meet the requirements of a television I.F. and R.F. transistor. Short grid-base picture tubes, and transistors able to stand high collector potentials, offer possible solutions of the video drive problem. Finally, a form of scan magnification, an invention of D. R. Skoyles, of the Mullard Research Laboratories, described here for the first time, reduces the scanning problem to manageable proportions. All these techniques are still in the research laboratory stage but they do point the way for the future.

An experimental receiver will now be described stage by stage. The thoughts behind the design of a particular stage will be coupled with some attempt to forecast the future trend and special attention will be given to the new techniques mentioned above.

R.F. and I.F. Amplification

Experimental V.H.F. transistors made by the alloy diffusion technique were available in the laboratory for the construction of the R.F. and I.F sections of the receiver. The construction and properties of these particular experimental transistors are of interest and they will now be discussed briefly.

The diffusion technique for making the base material has two advantages. First, it is a relatively slow controllable process and second, it can produce a base of graded resistivity and hence a drift field.

However, contact has to be made to this thin base layer and it must be bounded by the emitter and collector junctions. If these junctions are made after the base has been formed there is the grave risk of damage to the thin base. The alloy diffusion process avoids this difficulty in the following manner: An n-type layer is first diffused on to a p-type germanium block. The emitter material is doped with both p- and n-type impurity and then alloy-diffused into the thin n layer. The doping materials are chosen so that the n material diffuses most rapidly. The result is an accurately controlled narrow base region of n material of graded resistivity connected to the original n layer. The base contact can be readily fixed to the thin n layer, but the contact must be close to the emitter to obtain a low base resistance. The collector junction is limited by lacquering and etching and the lacquered area must be kept to a minimum to obtain a low collector capacitance. The final construction of the transistors is shown diagrammatically in Fig. 1.

As no attempt was being made to achieve the ultimate in performance or elegance of receiver design. V.H.F. transistors from widely different experimental batches were used and each circuit adjusted accordingly. It is too early to forecast how far the designer of the future will have to go to accommodate final production spreads.

Choice of Radio and Intermediate Frequencies

The first objective in building the receiver was to achieve a complete replacement of valves by transistors. In this way the whole problem of a transistorised receiver would be studied. As the complete receiver was more important than the individual problems there was no hesitation in making individual problems as simple as possible.

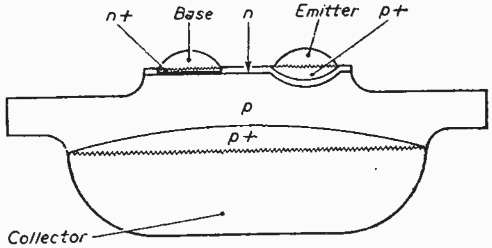


Fig. 1.—Diagrammatic representation of the alloy-diffusion junction transistor.

These considerations largely governed the choice of R.F. channels, I.F., and oscillator frequencies.

From measurements taken at 100 Mc/s it seemed likely that the gain of a single R.F. stage employing a typical transistor of the batches available would be approximately 16 dB for Channel 1 Band I, and 2 dB for Channel 13 Band III. Thus it was early to embark on the design of a thirteen channel tuner.

Having decided on a Channel 1 only receiver there was a wide choice of I.F. and oscillator frequency. To make the design problems as simple as possible and yet retain some realism the 16-19.5 Mc/s band was chosen for the I.F., with oscillator low. Later a very simple Band III to Band I, single channel, converter was added so that both programmes in the London area could be received.

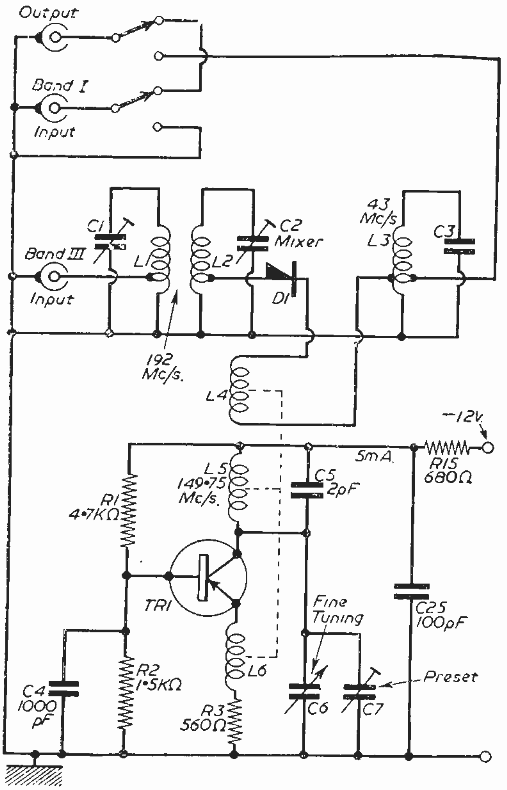


Fig. 2.—A Channel 9 to Channel 1 Converter.

Band III to Band I Converter

The converter (Fig. 2) for Channel 9 to Channel 1 has no R.F. stage, the aerial being fed to a crystal mixer through a band-pass coupled circuit tuned to the centre frequency of approximately 192 Mc/s.

The oscillator, employing an experimental alloy-diffusion transistor, operates in its fundamental mode at a frequency of 149.75 Mc/s. Feedback from the tuned circuit in the collector is by loose magnetic coupling to a winding (L6) in the emitter. The winding (L4) to provide oscillator injection to the mixer is closely coupled to the oscillator coil L5. The D.C. operating conditions are stabilised by the usual potentiometers (R1 and R2) in the base circuit and a resistance (R3) in the emitter. In an attempt to stabilise the circuit the resistor R3 is unbypassed.

The Channel 1 signal is switched through to the output when the conversion is not required. Care with layout is needed to avoid cross talk.

In the experimental unit the measured Channel 1 rejection when converting from Channel 9 is 62 dB.

R.F. Stage

The R.F. stage of the receiver proper employs an experimental alloy-diffusion transistor in the grounded emitter configuration. The circuit is shown in Fig. 3. Simple capacitive neutralisation is effected by a trimmer C13 connected between the base and the secondary winding L9 across which appears a signal opposite in phase to that at the collector.

The conventional D.C. stabilisation circuit is used, but the base potentiometer (R4 and RV1) is varied to effect gain control. This gain control has a wide range (40 dB approximately) and at minimum gain the stage will accept a 10 mV vision signal before cross-modulation occurs. The aerial is matched for the full gain setting of the control and the mismatch accepted for other settings. The tuning capacitance C10 swamps the change of transistor input capacitance with gain control. At present the gain control RV1 serves as the contrast control.

The components C12 and R7 in the collector circuit help to swamp changes with contrast control setting of the output impedance of the

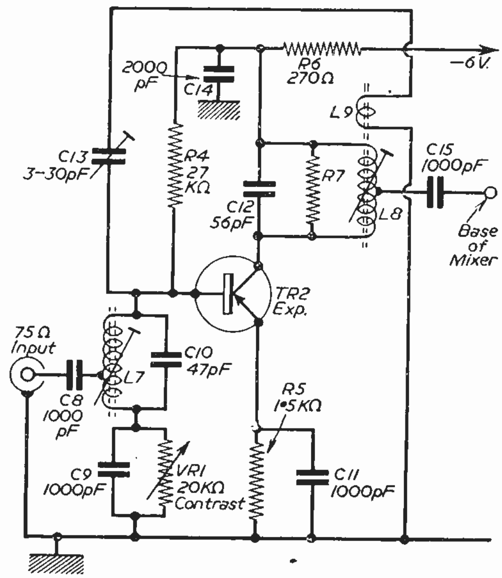


Fig. 3.—An R.F. stage.

transistor TR2 and also make the circuit less dependent on the mixer transistor.

The noise factor of the receiver is 4.5 dB; the gain of the R.F. stage is 17 dB.

If one makes the optimistic but not completely unreasonable assumption that techniques at present in the research laboratory will be improved to the extent of, say, one octave in f1, then an all-channel tuner, comparable in gain, selectivity, and noise factor with its valve counterpart, becomes possible.

The R.F. stage will have one serious drawback in comparison with its valve counterpart, namely the need for neutralising. How important the accuracy of neutralising will prove depends largely on the gain achieved, the range of H.T. potential

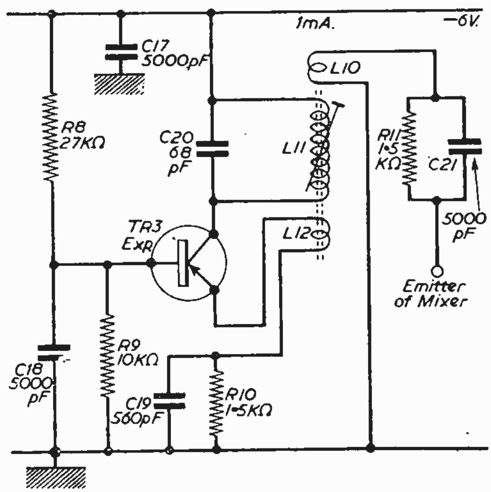


Fig. 4.—The transistorised local oscillator.

to be accepted and the tolerances achieved in the transistor production. Cross-modulation and range of control available for A.G.C. need to be investigated, but preliminary results are encouraging.

Local Oscillator

The local oscillator circuit (Fig. 4) operating at 25.5 Mc/s is similar to the one already described in the converter unit.

The oscillator is reasonably stable as the circuit capacitances tend to swamp the transistor capacitance.

Achieving stability in the local oscillator which, in its final form, must operate at about 230 Mc/s, may well prove to be the major technical problem of using transistors of this type in a television receiver. The use of H.T. stabilising circuits springs to mind. So does the use of extra transistors to increase the power gain of the feedback loop and so reduce the loading on the oscillator tuned circuit. Clearly the aim will be to achieve the desired performance without these complexities, but this may have to wait for yet another completely new transistor-making technique. In the meantime the problem is a challenge to circuit designers.

Mixer

The oscillator signal is fed to the emitter of the mixer transistor and is of sufficient amplitude to cut off the emitter-base diode during part of each cycle. The output of the R.F. stage is fed to the base.

The required I.F. components in the collector are selected by two separate tuned circuits. The vision circuit is tuned to 17.5 Mc/s and is damped by the coupling to the vision I.F. amplifier to have a working Q of about 10. The corresponding sound circuit, tuned to 16 Mc/s, has a working Q of 40 and is tapped down to avoid a series resonant effect occurring in the vision pass band.

Neutralisation is not required as the emitter and base are effectively short circuited at I.F.

The conversion gain is approximately 10 dB sound and 8 dB vision. The mixer is shown in Fig. 5.

Sound I.F. Amplifier

The sound I.F. amplifier (circuit to be shown next month) has two straightforward grounded emitter neutralised stages. As the circuit impedances are high, individual neutralisation is employed. The neutralisation and the tuning interact so that they must be adjusted in turn many times before alignment is complete. The second stage (TR6) is operated at a higher current to achieve a high output signal level before limiting.

The I.F. gain of the amplifier (base of TR5 to winding L22) is approximately 54 dB with

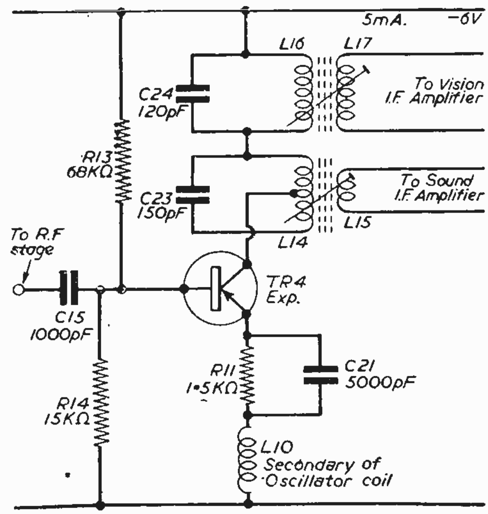


Fig. 5.—The Mixer.

a 3 dB bandwidth of 300 kc/s. The detector efficiency is approximately 80 per cent. An output of 0.3 volts of audio signal (30 per cent. modulation) can be achieved before limiting. No attempt has been made at this stage of the work to effect A.G.C., but this should not, in principle, be a great difficulty.

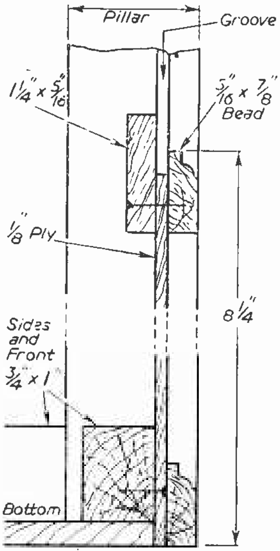
(*Continued on page* 282)

A Home Constructed TV Receiver

THIS, THE CONCLUDING ARTICLE, GIVES MORE INFORMATION ON THE CONSTRUCTION OF THE CABINET

By P. Green

IN the previous articles of this series, the author has outlined the construction of a modified version of the ViewMaster television receiver which he has built.



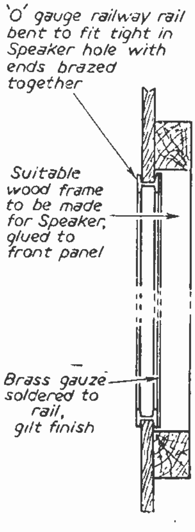
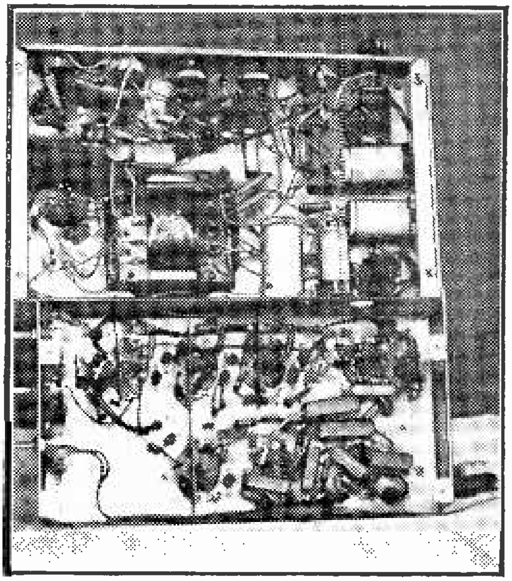


Fig. 18 (Above, left).—Shows the construction of the bottom part of the sides of the cabinet. The loose wooden sides slide into the groove indicated.

Fig. 19 (Above, right).—Shows the method of improving the appearance of the speaker opening.



Underside view of the chassis.

The construction of the bottom parts of the sides of the cabinet are shown in Fig. 18. The groove into which the panels slide is marked in this diagram.

Speaker Fret

The speaker fret, Fig. 19, is made from brass

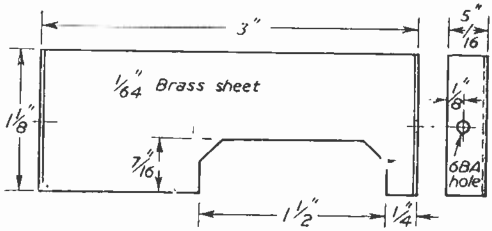
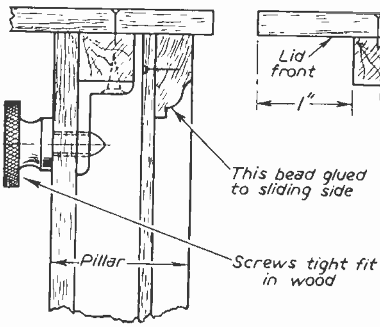


Fig. 20.—The dimensions of the screens, two of which are fitted into each of the converters.

The Cabinet

A great deal of thought was given to the design of the cabinet to allow for easy access to all trimmers and for the removal of any part or chassis. This was accomplished by making the sides and top of the cabinet removable for servicing purposes. In the photograph on page 248 of the December, 1958, issue of PRACTICAL TELEVISION, the sides have been removed. The ease of access thus provided enables any necessary repairs to be made with little difficulty.



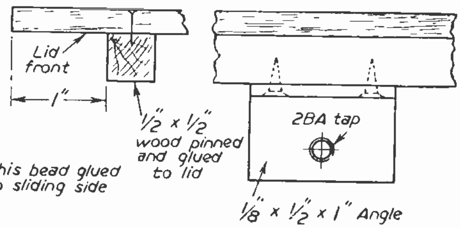


Fig. 21.—The method of attaching the lid to the top of the cabinet.

toy railway line, to which is soldered brass gauze, allowed to extend ⅛in. all round. The fret is then pressed into the opening at the front of the cabinet and is secured by a wooden frame, on which the speaker is fastened.

Converter Screens

Across each valveholder of each converter is fitted a metal screen made from 1/64in. brass sheet. The screens are fixed to the sides of the chassis of the converters with 6 B.A. bolts. These bolts are also used in order to secure the mounting legs of the converters. The necessary measurements for the making of these screens are given in Fig. 20.

Fixing the Lid

The method of fixing the top in position is shown in Fig. 21. Three locating pieces of wood, ½in. × ½in. are fixed at the sides of the front. On the side pieces are screwed four pieces of brass angle, with a 2 B.A. tapped hole in one flange located from holes in the top-side struts through which pass thumbscrews.

The Converters

There were a number of errors in the circuit diagrams, of the ITV and BBC converters, which were given respectively in the October and November, 1958, issues of PRACTICAL TELEVISION.

In the ITV converter, a connection should be made from the bottom of L6 to pin 9 of V2. The 10 pF condenser from pin 2 of V2 should not be connected to coil L4, but to pin 3 of V1 (a revised circuit diagram is given in Fig. 22 and should make this clear).

In the BBC converter, a 2 pF condenser should be inserted in the connection from pin 5 of V1 to the 75 pF condenser and top of coil L3B.

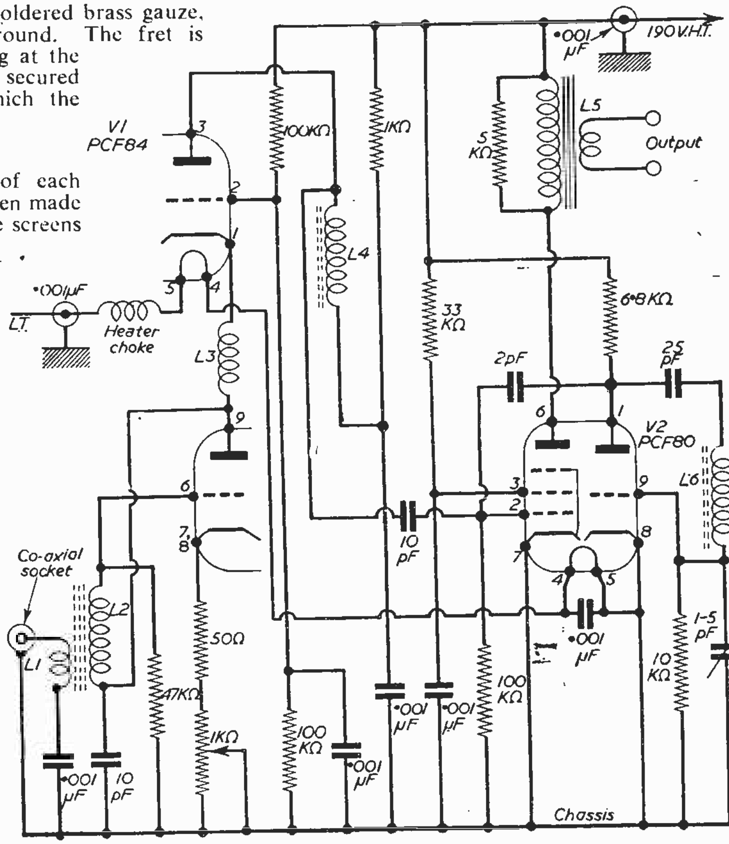


Fig. 22.—The circuit diagram for the ITV converter, incorporating the corrections mentioned below.

TRANSISTORS IN T.V. RECEIVERS

(*Continued from page* 280)

Vision I.F. Amplifier

The vision amplifier, to be shown next month, has stagger-tuned neutralised stages. Although the stage damping has been adjusted slightly to suit the particular transistors used, there has been some attempt to deal realistically with the problem of transistor parameter spreads. As examples, the base resistance accounts for only half approximately of the stage damping, the transistor input capacitance accounts for only 30 per cent. approximately of the total tuning capacitance in a stage, and the neutralising capacitor is fixed. The result is obviously a considerable loss of gain in comparison with that which could be achieved if conditions were carefully made optimum for individual transistors. The gain has to be restrained anyway for another reason. The feedback capacitance varies with the supply potential so that if a range of H.T. potential is to be tolerated, so must an unbalance in the neutralisation. The maximum stage gain, or more accurately the base to collector gain, permissible without risk of distortion to the response curve or oscillation will depend both on the initial accuracy of neutralisation at nominal H.T. line and the range of H.T. to be expected.

In the complete experimental amplifier some stabilisation is attempted with unbypassed emitter resistors and the response curve is maintained effectively constant over the range of H.T. −9 v. to −11 v.

Also on the score of stability the sound rejector must not be of a type which tends to isolate the collector from the base of the following stage.

(*To be continued*)

An Automatic Aerial Switch

AVOIDING AERIAL CHANGES WHEN TRANSFERRING FROM ROOM TO ROOM

By S. E. Addis

WITH the introduction of television into the home, the need for some form of aerial switching soon becomes obvious so that the set may be used in more than one room.

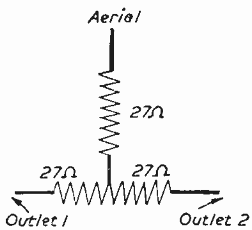
In areas of strong signal strength an arrangement with three 27 ohm resistors as shown in Fig. 1 may be used which will enable the signal from the aerial to be fed into two outlet sockets thus providing a signal source for two rooms.

The writer has used this type of "two-way split" for a number of years until the commencement of Band III signals, when difficulties began to arise owing to a weak signal.

After a Band III aerial had been erected and positioned for maximum signal, the picture was weak and showed considerable noise. The cross-over unit coupling the Band I and Band III aerials together was changed with no noticeable improvement.

Considerable gain in signal strength was obtained when the coaxial down-lead was changed for the "low-loss" type, but the final and best improvement came when the three-resistor two-way split was removed from the circuit.

We now had a good picture on Band I and Band III but were confined to one room. As a temporary arrangement a coaxial plug was fixed to the lead to outlet No. 2 and this was then plugged into outlet No. 1 to pipe the signal into the next room. Apart from being untidy this arrangement does not seem satisfactory for permanent use. Some form of switching seemed to be the answer and this was tried for a time until it was found that the switch was very often left in the wrong position.



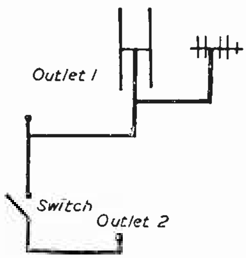


Fig 1 (Left).—Theoretical circuit for two outlets.
Fig. 3 (Right).—Arrangement of the switching system.

The Switch

After some experimenting a form of automatic switch was made which has proved very successful in use. The basic parts needed to construct the unit are a coaxial socket and a portable radio lid switch. The coaxial socket must be of the type having the centre pin hollow right through. The socket should be mounted on a suitable base with the lid switch fixed below it as shown in Fig. 2. In one or two prototypes made up, the unit was constructed in a disused cross-over unit box. The coaxial socket was already attached, the switch fitted neatly inside and the existing cable fittings could be used.

The lid switch must be arranged so that its actuating lever is immediately below and in line with the hollow centre pin on the coaxial socket. A small length of knitting needle or similar material of suitable diameter is then cut and filed to form a plunger, and this is then dropped into the hollow pin on the socket.

Some experiment will be needed to find the correct length for the plunger, and any obstruction such as a screw or solder tag should be removed from the bottom of the centre pin, connection for the coaxial lead being made by soldering to the side of the pin.

The Action

The action of the unit is as follows. Insertion of a coaxial plug in the socket depresses the plunger in the hollow centre pin which in turn actuates the portable lid switch, thus switching the aerial to the desired outlet socket. Removal of the plug returns the switch to normal as it is spring loaded.

The electrical arrangement of the system is shown in Fig. 3, where it will be seen that Band I and Band III aerials are coupled together and fed via the low-loss cable to outlet No. 1

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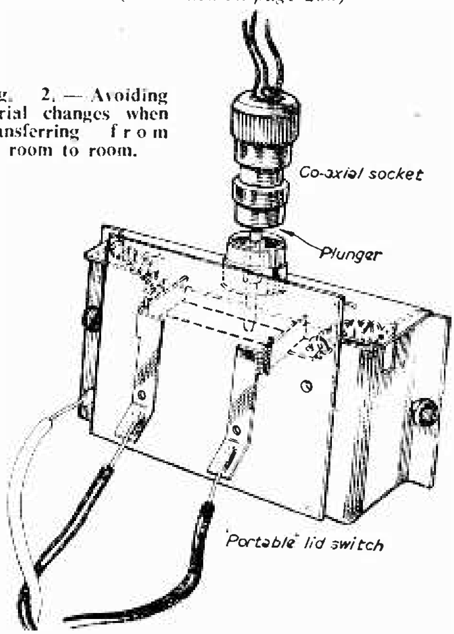


Fig. 2.—Avoiding aerial changes when transferring from room to room.

No. 44,—THE DECCA DM3, DM4 AND DM5

(Continued from page 254 of the December issue)

By L. Lawry-Johns

FURTHER faults will now be detailed, but it should be remembered that the chassis should be respected as it is "live."

Low Sound

Check V16, V17, V18 and R90, 220 KΩ load resistor of V18 triode section—pin 1.

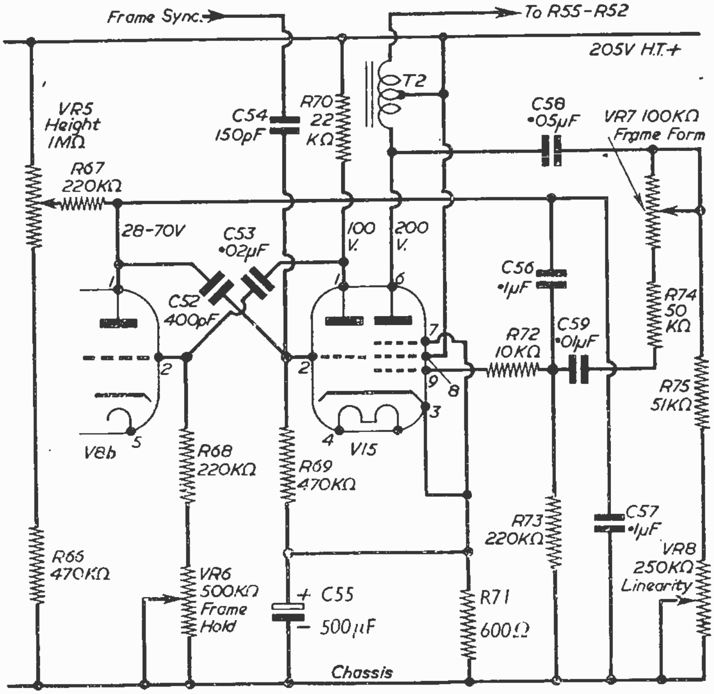
No Vision—No Sound

Valves not lighting up; check mains input, 1 a. fuse and continuity of valve heaters. If fuse and circuits are in order, check on/off switch.

Valves lighting up. Suspect 500 mA H.T. fuse and check H.T. line for shorts.

Some valves lighting brightly, others not at all. Study circuit diagram of heater chain and suspect last valve in chain to be alight. The ECL80 is a frequent offender here, check V9, V15 and V8. The effect of such a short can be cumulative and the heater/cathode insulation of the PY82 valves may fail resulting in a blown 1 a. fuse and the necessity to proceed with caution after the apparent cause has been established and the offending valve(s) replaced. Always be ready to switch the receiver off at the slightest sign of excessive heater glow in a few of the valves.

The PL81 may present a normal appearance and the line whistle fully audible, in which case the EY51 should be more closely inspected—but not too close. Is the heater glow visible? If it isn't, apply a spark test to the nearer (anode) end where a healthy spark should be obtained. If it is, suspect the EY51 itself and replace. Cut the connecting wires to the right size and solder with clean round blobs. If, however, the EY51 still does not light up, remove the C.R.T. anode clip to check for internal shorts in the tube. This latter procedure should be carried out if the spark at the anode of the EY51 is subdued, denoting a heavy load imposed upon the EY51 and thus the line output stage. If, however, the PL81 anode is glowing red hot, check the valve itself which may have an internal short. If the valve is in order, check C44 500 pF capacitor wired from one of the line output transformer tags to the linearity coil-width switch panel under the chassis. A short in this capacitor is quite a common occurrence. The line output



Frame oscillator and output stages.

transformer can produce several fault symptoms if defective, from a simple case of non-operation to the symptoms just described. Replacement of this item needs no description as it is quite simple and straightforward provided a note of the connections is made.

Excessive EHT

A less obvious fault produced by the line output transformer is reduced width with excessive EHT, producing a very sharp picture lacking some 1-2in. either side. Considerable caution should be used in approaching this fault symptom; note that the picture is bright and clear—not blurred at all. As a quick check, a 2,000 pfd high-voltage working capacitor can be wired across C44 (500 pfd previously referred to) and whereas under normal conditions this would spoil the picture completely, it may restore normal width and working conditions, thus indicating the real culprit. Where the width is reduced and the picture blurred, check the ECL80 (V9), PL81 (V10) and PY81 (V12), the setting of the line drive control (pre-set to the right of width knob) and the resistors associated with the V9 valve base and R49, the 4.4 KΩ screen dropping resistor to pin 8 of the PL81.

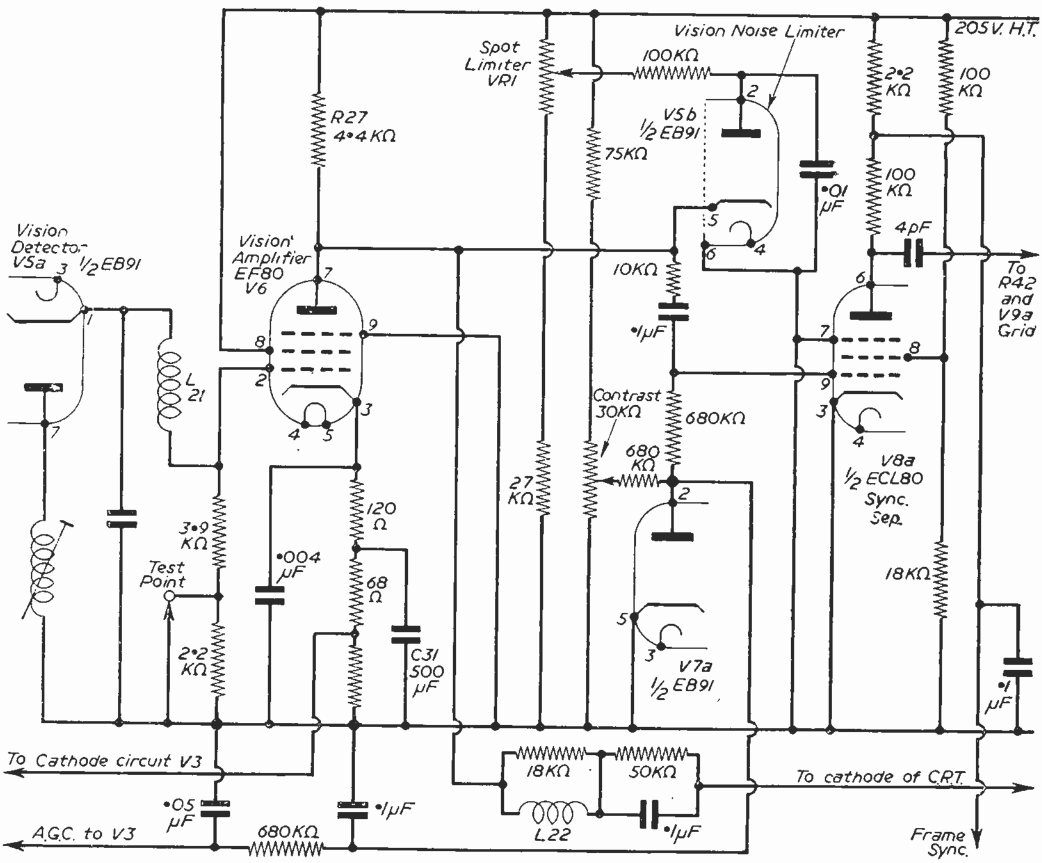
Line Hold

If the setting of the control has to be varied, check V9 and the 220 KΩ resistor R45, in series with control to pin 9 of the ECL80 valve base.

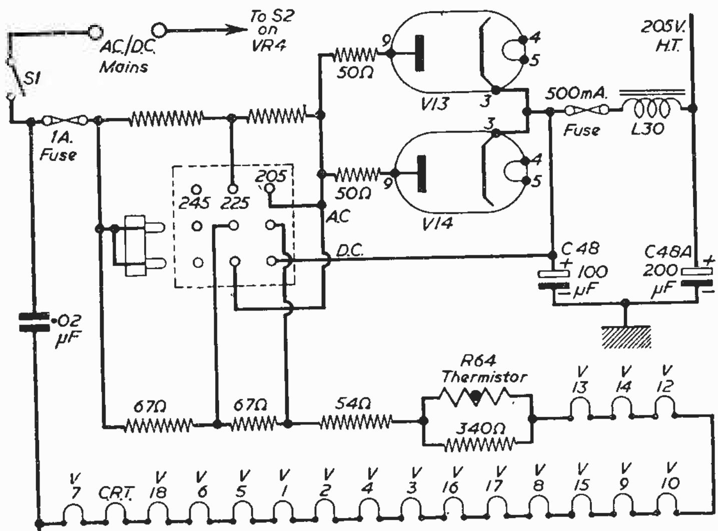
Frame Timebase

The number of "usual" faults are comparitively few, mainly being restricted to linearity and hold troubles. As there is no interlace diode incorporated in the circuit, it is essential to set the frame hold correctly to secure a good interlace free from line pairing.

The main complaint is compression at the bottom of the picture and this occurs after the set has been on a short while. It should be noted that a certain amount of bottom shrinkage normally occurs due to temperature rise after the set has been on some time but the compression referred to is more severe. Generally a replacement ECL80 in the V15 position will restore normal conditions. Insufficient height, equal top and bottom may indicate a faulty R67 220 KΩ resistor in series height control to pin 1 of V8 ECL80. A similar resistor R68 is wired from the frame hold to pin 2 of the V8 valve base and should be suspected if the control is at the end of its travel.



Circuit of the vision detector, amplifier, limiter and sync separator stages.



The power supply.

Faults Affecting the Video Section

It will have been noted that when the fault of "no vision—sound in order" was discussed, it was terminated by the conditions obtaining due to a fault in the line timebase. It is not suggested that only line timebase troubles can cause a loss of raster (not picture) but it is certainly most often the case. However, there are several possibilities which may be mentioned. The tube itself may develop a heater/cathode short which most often (not always) will cause the raster to illuminate fully before dulling and fading as the EY51 and the line output stage becomes unable to cope with the increased current demand. Sometimes the bright raster will remain all the time the brilliance control is kept down to minimum, fading as it is advanced. A 6 v. isolating transformer should be fitted to divorce the tube heater from the valve chain. It should be noted, however, that uncontrollable brilliance can, and often is, caused by a brilliance control open circuited at its chassis end—in this case, one side of the on/off switch. Similar symptoms again are provided when the load resistor of V6 (EF80) becomes open circuited—R27, 4.4 KΩ—this fortunately does not happen very often.

The "usual" fault symptoms having been discussed, a few items of interest may be pointed out. Valve V7, EB91, is the vision A.G.C. clamp and sound noise limiter double diode. The sound detector is a crystal diode—normally a GEX34 but may be an OA79 or a CG12E.

Line Linearity

The line linearity control expands and contracts the sides of the raster, mainly the left in relation to the right.

The C.R.T. heater is not the final one in the heater chain—V7 is.

Focusing on the DM1 receiver is by means of selecting the position of a wander plug on the tube base.

The frame form (VR7) control (on chassis) should be adjusted to give uniform vertical scanning in conjunction with VR5 (height) and VR8 (frame linearity).

AN AUTOMATIC AERIAL SWITCH

(*Continued from page* 283)

which is on the automatic switch. Outlet No. 2 is connected to the aerials via the switch. Insertion of the coaxial plug in outlet No. 1 automatically disconnects outlet No. 2. If a double-pole lid switch is available it may be wired in such a way that outlet No. 1 is switched out when outlet No. 2 is in use, but this is not really needed as due to the short connections to socket No. 1 it has no effect on performance when socket No. 2 is in use.

If no box is available in which to construct the unit, it may be made up on a wood or metal base with a lid to cover it if desired. The coaxial socket may be mounted on a small metal bracket and the lid switch mounted direct on the base.

Some care is needed in forming the plunger to ensure that it has free movement in the hollow centre pin, and all rough edges should be filed down to avoid any possibility of sticking.

If the plunger is made of material such as a plastic knitting needle, it will be found that if the lower end of the plunger is touched with a warm soldering iron, a slight spread will be made which will stop the plunger from falling out, should the unit be turned upside down.

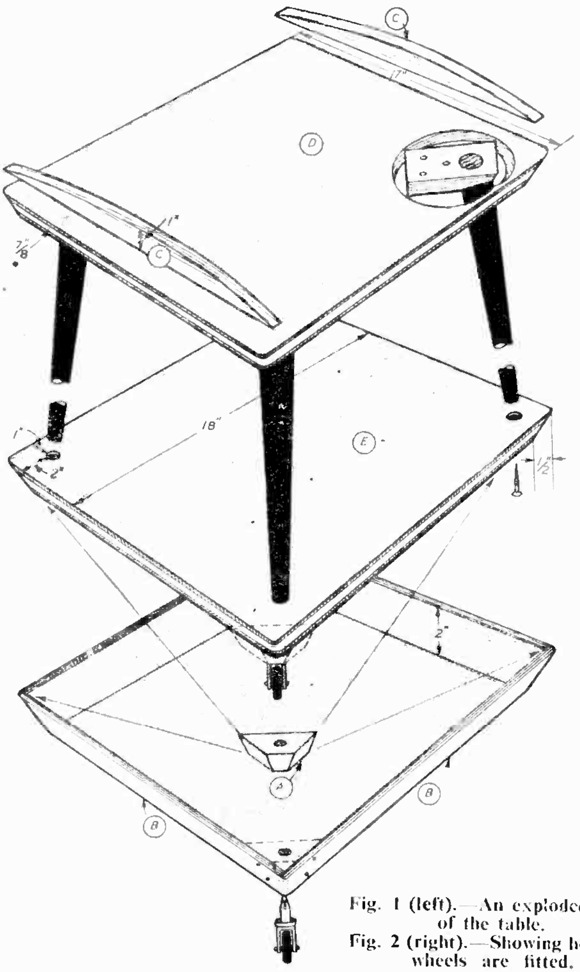
Two holes should be provided in the base for screwing to a skirting board or wall. When the unit is complete and installed it will be found that one has all the advantages of the arrangement in Fig. 1, but with none of the losses.

TELEVISION TABLE

By D. S. Malcolm

A MOBILE TROLLEY FOR THE TELEVISION RECEIVER

THE simple assembly of this contemporary television table is shown in the exploded view (Fig. 1).



The Legs

The legs are secured to the underside of D so that the feet of the legs rest on E in the approximate positions shown. Mark circles on E round the feet of the legs and bore out ¼in. deep. The legs sink into these holes. Continue drilling with a ¼in. drill to take the No. 12 screws which pass from under E into the legs. Dismantle the legs and plane back all the edges ½in. in and round the corners. Glue and screw the legs into position. Shape the pieces C to a curve and glue and nail to D.

Wheels

Be sure that they are capable of taking the load of the television receiver. Those with a bearing plate can be screwed direct to the underside of E with ¾in. screws. Those with a stem and commonly used on trolleys require a block A. Fig. 2. To hide the block an apron can be nailed thereto.

Apron

Fig. 3 shows the block screwed to the underside of E with a hole drilled for the trolley wheel stem lying on a diagonal drawn across E. Saw off the overhanging corners and plane back to the slope of the undercut edges of E. Then saw off a piece down the dotted line shown in the lower

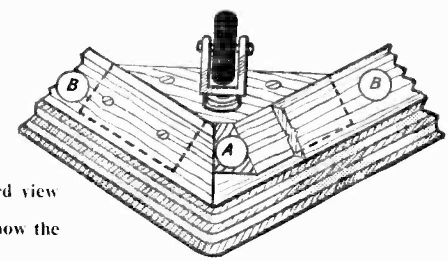


Fig. 1 (left).—An exploded view of the table.
Fig. 2 (right).—Showing how the wheels are fitted.

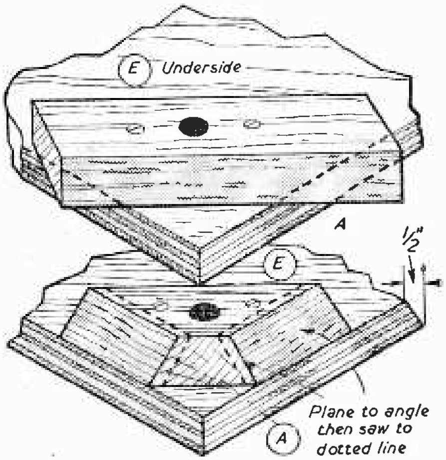
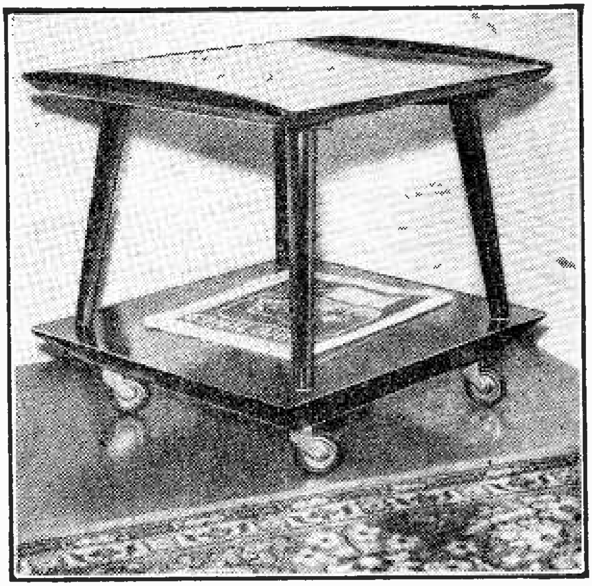


Fig. 3 (above).—Fixing the apron.

Fig. 4 (right).—The completed table.



MATERIALS REQUIRED:

- Two sheets of $\frac{7}{8}$in. multi-ply with a mahogany, oak or walnut veneer 18in. × 17in.
- Four round tapered hardwood legs 12in. long with blocks and screws.
- Four wheels.
- Two pieces mahogany, oak or walnut 18in. long × 1in. square for C.
- Four No. 12 screws (steel) $1\frac{1}{2}$ in. long.
- Apron (optional).
- Foor blocks of planed softwood 6in. long × 3in. wide × $1\frac{1}{2}$ in. thick.
- Four lengths of $\frac{1}{4}$in. plywood 19in. long × 3in. deep to be cut and planed to size when fitting.

half of Fig. 3, equal to the thickness of the apron, and nail on the apron, cutting and planing it as required. Round off the corners.

Finish

An ebony effect on the legs and undercut edges can be achieved by painting with three coats of black lacquer followed by two coats of clear varnish, allowing twenty-four hours between each coat. Rub lightly with No. 7 garnet paper and then burnish with metal polish or car polish. The flat surfaces can be waxed, french polished, or given three coats of clear varnish and rubbed down as with the legs.

A Slide Projector

RCA GREAT BRITAIN LTD. announce the U.K. availability of the new RCA type TP-8B Random Access Slide Projector which provides a means of projecting standard 2in. × 2in. slide transparencies, remotely selected, into a monochrome or colour television vidicon film camera. Up to 36 slides may be projected either in fixed sequence or in randomly selected sequence; in addition to handling the programming of a series of slides in sequence the TP-8B assures, at any time, the immediate availability of slides such as standby or emergency slides.

The optical resolution and detail contrast provided by the RCA TP-8B are sufficient to fully satisfy the requirements of television slide programming. The projector has ample light output for 3-V colour film camera systems (approximately 450 foot candles with open gate) and provides uniform brightness over the entire field of the projected image.

Designed to operate in television film rooms, it is optically interchangeable with the RCA TP-7 slide projector as already installed in many television studios in this country and may be used with any vidicon film camera using proper multiplexer mounting facilities and projection lenses.

Two Channels

The type TP-8B Random Access Slide Projector consists of a projector, a control chassis, a remote control panel and a remote indicator panel. The projector employs a dual condenser lens system which forms two optical channels. A drum type magazine associated with each optical channel change is made possible by projecting successive slides first from one drum and then from the other.

One projection lamp is used in conjunction with both optical channels. Light is collected from both sides of the lamp filament by these optics and directed to each of the two slide gates which are offset from, but symmetrically located with respect to, the projection axis. One movable and three fixed front surfaced mirrors located between the slide gates and the single projection lens multiplex each of the channel axis into the centrally located projection lens. Split second movement of this mirror into or out of the optical path provides the multiplexing action between channels.

Relaxation Oscillators—2

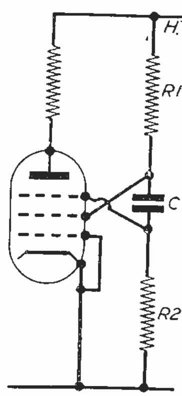
THE SECOND OF A SERIES OF NON-MATHEMATICAL ANALYSES

By R. Couvela

(Continued from page 245 of the December, 1958 issue)

THE transitron-connected pentode is in itself a curiosity. If you look at the characteristic curves of a pentode, you will see that the sum of the anode current and screen current is almost constant. At low values of anode voltage, the screen conducts much more heavily than the anode. As the anode voltage rises, so the anode current rises, and the screen current reduces, until the anode takes over practically all the current which was originally being passed by the screen. This is the normal operating condition.

It is found that the suppressor grid voltage plays a considerable part in deciding the position of the change-over point, where the anode current becomes greater than the screen current. If the suppressor is held very negative, the changeover point can be very high. Effectively, the anode is thus cut off. The transitron relaxation oscillator relies on these facts for its operation.



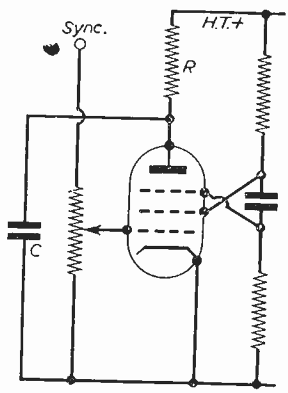


Fig. 1.—(Above, left) Basic circuit of transitron oscillator.
Fig. 3.—(Above, right) Circuit of transitron time-base generator.

Action of the Transitron

Consider the circuit of Fig. 1. In a stable condition, C is charged to Vg2. Vg3 is zero. Now, in the event of a slight increase of Vg3, Ia will increase, Ig2 will decrease, causing Vg2 to rise. This rise is transmitted through C to Vg3, which also rises. Thus, the initial change becomes a precipitate change in the same direction, until Ig2 is cut off completely, so Vg2 equals $V_{H.T.}$ and Vg3 is at its maximum value. The anode is now conducting heavily.

C will then charge towards full H.T. value through R2, thus slowly reducing the value of Vg3, until this voltage reduces sufficiently to reduce Ia, thus permitting the presence of Ig2. The occurrence of Ig2 drops Vg2, which transmits the drop to Vg3 through C, causing Vg3 to drop faster. Thus a landslide is started again, ending up with Ia cut off, Ig2 at maximum, and Vg3 well below zero.

C will then discharge towards Vg2, through R2, and the circuit will be in relaxation until the rising Vg3 permits anode current to flow, thus reducing Ig2. The cycle then repeats itself. From the above, it will be seen that a square wave is available from either the screen or, preferably, from the anode, the two being in antiphase. It is normal to take the output from the anode, as this is not required for any other purpose, so the coupling network will not have any effect on the performance of the oscillator.

It will be seen that we have only one time constant which controls the frequency, namely, C/R2. Thus, the frequency will be given by

$$f \simeq 1/2CR2$$

As in the Multivibrator, this formula is to be taken only as an approximate guide, for the same reasons. As an example, if C = 0.001 μF and R2 = 100 kΩ.

$$f \simeq \frac{1}{2.10^5.10^{-9}} = \frac{1}{2.10^{-4}} = \tfrac{1}{2} \times 10^4 = 5 \text{ kc/s.}$$

Control of frequency may be obtained by variation of either C or R2, or both, i.e., C coarse and R fine. There is no danger of appreciably unequal pulse widths.

The anode load may be determined by the same means as given in the last issue for those of the Multivibrator. R1 may be the same value.

The Transitron Timebase (Fleming-Williams Timebase)

The circuit of the transitron relaxation oscillator modified to function as a timebase is shown in Fig. 3. In this circuit, as in the neon timebase, the sweep is obtained by slowly charging a capacitor through a resistor. On switching on, the transitron oscillator cannot act, as Va is too

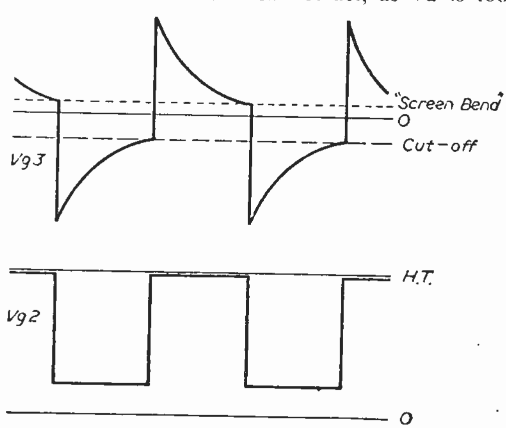


Fig. 2.—Waveforms in the transitron.

small. Thus, this part of the circuit assumes the condition of the transitron just before Ia flows, i.e., Vg3 is zero, and Ig2 is at maximum. As C charges, however, Va rises, and as it does so Ia rises, following the characteristic curve. This action reduces Ig2, so the transitron effect takes over, and Ia is permitted to flow freely, Vg3 falling below zero. This discharges C. When C is discharged, the anode current drops to a very low level, supported only by R, so the screen current rises. Thus the circuit is restored to its original condition, and C once more charges through R, and so the cycle becomes repetitive.

The transitron frequency should be made very considerably higher than the required sawtooth output frequency, as half the cycle time of the transitron is used as the discharge time of the capacitor, and thus determines the fly-back time. The transitron frequency should not be high enough to prevent the complete discharge of the capacitor, otherwise the sweep amplitude will suffer.

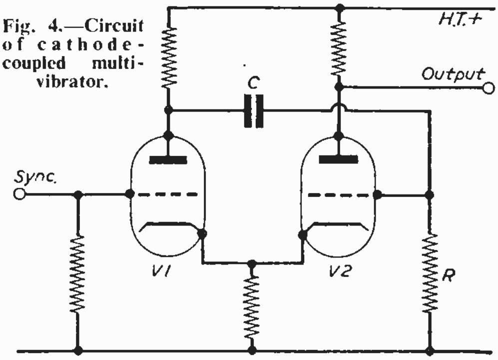


Fig. 4.—Circuit of cathode-coupled multi-vibrator.

As a very rough indication of the frequency of the sawtooth, f $\simeq$ 1/CR may be used although this formula should not be relied upon, as the frequency will be very dependent on the characteristics of the transitron used.

We will now consider the modification of another circuit to act as a timebase.

The Cathode-coupled Multivibrator Timebase

First, let us consider the cathode-coupled pair amplifier, sometimes known as the long-tailed pair. In Fig. 4, if we temporarily ignore C, we see two valves using a common bias resistor. As there is no decoupling capacitor used on the cathodes, any signal fed to either grid will not only appear, amplified, at the anode of the same valve, but the same valve will act as a cathode-follower, which will inject the signal into the cathode of the other valve. As the grid of the other valve is held constant, the signal will appear amplified at its anode. The main usefulness of this circuit lies in the fact that the two anode signals thus obtained are in anti-phase, and of equal magnitude: moreover, the circuit will function equally well from either grid, or from both simultaneously.

Action of Circuit

From this we derive the cathode-coupled multivibrator, which is the circuit shown in Fig. 4. Its action is as follows:

Assume that both valves are conducting normally. Then, if the grid of V2 were to rise slightly in voltage, the cathode voltage of V2 would follow, bringing with it the cathode voltage of V1. Now, as V1 grid voltage is constant, this has the same effect as reducing the voltage on V1 grid, keeping the cathode voltage constant, i.e., Ia of V1 falls. This causes the anode potential of V1 to rise, which is passed on through C to the grid of V2, thus causing a landslide. As with the normal multivibrator, this ends with V2 conducting heavily, and V1 cut off. There then follows a period of relaxation, during which the voltage of V2 grid falls towards earth potential, until V2 reduces current. Then V2 cathode voltage falls, V1 cathode voltage falls, Ia of V1 rises, V1 anode voltage falls, causing V2 grid voltage to fall, and there is once more a landslide.

We finish with V1 conducting and V2 cut off, with the grid of V2 well below zero, rising towards cut off, when the cycle is repeated.

It will be seen that this multivibrator has many advantages over the conventional version. This one has automatically equal pulses widths, and only one CR network to control frequency, thus avoiding the necessity for ganging. Sync is easily fed into the grid of V1, and the anode of V2 is left free for output purposes.

We find that V2 is cut off for much of the time, and it is from this fact that we obtain the sawtooth generator, by connecting a capacitor across the output, as shown in Fig. 5. When the valve is cut off, the capacitor charges through the anode load; when the valve conducts, the capacitor is discharged. As in the transitron timebase, the multivibrator frequency is made much higher than the required sweep frequency, and the anode load of the output valve is made much higher than usual.

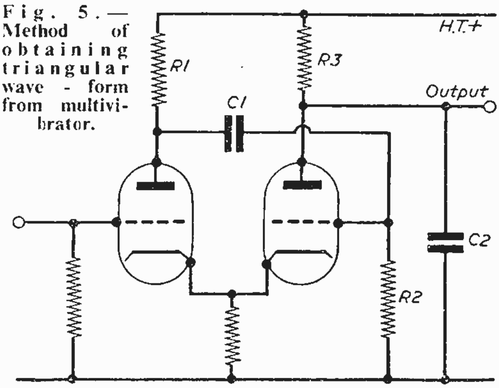
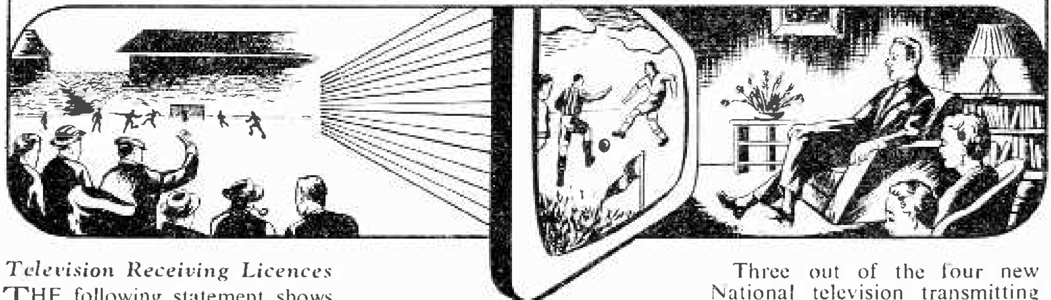


Fig. 5.—Method of obtaining triangular wave-form from multivibrator.

Note on Formulæ Given for Oscillation Frequencies

Accurate formulæ would take into account the H.T. voltage, valve parameters, and many other factors. These approximate formulæ have been given in the belief that the average experimenter is only interested in a rough guide upon which to base his own experiments.

TELENEWS



Television Receiving Licences

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

Region	*Total*
London Postal	1,624,280
Home Counties	1,076,325
Midland	1,358,754
North Eastern	1,380,313
North Western	1,196,236
South Western	682,043
Wales and Border Counties ...	498,015
Total England and Wales ...	7,815,966
Scotland	662,028
Northern Ireland	93,497
Grand Total	8,571,491

No "Pay TV"

NO "Pay TV" will be authorised in U.S.A. until next summer at the very earliest. Replying to a request by Chairman Oren Harris (D.-Ark.) of the House Interstate and Foreign Commerce Committee to give Congress further time to study the entire issue of pay TV, the commission stated it would refrain from approving any application for broadcast subscription TV until the adjournment of the next session of Congress, probably in July or August, 1959.

This applies to on-the-air pay TV only, and not closed-circuit wired systems, over which the FCC has no jurisdiction.

Bulgaria's First Outside Broadcast

THE first Television Outside Broadcast in Bulgaria took place recently when a fashion show was televised from this year's International Fair at Plovdiv. This was as a result of a very satisfactory international co-operation between Hungary, France and Great Britain.

One of the British Pye outside broadcast vans with three cameras fed pictures and sound to the French C.S.F. stand whose transmissions were picked up by the Hungarian Orian receivers at various points in and around Plovdiv.

The illustration below shows the very attractive dresses of modern Budapest being televised.

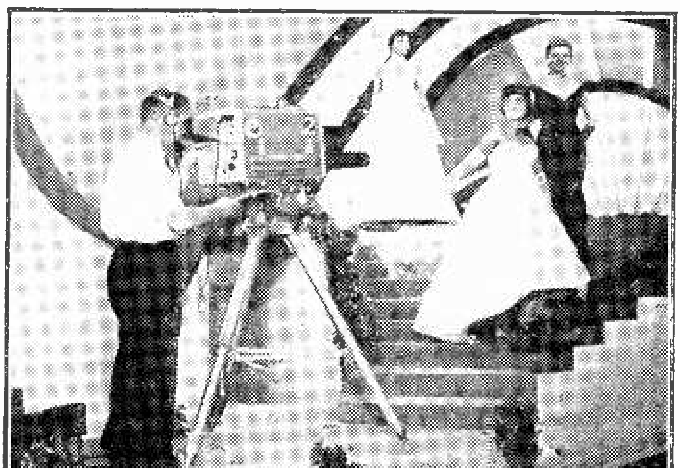
New Television Stations for Australia

NEW contracts have been awarded to Marconi's Wireless Telegraph Company Ltd. for the supply and installation of further television transmitting stations and studio equipments in Australia. These orders have a total value of approximately £400,000.

Three out of the four new National television transmitting stations to be built will be Marconi - equipped. These stations will be at Brisbane, Adelaide and Perth.

Each of the three stations will be equipped with two Marconi 10kW television transmitters Type BD371, two 2kW sound transmitters Type BD325C, a control desk, programme input equipment (vision and sound) and extensive monitoring facilities and spares. The aerial system will consist of a split 8-stack array.

At each of the three stations the outputs of one vision and one sound transmitter will be combined to feed four stacks of the aerial array, while a similar procedure with the second set of transmitters will feed the remaining four stacks. The two vision transmitters are thus effectively in parallel, as also are their sound counterparts. The effec-



Bulgarian TV. See Bulgaria's first Outside Broadcast, on the left.

tive radiated power (vision) in each case will be 100kW.

Peter Dimmock's New Clothes

PETER DIMMOCK has had a new suit made—not because he wants to add to his wardrobe, but to wear in "Grandstand." Dimmock requires the suit so that he can move unfettered about the studio, talking to viewers and keeping in touch with all the various items. It is fitted with a radio microphone and a small hearing-aid receiving set. This means stowing batteries, miniature transmitter and various other pieces of equipment about him, and when the programme was given its first "dry run" recently, his suit with its bulging pockets became more and more unsightly.

So the BBC decided he needed a specially made suit and the editor of the *Tailor and Cutter* was consulted. He suggested a tailor who would build Dimmock one with cunningly placed pockets, cut so that it hangs properly when the pockets are full, and made from a cloth that televises well.

"It's not a suit I could wear outside the studio," says Dimmock. "There are holes in various places to thread wires through—and I'd hardly want to walk about London with aerials sewn into the seams of my trousers."

TV in Japan

THE Japanese are making every effort to expand the commercial television coverage in their country and by the end of next year it is anticipated that 40 stations will be in operation. Furthermore, in Tokio itself, what is claimed to be the world's largest television tower is being erected.

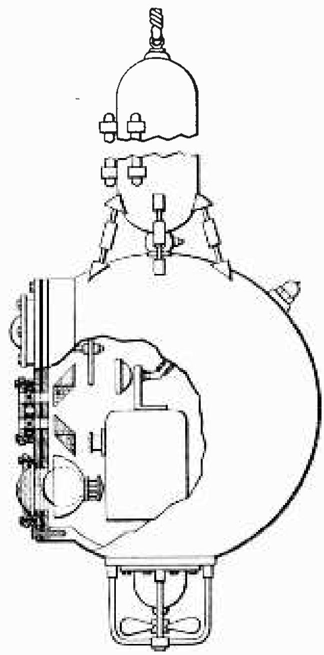
The Redcar Racecourse Relay

THE value of closed-circuit television has been made manifest at the Redcar Racecourse, for eight 17in. television receivers have been installed in the popular stands and also in the bars. Signals to these sets are fed from television cameras on the course itself. This has enabled some of the racecourse group to obtain a better view of the finish of the race by watching the television screens, while, if it rains, those taking shelter in the bars can still enjoy the thrill of the race.

Radio and Electronic Component Show, 1959

THE sixteenth annual Radio and Electronic Component Show, organised by the Radio and Electronic Component Manufacturers' Federation, is to be held at Grosvenor House and Park Lane House, London, W.1, from April 6th to 9th, 1959.

Admission (from 10 a.m. to 6 p.m. daily) is by invitation only, applications for tickets to be made to the secretary, R.E.C.M.F., 21, Tothill Street, London, S.W.1.



Part sectional view of the under-water TV camera.

Underwater Television

IT is amazing to think that although underwater television has only reached a state of high efficiency during the last few years, the idea had occupied the minds of inventors soon after the first low definition demonstrations had been given in Europe. As evidence of this, reference can be made to the accompanying drawing which shows the features of equipment proposed by Dr. Hartman of Monaco. A bell-shaped container was to house the lights, scanning disc, camera, etc., with a propeller drive to aid movement.

Television on Tape

AS far as the U.S.A. is concerned, it is certain that magnetic tape will be used far more extensively in the near future for the recording of commercial television programmes. The companies responsible for this side of the business are purchasing camera chains, generally of the vidicon type and also the actual tape recorders themselves. There should be a distinct saving in cost when compared to the film counterpart for the tape can be erased very readily and used again. In addition, films have to be processed, cut and edited and there is a considerable time delay factor, whereas, the tape may be played back immediately and any corrections made straight away.

Increased Colour TV Viewing

ACCORDING to the latest reports, the number of colour television receivers in use in the U.S.A. now exceeds 350,000 which is an increase of nearly 150,000 since the autumn of last year. Considerable efforts are being made by the interested parties to step up sales but price is the biggest stumbling block—£180 to £340 at the present dollar rate of exchange. The biggest single expensive item is still the complicated cathode-ray tube using three guns and although research is going on, an alternative device which can be mass produced has not yet been found. There is the inevitable cycle of opinion that additional colour television transmissions would improve sales but bearing in mind that advertisers foot the transmission bill, they quite naturally want to see more viewers for their outlay. Plans are afoot, however, to provide more colour programme hours during the Festive season and this will gain momentum in the New Year.

Mr. F. J. Camm

MR. F. J. CAMM has been elected Vice-president of the Incorporated Practical Radio Engineers.

Vision-on-sound and Sound-on-vision Problems

By G. Earl

CAUSES AND CURES OF INTERFERENCE DUE TO MISALIGNMENT

SOUND-ON-VISION represents the most troublesome of these two problems, and is inevitably experienced at some time or other by the experimenter and viewer. The closely related symptom known as vision-on-sound is probably less likely to develop without provocation, but under certain conditions there is a chance that both effects will exist simultaneously.

The television aerial is designed to respond equally to both sound and vision signals, and both signals are fed to the set through the aerial feeder cable and amplified together in the first two or three stages. At a certain point in the receiver the signals are separated and then fed to the sound and vision amplifiers for individual amplification.

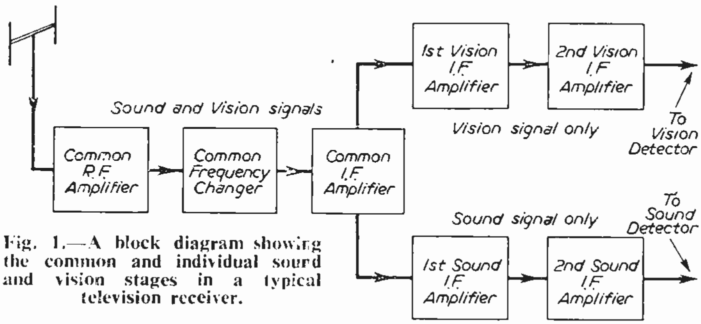


Fig. 1.—A block diagram showing the common and individual sound and vision stages in a typical television receiver.

Receiver Front End

The idea is clearly shown in Fig. 1. Here it will be seen that the sound and vision aerial signals are first amplified by a common radio-frequency (R.F.) amplifier, and then fed to a common frequency changer stage. This results in the production of sound and vision signals at intermediate-frequency (I.F.). Again, these signals are amplified together in the common I.F. stage, but in its output circuit they are separated and fed to the appropriate sound and vision I.F. amplifiers.

Provided the signals do not lose their identity in the common stages, and can be adequately separated one from the other in the sound and vision individual amplifiers, all is well and the symptoms under consideration will not occur. However, if there is considerable unbalance in the individual amplifiers or excessive non-linearity in the common stages the troubles will be very much in evidence.

It will now be realised that sound-on-vision means that the sound signal has found its way into the vision channel, and vision-on-sound results when the vision signal "spills" into the sound channel.

The vision modulation is the electrical representation of the image "seen" by the television camera. This, of course, does not make sense when heard from a loudspeaker since it consists essentially of quickly changing pulses and constant frequency synchronising signals. The vision modulation, in fact, occupies a very wide frequency range, well outside the audible range at the higher end of its spectrum. However, there is considerable signal material, including the frame pulses, at lower frequencies corresponding to the audible spectrum, and it is this material which is demodulated by the sound detector when the vision signal inadvertently becomes mixed with the sound signal in the sound I.F. stages.

It is heard accompanying the sound as a rough buzzing noise and the pitch of the note and the volume may alter on different scenes and on camera changes. The effect may also become more troublesome as the contrast control is advanced.

When the sound signal enters the vision channel, it also is demodulated by the vision detector, and the sound signal then accompanies the vision signal at the input to the picture tube and sync separator. This causes the picture to jump vertically in sympathy with the sound modulation and in severe cases, where excessive

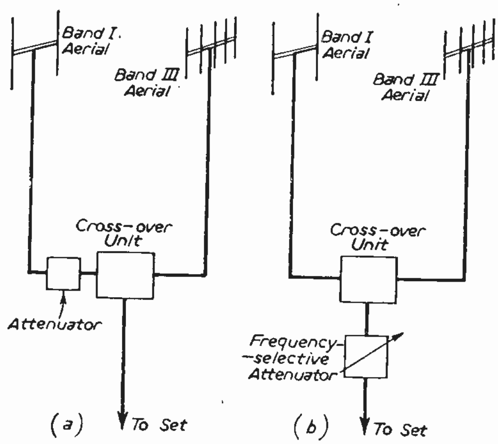


Fig. 2.—Showing at (a) the position for the introduction of an attenuator for eliminating cross-modulation on Band I, and at (b) the position for a frequency-selective attenuator which serves to adjust the level of the Band I signal with respect to the Band III signal, which is hardly affected by the unit. This method is essential where a combined aerial and single down-lead are adopted.

sound signal gets into the sync separator, both line and frame holds may be completely destroyed.

Cross Modulation

If both symptoms are present, cross modulation of the sound and vision signals should be suspected. This is often responsible in areas of very strong signals, especially if a set has been moved from an area of poor signal to a site near a transmitter, or if a local station is put into service. According to the large number of problems of this nature which are dealt with by our Query Department, it would seem that the trouble is still very widespread.

What happens is that the very strong signals picked up by the aerial push the "common" valves well into overload where they fail to amplify linearly, which means that amplitude variation of the signal at the input does not result in a corresponding amplitude variation at the output. In other words, the overloaded valves tend to rectify partially both sound and vision signals.

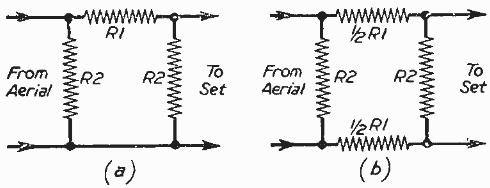


Fig. 3.—Pi-type attenuators (a) for coaxial feeder and (b) for twin feeder. $R1 = Z(N^2 - 1)/2N$ and $R2 = Z(N+1)N-1$, where Z is the feeder and receiver input impedance, and N is the ratio of input to output signal voltage (attenuation ratio).

The sound and vision signals thus become intermodulated, for the effect is exactly the same as that purposely created in a frequency changer valve in mixing the local oscillator signal with the incoming signals to give the intermediate-frequency.

When this happens the sound and vision signals immediately lose their identity and can no longer be individually amplified, even though the sound and vision amplifiers may be adjusted correctly and be themselves working perfectly normally.

The Solution

The solution to the problem is simply that of reducing or attenuating the aerial signal before it is applied to the set. Various types of attenuator units are now readily available for this purpose, and consist essentially of resistive elements. It should be noted, however, that where the signal on one band only requires such treatment, the attenuator must be introduced into the lead appropriate to the aerial of that band.

If the attenuator is fitted in the lead carrying both BBC and I.T.A. signals, then both will be attenuated to the same extent, but this is not usually desirable since the BBC signal is generally the stronger of the two and responsible for cross modulation. Fig. 2(a) shows where the attenuator should be connected in this case.

However, frequency-selective attenuators are also available, and these may be connected in the lead carrying both programmes, as shown in Fig. 2(b). This may, of course, be essential if a combined aerial and single down-lead are adopted. The frequency-selective attenuator can be adjusted for the correct level of Band I signal in relation to the Band III signal, which is hardly affected by the attenuator. It should also be noted that variable attenuators of the ordinary kind can be obtained.

Pi-type Attenuators

A few resistors can easily be arranged to form a π-type attenuator, as shown in Fig. 3; the idea being to maintain correct matching between the feeder and the receiver while reducing the signal. Carbon ¼-watt resistors are very suitable, and should be arranged in orderly form as close as possible to the aerial socket.

At locations close to a powerful transmitter, it is often necessary to reduce the aerial signal by at least 10 times (20 db) before applying it to the set; and where large attenuation ratios are needed two or more series-connected attenuators are mnre suitable than endeavouring to secure a high ratio with a single unit.

The ratio should be adjusted to reduce the signal to a level sufficient to remove the cross modulation effects without detracting from the quality of the picture. If "grain" becomes troublesome after attenuation, however, the signal level has been reduced too much and a smaller attenuation ratio should be used.

Vision-on-sound

When this symptom is not partnered by sound-on-vision, it is invariably caused by misalignment of the sound I.F. stages. Misalignment, apart from reducing the sensitivity of the sound channel, results in the spreading of the sound response as illustrated by the broken-line curve in Fig. 4. Here it will be seen that the curve "spills" into the vision I.F. response and thus causes the sound channel to respond to some of the vision signals. The response should, of course, be relatively narrow (usually about 200 kc/s), as indicated by the full-line curve.

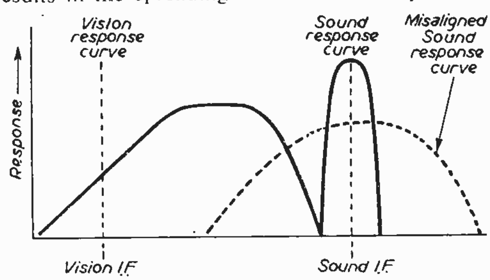


Fig. 4.—Vision-on-sound is often caused by misalignment of the sound I.F. channel. This causes the sound response to spread out and embrace the vision response, as indicated by the broken-line curve.

The trouble can be cured quite easily by adjusting the sound I.F. transformers for maximum sound after first ensuring that the local oscillator is adjusted for the best quality picture consistent with minimum *sound-on-vision*. On some receivers sound channel instability may occur if the sound I.F. transformers are all peaked at one frequency. Should this happen, the I.F.s should be peaked as far as possible at a low contrast setting, and then slightly detuned to avoid instability and the effect of oscillator drift. It is important *not* to adjust tuning cores other than those in the sound I.F. transformers.

Sound-on-vision

This trouble is nearly always caused by wrong adjustment of the local oscillator. On single-channel and five-channel superhets, the oscillator trimmer or channel adjusting knob should be very slowly rotated first one way and then the other while observing the picture. Adjustment should initially be made for maximum sound, and then a very slight detuning adjustment may be required to eliminate sound-on-vision.

On multi-channel receivers careful adjustment of the fine tuning control should solve the problem, but if this does not help much and it seems as though the picture could be cleared if the fine tuning control could be rotated past its stop, the oscillator tuning on the channel affected probably requires balancing.

Oscillator Tuning

This is a simple operation which can be performed by most viewers. On most receivers employing a turret tuner, the oscillator tuning core appropriate to the channel to which the unit is switched is adjustable from outside the cabinet by removing the fine tuning and channel selector knobs and inserting a non-metallic trimming tool through the small hole adjacent to the spindle. A thin knitting needle (plastic type) filed at one end to the shape of a screwdriver serves admirably as a trimming tool. This should be inserted in the hole, pushed lightly against the core and rotated until the blade engages with the slot in the core. Adjustment should be made for maximum sound consistent with minimum sound-on-vision with the fine tuning control set to the centre of its travel.

On other tuners, the oscillator cores may be differently placed, but the procedure as detailed above is still appropriate. It is usually necessary, however, to make adjustment individually on each channel affected or in need of balancing.

If oscillator misadjustment does not appear to be the cause of the symptom, misalignment of the sound rejectors in the vision I.F. channel or the I.F. transformers themselves should be suspected. If the picture definition is very bad, then the whole vision channel tuned circuits should be realigned in accordance with the makers' instructions. However, if the definition is of a reasonable standard, it is often possible to re-set the rejectors fairly well without instruments.

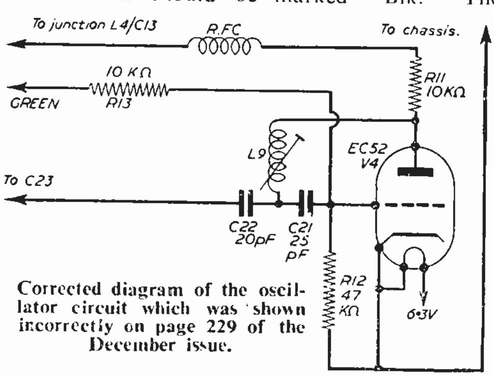
The oscillator should first be very critically adjusted for maximum sound, after which the rejectors should be adjusted in turn for minimum sound-on-vision.

If a signal generator is available, a modulated signal at the sound carrier frequency should be applied at the aerial socket with the aerial removed; the contrast should be turned fully on and the brightness adjusted to produce a raster. The level of the applied signal should then be increased until dark horizontal bars, representative of the modulation, appear on the screen. It is then a relatively simple matter to adjust the rejectors to eliminate this modulation pattern.

Modifying the "Unit 161" Correction

AN error occurred in the circuit diagram which was published in last month's issue: the wire from R13 (to C22) should have been taken to the junction of C21 and R12. A revised diagram of the oscillator circuit is given below.

In Fig. 2 on page 230 of the December, 1958, issue, the wire "4" marked "Yel Blk" on the wafer switch should be marked "Blk." The positive and negative wires from the 24 v. D.C. supply are respectively yellow and black.



Corrected diagram of the oscillator circuit which was shown incorrectly on page 229 of the December issue.

The author also points out that if the unit is used with the standard I.F. (36 Mc/s), second harmonic mixing must be used, for the correct relationship of vision I.F. to sound I.F. Positions 1 and 2 would give oscillator frequency 240-280 Mc/s: positions 3 and 4 would probably be too high.

If the unit is converted to Band I or Band II, the input circuit must be modified to suit each band, otherwise users might blame the unit for poor performance.

Replacing Catl

REMOVING, CHANGING AND TES

THIS series is presented for two reasons. One is that there is a tendency for service manuals to gloss over the mechanical details of television receivers and concentrate on the circuitry. The other is that no matter how many tubes one changes in other people's sets, confidence vanishes immediately one removes the back of one's own receiver.

Changing the tube in the greater majority of them will involve unboxing and enable the inside of the safety glass to be cleaned, but where these two operations do not form part of the tube change, or where there are short cuts, these will be included for the sake of completeness. Wherever possible advice will also be given on fitting low-capacity boost transformers.

Handling C.R. Tubes

Because television tubes are completely evacuated they can be extremely dangerous to handle. The entire glass surface is continually subjected to atmospheric pressure of approximately 14lb. per square inch, which works out at about one ton on the face of a 17in. tube. Any fracture of the glass will produce a violent implosion, the glass bulb collapsing with such force as to make a loud report and send fine slivers of glass across the room. For this reason it is advisable to wear protective goggles when handling, and in the home it is essential to keep the tube away from the rest of the household where it cannot be knocked. A suitable method of handling a tube is shown in Fig. 1, with one hand gently guiding the neck and the other

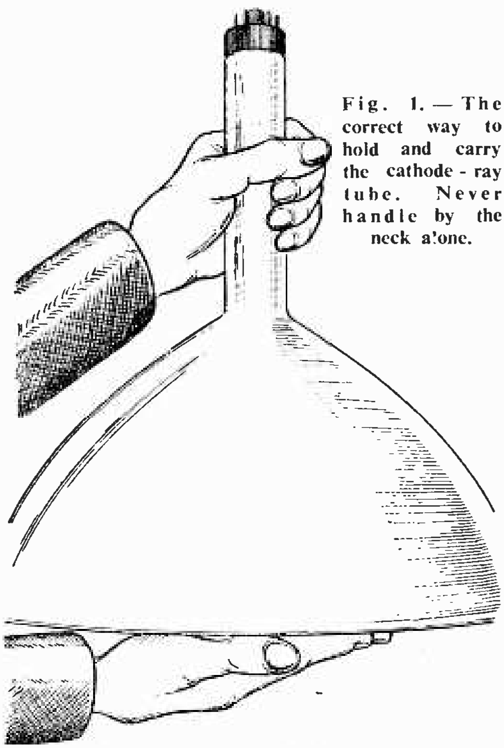


Fig. 1. — The correct way to hold and carry the cathode-ray tube. Never handle by the neck alone.

placed squarely underneath taking all the weight. *Never lift a tube by the neck alone.* In the case of 21in. tubes, which are large and very heavy, it is as well to enlist some aid when changing them, for if they become stuck during fitting it is almost impossible to support the weight in one hand for any length of time whilst the other is used to free the tube.

Always discharge the anode to the aquadag coating before handling, and if a spark is observed repeat the process once or twice more. Cathode-ray tubes can hold an EHT charge for

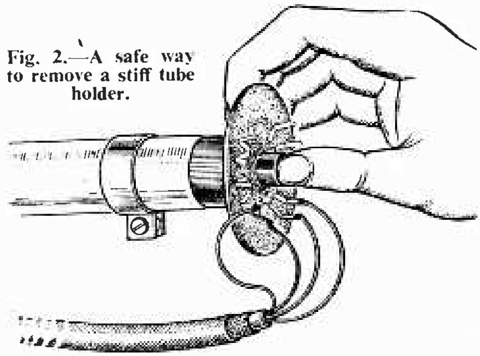


Fig. 2.—A safe way to remove a stiff tube holder.

many days, and although it is not a dangerous amount, it may be sufficient to make you drop the tube involuntarily.

Examining Your New Tube

This can be done very quickly (in the presence of the carrier if necessary) and should be carried out immediately if any claim for damage is to be made.

Open the box at the bottom (heavy end). Check that the tube face has been protected by a soft cloth and that it is free from scratches, large bubbles and glass folds. Lift the tube out, place it face downwards on a soft cloth and examine the gun for a loose base and check the gettering. This is the metallic "splash" on the side of the glass wall. If this has turned a milky colour or is white round the edges your tube has gas or air in it and should not be accepted.

A good tube will give a clear ringing tone if tapped gently on the gun with the fingernail.

Preparing the Old Tube for Removal

It is here that the instruction book lets you down badly. It will merely say "remove the anode and base connections, and slacken off the scancoils." No allowance is made for the usage the set has had, which is understandable as most manuals are prepared from a shiny new chassis, and it has been the writer's painful experience to have had a few tubes implode whilst trying to remove stubborn EHT caps and stuck deflector

ıode-ray Tubes—1

'ING :TUBES

BY H. PETERS

coils. A useful way of removing the EHT cap is to insert a screwdriver between the cap and the anode and twist. If it is badly stuck it is safer to renew the whole EHT lead than try to force it off.

The tube holder may be dealt with similarly, but the majority of the 12-pin types can be removed by gripping the outside of the holder with the fingernails and pressing the thumb on the spigot. Never pull the holder off against the weight of the tube. Stuck deflector coils readily come loose if you run the set for about half an hour before you remove the tube, and dusting the neck of the tube with french chalk will prevent them sticking again on the way out.

Despite the fact that most scancoils will only fit one way round it is surprising how many of them can reverse themselves and remain unnoticed until switching on. It always pays to mark them and the ion-trap magnet whilst they are still *in situ* on the old tube and a suggested convention, i.e., an arrow top dead centre pointing forward, is shown in Fig. 3. The writer uses quick-drying cellulose paint, but a small quantity of nail varnish is a useful substitute.

(To be continued)

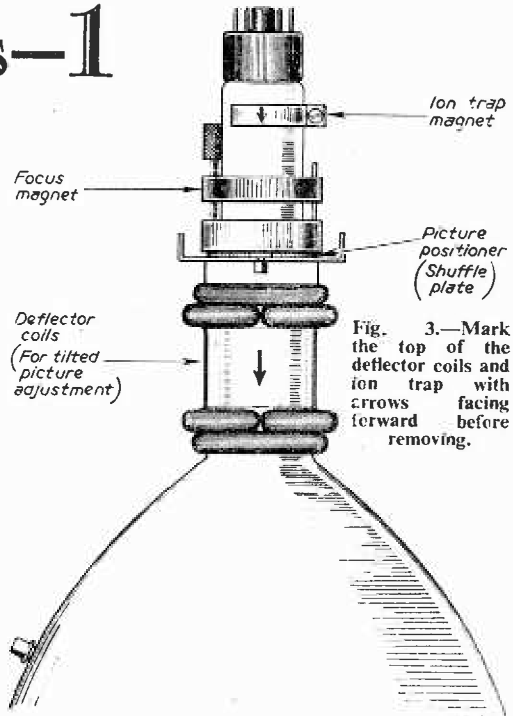


Fig. 3.—Mark the top of the deflector coils and ion trap with arrows facing forward before removing.

A USEFUL TABLE OF TUBE SUBSTITUTES

TUBE	Can be used instead of :	Notes
Ediswan CRM123	CRM121, CRM121A, CRM121B. Brimar C12A	No electrical change but will give a softer picture when EHT is below 7 kv.
Ediswan CRM141	CRM142	CRM142 has grey face. CRM141 has white face.
CRM152B	CRM152, CRM152A	CRM152B has grey face. CRM152A has white face.
CRM172	CRM171	Connect aquadag coating to chassis. May need C.R.T. cap adaptor.
	Mullard MW 43/64 and 43/69	CRM172 12.6 v., 3 amp. heater. MW43/64 and 69 6.3 v. .3 amp. heater. In series chain reduce heater ballast resistor by 20 ohms.
Mullard MW31/74	MW31/16, C12 FM Brimar, Cossor 121K, 12Xp4A Emitron	No change. MW31/74 has grey face, most of the others have white face.
	Ediswan CRM121, 121A, 121B, 122, etc.	Supply 6.3 v. for heater and 350 v.-450 v. D.C. to A1 Pin 10, earth aquadag coating, reduce focus field using magnetic shunts around existing magnet. Fit ion trap magnetic.
Mullard MW36/44	MW 36/24*, 14KP4A, 141K	Connect pin 7 to cathode pin 11 or H.T. rail.
	Ediswan CRM143, 144	Mullard tube 6.3 v. .3 amp. heater, Ediswan tubes 12.6 v.
MW43/69	MW43/64, Ediswan CRM171 and 172	Ediswan tubes have 12.6 v. heater, Mullard 6.3 v.

* Now obsolete.

An Inexpensive EHT Voltmeter

A USEFUL TEST INSTRUMENT

By K. A. Bisher

A VOLTMETER which will measure voltages up to 12 or 14 kilovolts is a very useful addition to the normal range of test equipment. With one, the EHT in a television set can be measured accurately instead of the usual haphazard sparking test which only indicates vaguely that some EHT is present, and by the length of the spark a rough idea of the actual voltage.

Unfortunately, the EHT systems in modern television sets are only capable of supplying current in the region of 100 microamps at most. A meter to measure these voltages must, therefore, have a very high resistance in order to draw an extremely small current from the source. The only really practicable meter for such a purpose is the electrostatic voltmeter which does not require any current for its operation.

An electrostatic voltmeter to measure up to 14 kilovolts is a relatively expensive instrument and beyond the reach of most readers. However, there are available from time to time, ex-government meters of the electrostatic type which have a full-scale deflection of 2 kilovolts. These are reasonably priced: the author paid only £1 for one in brand new condition. As they stand they are of little use in measuring the EHT voltage in a modern television set, for which a range of up to 14 kilovolts is required.

By means of a simple potentiometer, however, the 2 kV. meter can have its range extended to read up to 14 kV. or even higher.

The orignal one was made to read up to 12 kV. But, of course, any range can be made up by using different values of resistors in the potentiometer.

A current of 100 μA was decided upon as a suitable load for the EHT system to be tested with. This gives a fairly severe test to the EHT system: if all the parts of the line output stage are in good condition, then it should be capable of supplying this current without a severe drop in the voltage. In practice it is found that this is better than measuring the voltage with a meter that takes no current at all as it gives a good indication of the state of the line output stage.

Construction

The construction of the meter is very simple. First the value of resistors has to be calculated. In the original, a full-scale deflection of 12 kilovolts was decided on. The total resistance is found by dividing the voltage (12 kV.) by the current (100 microamps): the result being 120 megohms. Six 20 megohm resistors were used, connected in series. The meter was connected across one of the end ones and consequently reads one-sixth of the total voltage across the chain.

Using the Meter

To use the meter it is necessary to multiply the reading shown by six. Or, alternatively, the meter can be carefully dismantled and the scale altered. In this case the meter was left severely alone.

The construction of the potentiometer can take many forms, the only points to watch are:

1. In view of the high voltages present, keep the resistors well clear of each other and of any other parts.

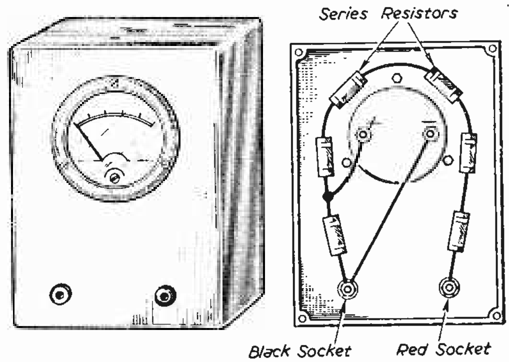
2. Use a piece of high quality paxolin to mount the parts on.

3. Remember to keep the meter to the low potential end of the resistor chain by marking the terminals clearly.

Assembly

In the original the construction was as follows: A piece of high quality paxolin 3½in. × 4½in. was used as the base and the meter was mounted in the centre, using the terminal screws to hold it to the paxolin.

The six resistors were mounted around the



The meter in its case, and a rear view of the panel.

meter on the reverse side of the paxolin. Small solder tags were used on which to mount the resistors. All soldered connections were made with care and carefully rounded to eliminate any tendency to corona effect.

The meter was connected across one of the end resistors. The two ends were connected to two small sockets mounted at one end of the sheet. Solder joints were made. One socket was red and the other black. The red one was connected to the high potential end of the resistor chain and the black one to the end which had the meter connection.

The whole unit was fixed into a small wood box which was big enough to allow an inch clearance all round the resistors.

If seven 20 meg. resistors were used instead of six, then the range would be extended to 14 kilovolts and the current for full-scale deflection would remain at 100 microamps. The reading on the meter would then have to be multiplied by seven.

A Quad Aerial for the Loft

AN AERIAL ARRAY CONSISTING OF DRIVEN MEMBER AND REFLECTOR

By L. S. King

LOFT aerials for Band I with quarter-wavelength components are often difficult to accommodate in the roof-space available, but such an aerial is attractive because of the protection and accessibility afforded, compared with outdoor aerials. An elaborate array can be designed to take its support from the internal roof members, whereas its outdoor counterpart would possibly be difficult to construct. The normal indoor loft aerial has a V-shape and is fitted into the apex of the roof. It is merely a dipole, bent for convenience and not quite so good as the dipole from the point of view of signal pick-up. The normal half-wave dipole for vertical polarisation is an impossible arrangement for a loft aerial owing to its length alone.

Increased Gain and Directivity

In order to give reasonable gain an aerial array is needed, consisting of a driven member with a reflector behind, and perhaps a director in front. This arrangement will give increased gain and directivity. A suitable array is the quad aerial, which is reasonably compact, even on Channel I. It was described by S. A. Money, in the July, 1958, issue of PRACTICAL TELEVISION. A difficulty arises when the ceilings of the top-floor rooms are built up to some extent into the roof space, so that the sloping-roof beams come down to meet the corners of the quad and there is little room to manœuvre the aerial for best results. If the direction of the transmitting station or the most favourable direction of the received signals coincides with the length of the roof, or is even broadside on to the roof, no difficulty should generally be experienced in placing the aerial parallel to the party wall or at right-angles to it (see Fig. 1). But, in a large number of cases, it will be found that the direction of the received signal is not so accommodating and when the aerial is aligned, it will have to be somewhere in between the above fortunate positions. This means that inches will count and probably some compromise will be necessary between the usually accepted size for the aerial and a size suitable for the available space.

Author's Arrangement

For several years the author has had in use an arrangement as shown in Fig. 2 at a distance of about 20 miles from the transmitter, and results were very good, far better than those obtained with a dipole or any of its variants.

Firstly, the length of the side of the driven member had to be somewhat less than the 5ft. 6in., which was given in the table in the July issue: secondly, the side of the reflector can be no longer than the side of the driven member and it is the roof space available which determines this length. A director if used will be smaller.

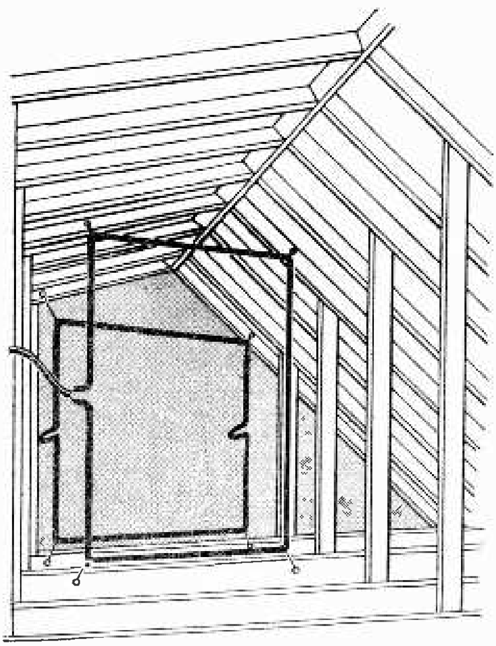


Fig. 1.—A quad aerial positioned parallel to the party wall which is shown shaded.

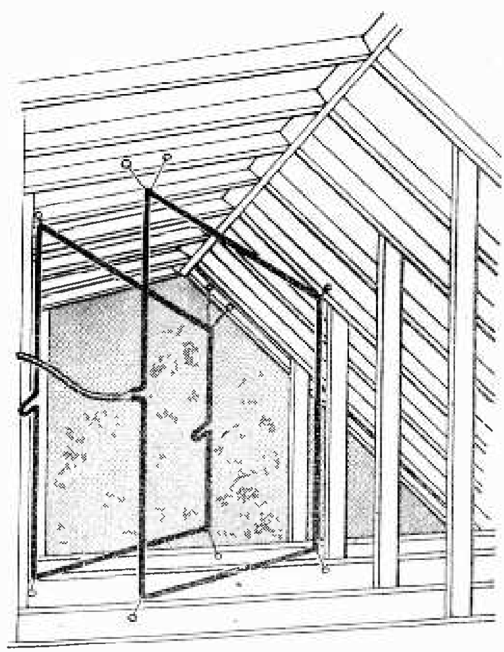


Fig. 2.—Optimum positioning of the author's aerial in the loft.

Thirdly, some degree of side-stepping of the reflector relative to the driven member became necessary, because a true in-line position was not possible. The writer's loft would not accommodate a larger quad than the one having a side of 5ft. 3in. when in the position of alignment, and this length made the optimum frequency of operation 45 Mc/s, a frequency which is higher than that normally used by aerial designers for Channel 1. It is, in fact, the vision carrier frequency of Channel 1, so that 5ft. 3in. represents about the minimum size for a quad that can be used without resonating the aerial too far away from the sound carrier frequency of 41.5 Mc/s and some may think that the departure is already rather excessive.

Driven Member

At 45 Mc/s, a quarter wavelength (¼ γ), equals 5.47ft. Therefore, the side of the driven member needs to be 95 per cent. of 5.47ft. which is 5ft 3in. (see Fig. 3), which gives a total wire length for the driven member of 21ft. The driven member can be soldered directly to the down-lead, and no trouble will then arise owing to bad connections.

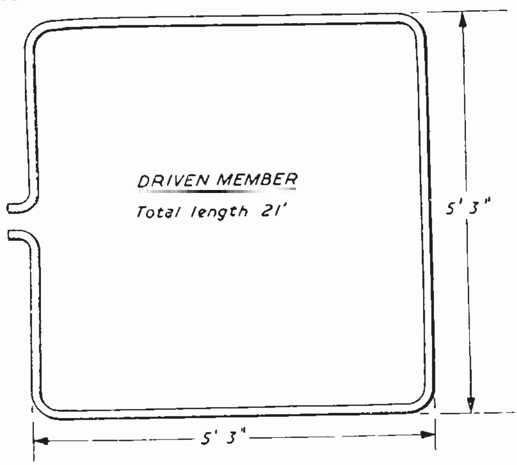


Fig. 3.—Active element of aerial.

Now the reflector cannot be accommodated any more easily than the driven member and the side of its quad cannot exceed 5ft. 3in. if that is the settled maximum dimension for the driven member, but for the reflector to be 97 per cent. of 5.47ft. or approximately 5 per cent. greater than the driven member, each side of the reflector should be 5ft. 5in. or a total wire length of 21ft. 8in. is needed. This extra length can be taken up in loops symmetrically arranged in each vertical side of the reflector. The reflector designed by the author is shown in Fig. 4. The loops could be turned away from the driven member, so that there is no pick-up, but their position is not critical.

Quads Suspended Between Roof Members and Ceiling

It will be noticed from Fig. 2 that the quads

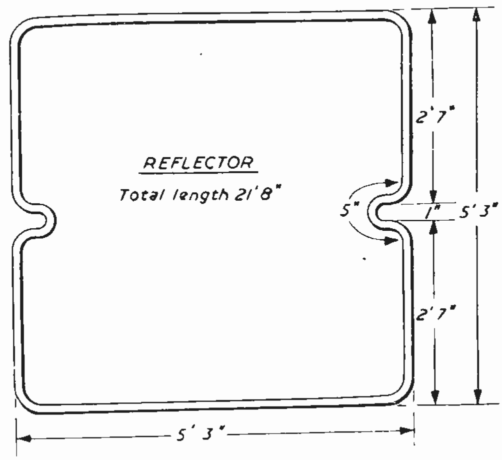


Fig. 4.—Reflector design.

have been suspended between the roof members and the ceiling. This may mean a little adjustment first with a string hook-up, so that any compromise required is not made at the expense of one dimension alone. This freedom gives an advantage over the use of a couple of preconstructed frames which may be more difficult to fix into position. The perpendicular distance between the respective planes of the driven element and reflector is usually taken as 0.2 γ, which will give about 4ft. Owing to space restrictions this had to be reduced to 3ft. 6in. and even then the reflector was out of the true in-line position by some 8in.

The writer has set out to show the effects of space limitations, and the picture obtained on his set is at its best when a quad aerial is used. Several quad aerials with reflectors have been used, and there is absolutely no ghosting, but a good clean picture is obtained which seems to indicate that the aerial gives a useful gain in the direction of the transmitter. On sound, there is ample quality, and quantity too, which does not suggest that the resonant frequency of the aerial is too far from the sound carrier.

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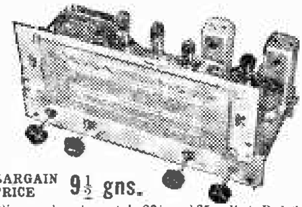

S.W. 16 m.—50 m.
M.W. 200 m.—500 m.
L.W. 800 m.—2,000 m.

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6K7	6 6	EB91	6 6	EL84	11 6	PY80	9 6
6K8	8 6	EBC41	10 6	EM85	11 6	PY81	9 6
6Q7	8 6	ECC83	9 6	EY51	12 6	PY82	8 6
6SN7	8 6	ECC84	12 6	EY86	14 6	PY83	10 6
6V6	7 6	ECF80	12 6	EZ40	8 6	U22	8 6
6X4	7 6	ECF82	12 6	EZ80	8 6	U25	13 6
6X5	7 6	ECH42	10 6	EZ81	8 6	UCH42	10 6
7C5	9 -	ECH81	10 6	MU14	9 6	UF41	10 -
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IMPROVING OLD TV SETS

USEFUL HINTS FOR OWNERS OF AGEING RECEIVERS

By J. Booth

AFTER using a television receiver consistently for several years, the owner may suddenly realise that the quality of his picture falls far below the now accepted standard. There may not be a definite fault which he is able to pinpoint, but a comparison of the performance of his set with that of a modern one may strikingly disclose the shortcomings of his own picture.

Gradual Fall-off

As one would expect, there occurs a gradual falling off in the efficiency of a television receiver starting from the time when it is first put into service. Normal day-to-day viewing does not reveal this ageing.

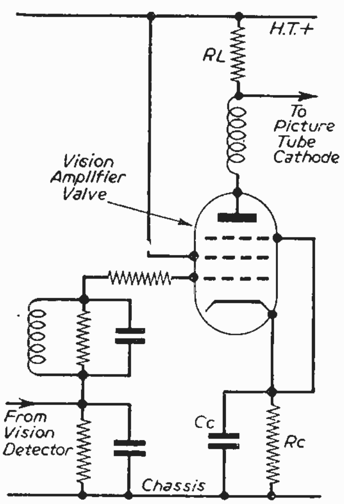

Fig. 1.—Sensitivity increase of the video amplifier can be accomplished either by increasing the value of Cc or RL.

It is invariably the picture which suffers first, and when the deterioration in quality is noticed there is a great temptation to replace the set with a new model. This is sometimes sound economics, especially if the ailing set has given in the region of five years' good performance and to restore it to standard requires the replacement of the tube and possibly several valves and smaller parts.

Old Set Remains in Circulation

Experimenters new to television may become initiated by way of an old model picked up from either a dealer, who himself acquired it from a part-exchange deal, or from a friend or relative who has purchased a new model. It seems, therefore, that the old set is far from dead but remains the pet of the enthusiastic experimenter.

If the tube is in reasonable order it is surprising how the performance can often be enhanced by one or two small operations.

Clean the Screen

The picture may appear dull and lacking sparkle. On sets with plastic implosion guards, such as the old Ferguson range, this is invariably caused by a deposit of dust and carbon on the face of the tube and the inside of the implosion guard. The chassis and tube should be slipped out of the cabinet and these optical items cleaned thoroughly with a TV screen cleaner. This can be obtained from most dealers, and takes the form of a specially prepared anti-static compound, which not only removes the dirt and polishes the screens, but also lessens the tendency for the tube and screen to exhibit electro-static attraction to dust particles, which happens soon after cleaning with other liquids.

If a proper cleaner cannot be obtained and water is used, both the tube and the mask should be thoroughly dried in front of a fire before being returned to the cabinet. If this precaution is not taken the tube face may develop uneven electro-static charges and the picture may not fill the screen immediately on switching on and warming up, but gradually build up from the centre, leaving the edges devoid of illumination and suppressed as is water on a greasy surface.

Ion Trap Magnet and Focus

There is usually no need to extract the tube from the chassis, and it is just as well to avoid disturbing the tube mounting fitments when cleaning as described. After the chassis has been refitted and the set warmed up properly, attention should be directed to the setting of the ion-trap magnet (if used) on the tube neck.

Even though this may be tightly clamped to the neck, it pays to check that it is adjusted for maximum picture brightness, for as a tube wears, improved brightness often results from resetting the magnet, possibly owing to alteration in tube characteristics. The magnet should be gently rotated on the neck, while also being shifted along it and a point will be established coinciding with maximum brightness.

Adjustment should never be made to eliminate corner shadowing if this results also in a reduction in brightness. Shadowing is invariably caused by the scanning coils not being pushed hard against the flare of the tube along the neck or by incorrect adjustment of the picture centring screws on the focus unit.

After attending to the ion-trap magnet, the picture should be properly centred on the screen by using the test card, and then should be brought into optimum focus by means of the appropriate adjustment.

It is surprising how much better the picture will be after these very simple adjustments. Then the linearity of the picture may need balancing, and this can be accomplished by adjusting the appropriately labelled controls, bearing in mind that the height control is somewhat associated with the vertical linearity control, and likewise with the horizontal linearity and width controls, both of which may be cores in inductors adjustable by wire loops.

If the picture lacks width and brightness, replacing the H.T. rectifier will invariably help matters, especially so if this component is of the metal variety, which will almost certainly be found to be well below standard after several years of use.

If the width is reasonable, but the picture is very dim and turns negative when the brightness or contrast control is turned up, the tube is down. Replacement is hardly warranted on the type of set being considered, but it may pay to boost the heater voltage, since a far superior picture may be achieved for the small cost of a booster transformer or unit.

If the set sensitivity is low, indicated by the contrast control having to be at maximum, some of the vision channel valves may be low in emission. Large scale replacement may not be economical, but changing over some of the sound channel valves with the vision channel valves (assuming they are of the same type) often gives improved vision gain while hardly affecting the sound. The sync separator valve generally lasts longer than the others, and this can be changed with a vision channel valve in a lot of sets, provided the type is the same, without affecting the performance.

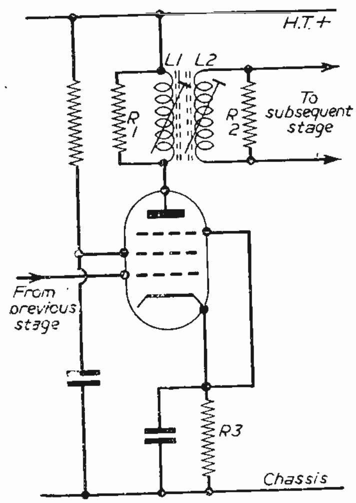

Fig. 2.—**Improved gain at the expense of definition can be secured by increasing the value of the damping resistors R1 and R2, or by shunting R3 with a 500 ohm resistor.**

If the gain is really low, the use of a pre-amplifier, if one is at hand, will inject new life into the ailing set. The R.F. and vision I.F. trimmers can also be adjusted carefully first one way and then the other, while observing the effect on the test card, to enhance the vision channel sensitivity. Quite a useful increase in gain is possible by this artifice without detracting too much from the definition of the picture. Care should be exercised not to tamper with the sound rejectors which are difficult to reset effectively without instruments.

The same reasoning applies to the sound channel, but, as already intimated, it is usually the vision which fails first after years of use. Peaking the sound I.F. stages (or R.F. stages in a T.R.F. set), again gives a useful gain increase.

Increasing Video Amplifier Gain

It is surprising how much extra gain can be squeezed out of the video amplifier stage by a few component alterations. In Fig. 1 is shown a circuit of a typical video amplifier stage. Here Rc is the cathode bias resistor and Cc the associated by-pass capacitor, whose value is selected during design to provide a certain degree of video compensation. However, at the expense of a little definition Cc can often be increased to 0.1 μF with a terrific rise in gain. The value is usually in the region of 800 pF, depending on the circuit. If it is increased too much, though, black-after-white will become troublesome and the line sync may be impaired. Nevertheless, on some models the author has increased the value to 25 μF to keep an old set going in a fringe area while maintaining a definition equal to 2 Mc/s!

Resistor RL is the video load, which itself can be *increased* in value for the same reason. This is generally about 4.7 k. or less, and may be increased to 10 k. or more with a corresponding rise in gain and reduction in definition.

Extra R.F. or I.F. Gain

Fig. 2 shows a typical R.F./I.F. pentode amplifier in the vision channel. Here also we have methods of increasing gain. One is to reduce very slightly the value of R3. The best way of doing this is to shunt it with another resistor of about 500 ohms or so. L1 and L2 should then be adjusted to give the best results under the new condition of biasing.

Alternatively, the damping resistors (if fitted) R1 and R2 can be increased in value or eliminated if the occasion allows. This will decrease the definition while greatly increasing the gain.

A.G.C. in Negative Modulation Receivers

It is common practice in positive-modulation receivers to utilise the D.C. component of the video output signal at the grid of the sync pulse separator for the A.G.C. bias potential. However, with negatively modulated signals this circuit is susceptible to "lock-out" when a sudden signal change occurs, due to overloading of the video amplifier which cuts off before the A.G.C. potential is able to develop.

A novel form of A.G.C. circuit suitable for 625-line (C.C.I.R. standard) receivers is described by P.H. Mothersole in *Mullard Technical Communications*, September, 1958. The article is based on an earlier paper which appeared in Jour. Brit. I.R.E. (1958), and a corresponding paper for positive-modulation receivers was published Mullard, December, 1957.

To obtain a high loop gain from the A.G.C. circuit, the A.G.C. voltage is derived from the video signal output and a pulsed amplifier is used. The problem is to relate the A.G.C. potential to the black level occurring in the back porch of the video signal in the best possible way.

A method of exposing the back porch of the video signal is to cancel the synchronising pulses by the negative pulses at the anode of the sync pulse separator.

In the circuit described, the video signal is D.C. coupled to the grid of a peak detector and the sync pulses are A.C. coupled to the same grid. The D.C. cathode potential of the detector, which corresponds to the black level potential of the video signal, is applied to the grid of a pulse amplifier which operates as a conventional gate circuit, being triggered from the line output transformer.

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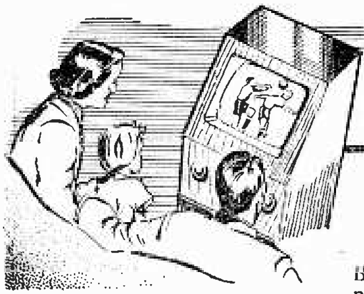

UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

THE pattern of television in the British Isles is becoming more complex as the months go by, with additional transmitters erected by both BBC and I.T.A. Indeed, there are already quite a few districts where it is possible on high ground to receive good pictures from three or four television stations. There are situations in the Leicester-Derby area which should be able to pick up BBC transmitters at Holme Moss and Sutton Coldfield, and I.T.A. transmitters at Lichfield, Winter Hill and, possibly, Emley Moor. When further I.T.A. transmitters are operating at Mendlesham and Burnhope, it will be possible for enthusiasts in favourable localities to "collect" quite a variety of programme companies' trade marks. That is, if they fit up a goodly selection of vertically and horizontally polarised aerials, optimised for each transmitter they hope to receive.

Trade Marks

THE I.T.A. have published an interesting folder in which all of their programme companies' trade marks are reproduced, together with data on transmitting stations and a little map showing regional coverage and overlaps. The BBC trade mark is universal to all BBC transmitters, but it would be of interest to TV "hams" if each region could have its own particular variation of the BBC emblem. Carlisle used to be the train-spotters' paradise, where the liveries of seven or eight different railway companies could be seen on different locomotives. Alas! Carlisle is served by one TV transmitter only at the moment, the Sandale relay station. Soon, however, there will be an I.T.A. transmitter within a few miles of the city and another one near Belfast which it might also be possible to pick up.

Regional Programmes

THERE seems to be an increase in the amount of local regional programmes put out by I.T.A. programme companies. The I.T.A. insist that at least 15 per cent. of the programmes provided by each programme contractor shall be of local origin, which is equivalent to six or seven programme hours per week. This compares with an average of about two hours per week each of local programmes in the Midland and North TV regions of the BBC, according to the BBC's report for 1956-57. Other BBC regions in Scotland, Wales and the West averaged only slightly more than one hour a week. However, the trend both for BBC and I.T.A. is to increase these local programme hours. Networking has been operated between the major I.T.A. companies for some time, programme exchanges being an obvious means of off-setting the high costs of the big shows. This has put the original "Big Four" Companies—A-TV, A-R, ABC-TV and Granada—in a particularly strong and prosperous position. However, Sir Robert Fraser is encouraging the newer and smaller companies to provide regional programmes and also to make contributions to the I.T.A. network. Southern Television already provides much more than its 15 per cent. of locally originated programmes, especially if locally originated films are taken into account. All these different programmes will give the television "ham" a variety of pictures to look at, apart from the different trade marks.

Charlie Drake

BBC television has made quite a lot of comics into big stars. The latest to make the grade is Charlie Drake, whose first starring show, *The Patriotic Singer*, was an immediate success. The second show in the series, *The Clapper Boy*, did not quite fulfil expectations, though the basic idea of the show was first class. In this episode, a storyline traces the rise of a film clapper-boy into a big movie star, who enjoys the most ostentatious luxuries that Hollywood can provide. His conversion to "method" acting, his failure in a costume picture and his return to the clappers, was smoothly told with clever continuity of live scenes, film interpolations, newspaper inserts, and shots of "Picture Parade," with Peter Haigh narrating. *The Clapper Boy* was put on at the old Shepherd's Bush Empire—pardon me, the BBC Television Theatre!—which carried the title of the show on the smart new illuminated canopy at the front of the house. But it was the theatre acoustics and the audience reactions which very nearly spoiled the enjoyment of viewers. Sound pick-up was reverberant on many scenes, possibly intensified by loudspeakers in the auditorium, and audience laughter and noise was far too loud. The sooner some of these live TV audiences are put behind glass, with their own microphones and loudspeakers, the better. Then they will be completely under control. Anyway, Charlie Drake is a new style of comedian who hands out a lot of laughs without forcing the pace, and Ernest Maxin proves once more that he is a master of fast-moving comedy shows. Why not try a Charlie Drake show in a studio instead of the Television Theatre?—say, at the Riverside Studio, which has achieved such a high technical standard.

"You Take Over"

THE days of film interpolations which stand out like a bad patch seem to be over. They now seem to fit into the general pattern of the most complicated TV plays in a way which seemed impossible a few years ago. In *You Take Over*, a series produced at BBC's Riverside Studios, the viewer is encouraged to imagine himself to be a character in the story. He is, for instance, the manager of an hotel or of a motor-racing team, and the other participants in the play direct their looks and their dialogue straight at the TV camera—at him. His point of view predominates throughout, and his voice, if not his face, provides the counterpoint. This method of production is applied to both live and filmed scenes, with equally good results. I thought that the motor racing episode was one of the best television playlets I have seen, well acted by a large and youthful cast and most expertly directed. The camera work and lighting were first rate and the production did full justice to what was obviously a very fine script.

Jingles

SIGNATURE tunes have long been a feature of sound radio for introducing and ending regular features. They have also become part and parcel of the regular television series, from BBC's *Panorama* to I.T.A.'s *Dotto*. Panel and parlour games and "give away" programmes also have little interpolated musical jingles which are faded-in to introduce new contestants, mark a pause, or more dramatically, to heighten the tension at the climax of the game. Then there are the musical jingles of the commercials on I.T.A., which play such an important part in putting over the "message" to viewers. The need for catchy musical jingles has resulted in quite an important little Tin-Pan-Alley industry of composers, lyric writers and agents who specialise in these musical cocktails. Personally, while I do not object to them and may even like some of them quite a lot, I get tired of the same tune very quickly. Some of the I.T.A. parlour games repeat the same jingles *ad nauseam* during a single programme, which becomes most irritating after a few minutes. The accompanist—who usually plays an electronic organ—should have at least eight different types of jingle available for a programme, to use as he thinks fit instead of repeating the same old standard jingle.

Video Tape

MANY of the principal BBC and I.T.A. television engineers have paid visits to the U.S.A. during the past few weeks, the main object of the visits being to see the Ampex magnetic video tape machine in full operation in various types of television station—from the huge network headquarters to the small town transmitters. They have been astonished at the rate of progress of the new techniques of magnetic video recording and the high percentage of shows which are now pre-recorded as a matter of course. The greatest asset of the system in America is the ability to delay shows to suit the various time zones from the East Coast to the West Coast. But it has also become a general purpose piece of equipment, enabling shows to be pre-recorded at times to suit the artistes, who may be in theatrical shows at night. It has not entirely displaced photographic telerecording—called over there "kinescoping." Plenty of 35 mm. and 16 mm. telerecording is still carried out in order to get fully covered all the smaller TV stations. Photographic telerecording lends itself more readily to editing, though this problem is also being energetically tackled for video tape, too. Ampex is already used over here by Granada, Rediffusion, ABC and A-TV, and programmes are now regularly scheduled for video recording. The BBC uses *Vera*. Some shows are video taped as well as telerecorded, photographically. This really is taking precautions —a kind of "braces and belt" plan!

"Keep It In The Family"

THE search for new gimmicks for parlour games continues, and this winter season has produced a huge crop of them. *Make Me Laugh*, *Dotto* and *Keep It In The Family* competed with the old-established *Double Your Money*, *Take Your Pick* and others. The new ones are not very exciting, to say the least, and *Keep It In The Family* still flags badly, even after a run of several weeks. To make the grade, a quiz show must have sparkle and fun, it should move at a fast pace under the firm guidance of the Question Master, and the stage setting itself must be pleasing to look at. *Keep It In The Family* has none of these. Bill Owen, a fine actor of character parts, is clearly out of his depth in coping with the deadly dull answers of competing families in a simple quiz competition. Chesney Allen was more at ease in the chair of *Make Me Laugh*, but this was another quiz game which didn't quite succeed. *Dotto* is probably the best of the new bunch, provided the personalities of the competitors are bright and interesting. All in all, I think that a quiz game stands or falls by the personality and wit of both the Question Master and the competitors. Tommy Trinder and Hughie Green, for instance, are never at a loss for words and are always masters of the situation. The form of the quiz game itself is almost a secondary consideration. But those games which enable the producer to make a careful selection of interesting and attractive competitors are the most likely to succeed.

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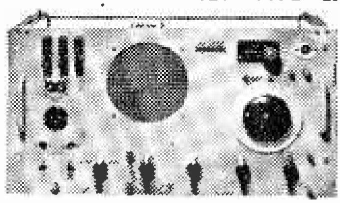

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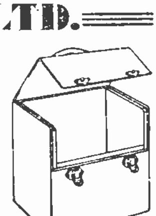

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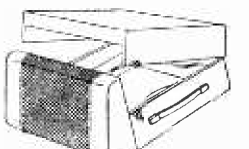

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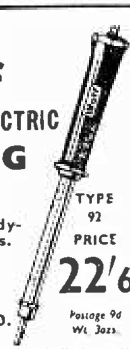

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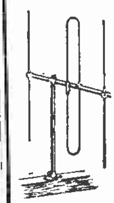

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It is ideal for the home constructor. It is supplied in two types. A and B, the former with measuring ranges of 0-12 and 0-250 volts, and the latter with ranges of 0-24 and 0-400 volts.

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All the parts are easily interchangeable and can be repaired at little expense.

A Swiss product, both types costing 77s. 6d. Harden Melvill and Co., Highgate House, 163, High Street, Guildford, Surrey, are the sole distributors in Great Britain.

C.R.T. Booster Transformer

ONE of the most commonly occurring faults in cathode ray tubes is low cathode emission. As tubes age the picture tends to grow dimmer and dimmer until the viewer comes to the conclusion that he must buy a new tube. The picture cannot be brightened by altering the contrast or brilliance controls and the only cure is to increase, by some means, the emissivity of the cathode. One way of doing this is to overrun considerably the heater of the tube for a short period: just long enough to melt the surface of the cathode and thus produce a new emissive layer. This method is liable to produce heater-to-cathode short circuits and is not recommended.


C.R.T. booster transformer.

One of the best ways to increase the emission of electrons from the cathode and one which has been used for many years is to increase the heater voltage by 20 per cent. to 50 per cent. or more. The cathode is then hotter and more electrons are emitted than before.

This method, which can only be used with receivers operating on A.C. mains, involves feeding the tube heater from a separate mains transformer known as a C.R.T. booster transformer which has tappings in its secondary winding which enable the heater to be overrun by the required amount.

Recently, a boosting device, of registered design and on which patents are pending, has been marketed. No soldering or wiring are necessary. It consists of a small canister with a duodecal tube base at one end and a duodecal tube holder attached by some 6in. of wire leads to the other.

The plug of the booster is inserted into the tube holder of the receiver and the tube socket of the booster is fitted on the tube base. The heater supply to the tube is then boosted.

The booster is made by Sinclair Electronics, 63, Old Compton Street, London, W.1. and is suitable for use in A.C. receivers and in A.C./D.C. receivers operating on A.C. mains. It is not suitable for D.C. mains. Types for 12.6 v. and 6.3 v. heaters are made at present and it is hoped to market others.

Co-axial Cable

AERIALITE LTD., Castle Works, Stalybridge, Cheshire, inform us that the price of Super Aeraxial Cable, Cat. 499, is now 1s. 7½d. per yard, retail.

New Germanium Diode

CONSIDERABLE time has elapsed since E.E.V. News No. 502 announced the E.E.V. germanium diode, type VA713. Since then this cell has found many applications in various industries, where it has given faultless service and demonstrated superior qualities of reliability, long life, and high efficiency.

To enlarge the range, E.E.V. now offer the VA719, which is dimensionally the same as the VA713 (except for a slightly larger negative connection), but has an increased current rating of 20A at 35 C. It is available either as a single unit, or in multiple units fitted with fins and assembled into a stack.

As a result of this new development, E.E.V. germanium rectifier stacks can now be supplied having maximum outputs as high as 130 amperes, at any output voltage up to 223 V.D.C. Enquiries for higher ratings will be welcome. By using various circuits it is possible to make economical use of the diodes, so that the range of stacks in production covers both current and voltage outputs in quite small steps. Further information is obtainable from English Electric Valve Co. Ltd., Chelmsford.

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).

UNCOMMON FAULT

SIR.—Since your columns have helped me on numerous occasions. I ask you to print the following which may be of assistance to others. The fault was blown fuses. The H.T. rectifiers were suspected and one had a blown heater which was shorted to the cathode. The 47Ω. 5 watt anode resistors did not appear faulty so I replaced the rectifier and the fuses and switched on. The line timebase was faint and there was no EHT. I replaced the line oscillator valve which had no effect; then the 7 pF silver mica sync feed capacitor, and there was still no change. I switched off and removed the booster diode (U329) and casually connected an ohm-meter between the heater and the cathode and to my surprise the reading was dead short. I still do not know why the fuses were not blown.

I replaced the valve and the line timebase worked correctly. I noticed that the upper half of the raster (there was no modulation) was white and the lower half was grey-black. I suspected the boost capacitor, but this was not at fault. The culprit proved to be the 100 μF electrolytic in the sub-chassis under the tube bulb. This capacitor smooths the H.T. to the frame timebase.—F. MALPASS (Hednesford).

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.

ULTRA 815

SIR.—Readers may be interested to know of a peculiar fault I recently found in the Ultra model V.815.

The picture broke up and appeared like the fine grain on polished oak! On examination under the chassis, R30 (8.2 K) was found to be extremely hot and ready to disintegrate. This was replaced by a ceramic type of the same value. The trouble was cured for a short time, then the picture again broke up and assumed the appearance of cathode heater short on the C.R.T. Examination under chassis revealed nothing running excessively hot—the leads from the separate filament winding for the C.R.T. were O.K—cathode lead was also satisfactory. A sharp gleam and glint was then noticed between the body of R33 (vision int. limiter) and the chassis. This turned out to be a piece of fuse wire trapped between the two and earthing intermittently the network C36, R42, R32! This wire was snipped out and the set has given no trouble since.—NOEL S. MORTON (Sheffield, 10).

THE BRAYHEAD CONVERTER

SIR.—I would like to help the reader who sent in a problem regarding Brayhead Converter and Philips 1748U.

I suggest that he has inadvertently removed the first vision I.F. valve and plugged in the Brayhead R.F. plug into this socket, this set has separate I.F. amplifiers for sound and vision, fed from frequency changer. The R.F. valve which should have been removed is the first valve on the right looking in rear of set. If, perhaps, he had looked in "Newnes Television Servicing" for this model I feel this is where he went wrong, as in the top view of the R.F. strip these valves are shown incorrectly, although correct on the under chassis view.

I agree with your answer that little trouble is experienced with the conversion of these sets by the Brayhead method, although definition is slightly impaired.

Hoping that it's not too late to help E. G. Sullivan (Leeds, 16) and that it may help others.—L. FULLARTON (Coventry).

SERVICE DATA

SIR.—Further to the experience of F. T. and W. C. in the November, 1958, issue of the PRACTICAL TELEVISION it seems to be a common practice of manufacturers to deal so with "customers." Of course he who buys a TV set is not the manufacturer's customer but is the customer of the retailer. But when the retailer is so pressed for staff and hence unable to deal with the servicing required (even though the purchaser has paid for such servicing as a separate item from the cost of the set) the system is subject to criticism. However, these things right themselves because in my own case with a portable seven months in service I am far from satisfied with the results and treatment, but realise I am flogging a dead horse so put up with what I have. But there is always the rented service and as soon as I get sufficiently "nettled"—which won't be long now—I shall get rid of my set and rent one and let the renter do the worrying. This is a prevalent view of many I know.—GEO. H. SHELLEY (Coventry).

A SATISFIED READER

SIR.—I received your letter and followed all of your instructions to cure my trouble. I tried a separate heater 6.3 transformer without success, and then I tried wiring the base for triode working and the trouble of erratic brilliance is completely gone. I wish to thank you for your help. This hint may be of help to other readers. —JOHN HOLMES (Dublin).

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B.S.R. MONARCH 4-SPEED AUTOMATIC RECORD CHANGER. Complete with High Fidelity turnover head type HGP37-1, capacity of 10 records. Plays 12in., 10in., 7in. intermixed in any order 78, 45, 33 and 16 r.p.m. For A.C. mains 100-250 volts. **£6.19.6.** Brand New. Post, etc., 5/-

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GERMANIUM DIODES, 1/- each **10/-** dozen. Post 4d.

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ALBA T324 17in.

When the brilliance is advanced the picture reaches a certain brightness (not very) then begins to go dark again.

I have had the usual fiddle with the noise limiter and contrast and manage to get a rather dark but stable picture. The picture then gets darker until it is hardly visible an hour or so later.

I have a good meter (Taylor 77A), but I am unable to make high voltage tests.

I feel it probably is the brightness control itself, but I am rather loath to make a move without expert advice.—E. Williams (Widnes).

This symptom is probably caused by a low emission tube, the emission of which deteriorates even more as the receiver is left on. However, before contemplating replacement, it would be as well to check the setting of the ion trap magnet on the tube neck (adjust for maximum picture brightness) and the emission of the EHT rectifier.

COSSOR 938

My trouble is loss of EHT. I get a spark from the anode of the EY51, but not from the cathode. I tested the voltage across the heater of the EY51 and found it to be only .2 volts. The line output valve has been tested and found to be O.K.—R. T. Pike (Cwmbran).

We advise you to check the EY51 heater with the EHT lead disconnected from the tube. A visual check is better than a meter which might read anything. The filament should glow a cherry red.

If removing the EHT lead does, in fact, restore EHT suspect the tube for heater-cathode and grid-cathode shorts and see that the ion trap magnet has not become displaced.

REGENTONE 14T

After a burnt out PL81 and R56 have been replaced, also a low valve four, I have a blank screen. All valve heaters are alight, also the tube. The line whistle is heard after about a 90 seconds time lapse and can be varied by the line hold control. The EY51 has also been replaced and a large spark can be got from its anode, also the tube anode gives off a good spark, this anode giving off a sizzling sound. Also the ion magnet fibre strap broke and I fixed this with a brass rivet and replaced magnet more or less in the same position. I have tried the tube as a triode, connected as given on page 165, November, 1956, but still no sign of a raster. Sound is quite loud and is varied by the contrast control.—L. R. Whittaker (Mansfield-Woodhouse).

We note that you have replaced the ion trap magnet—"*in more or less* the same position." The setting of this magnet is absolutely critical upon its initial setting up. We must assume, therefore, that you have not found the correct position for this. If there is a line on the tube neck align the magnet to this slightly in front of the base with the arrow pointing forward.

If there is no line, one may be imagined which would come into line with the position reserved for pin 3 on the base (this is not actually fitted).

FERRANTI 17K3

I had the EY51 changed and both the PY81 and PL81 tested, but were found to be perfect.

On switching on I get the line whistle, but it fades away before the picture builds up.

If I take the top cap off the PY81 I get a very good spark and brilliance, but the picture has no line or horizontal hold. On replacing the cap of PY81 the line transformer immediately goes dead.—G. Metcalf (Halifax).

It is very strange that the act of removing the PY81 top cap can restore working of the line timebase. Normally this would stop it as the circuit would then be broken. In view of this you should suspect the .5 μF capacitor (C68) wired from the H.T. line to the boosted H.T. line.

PHILIPS 563A

Flutter on frame on switching on which gradually turns into frame slip downwards which gradually increases to downward roll. Frame hold is hard over on maximum resistance. ECH35, oscillator, EL33 frame O/P, EB91 sync sep, and EF50 sync amplifier have been changed as well as frame hold control. I have no circuit diagram for this receiver and would be very glad of assistance in this matter.—C. Gavin (Hounslow).

There is a 390 KΩ resistor wired in series with the frame hold control to the ECH35 triode control grid. This has probably increased in value and should be replaced.

INVICTA 126

The picture tends to have wavy verticals. This trouble occurred when the picture lacked width. Replacement of the metal rectifier remedied the width, but still the wavy verticals were present.

Could you please help me to locate this fault ?—G. Fryer (Newcastle).

We have found the wavy verticals are caused by the improper contact between a chassis tag and the chassis. This tag is riveted and carries the heater return lead as well as the cathode component chassis connections of the PCF80 (line oscillator) valve. The tag should be well soldered to chassis or a thick lead taken to another chassis tag. The waviness is due to hum being induced into the PCF80 circuit by the poor contact.

BUSH TV24C

Picture width is slowly decreasing, also adjustment of volume control is accompanied by distortion.—George T. Singleton (Preston).

You should replace, or at least clean, the volume control and also have the PL81, PY81 and PY82 valves tested.

WESTMINSTER T1455

The fault appears to be in the frame timebase. The picture rolls round from top to bottom of the screen. If I adjust the frame hold control I can stop the picture rolling, but I then have two pictures, head and shoulders only, one at the top and one at the bottom of the screen, with a black line across the middle, then, by reducing the height, I can get one picture which is only 2-3in. in height.

As I have no data for this set could you say if there is a frame output transformer which could be a fault, if so could you please give the location of same ?

Also, is there a converter made for this model (if so could you give price for same) or would any make of turret tuner fit.—J. E. C. Mabbott (Newark).

You should check the ECL80 frame timebase valve and the resistors associated with the centre tag of the frame hold control (trace wiring to resistors). The Brayhead 16S tuner unit is suitable, fitting instructions are provided; proceed as for Sobell T143-T144, etc. Quote channels required when ordering.

BAIRD 167

Recently the picture disappeared overnight and the screen is blank, but the sound is quite all right. I suspected the U25 rectifier at first, since there was no glow from the heater, but on replacing it with a spare, got the same result. I also replaced the 20P1 and U801 without result. The line timebase whistle is absent. Could you please help me by indicating further steps I can take to trace the fault and put it right. A further point I would like help on is that prior to its breakdown, a black band at the bottom of the picture tended to creep up for about ½in. to ¾in. —Eric B. Hardy (Burton-on-Trent).

The 20P1 is self oscillating under conditions of normal signal reception. If, however, the vision signal is not present, the essential triggering of the timebase will not take place. The 20P1 can be artificially stimulated by momentarily shorting the screen of the 20P1 to chassis. If this action commences timebase operation, check the vision signal stages, valves and resistors, etc., to ascertain where the signal is lost.

If, however, the H.T. voltage is very low, check the 100 μF reservoir capacitor and the surge resistors of the U801.

PHILIPS 1229U/15

The picture keeps flicking over and over in an upward direction, rapidly when the set is first switched on, then slowing down after about an hour to about one "flick" per second. The vertical hold control is as far over as it will go, also the height control, and the picture just fills the mask. I have had the frame on and output valve ECL80, and the sync separator valve ECL80, tested, and both are O.K.—D. Stewart (Moulton).

You should check the 2.2 MΩ (red-red-green) resistor which is associated with the frame hold control, actually situated at the rear of the connecting socket of the left side timebase chassis.

If this is in order, check the 5.6 MΩ resistor—green, blue, green wired to the limiter control on the right side chassis, on a tag strip under the rear (rather hidden).

K.B. LVT50

When I switch to Channel 10 I receive no sound or vision. By applying pressure in an anticlockwise direction the set becomes normal. Having secured the channel change switch in position by a wedge I can view till around 8 o'clock in the evening then the sound and vision slowly fade and disappear for about two hours, then it will slowly come back to normal.

The set is perfect on Channel 2.—T. Pugh (Doncaster).

The tuner unit cover should be removed and the switch springs and studs cleaned with a reliable switch cleaner and lightly smeared with M54 silicone grease. If necessary retune the Channel 10 oscillator coil core by removing the tuner knobs and inserting a suitably shaped knitting needle (as a screwdriver) into the hole provided. It will be found that the core is set well back. Also suspect the tuner unit valve 7AN7 (PCC84), this may be the reason for the fading of the signals mentioned.

PILOT CV87

A neighbour's Pilot CV87 tuned to Wenvoe appears to be interfering with several other nearby sets tuned to North Hessary Tor. Would you inform me how to retune this set to Channel 2, i.e., which is the oscillator coil, etc.? I would also like to know the I.F.s of this set and also would you tell me the I.F.s of the Ekco 217. I believe they are 16 and 19.5 Mc/s, but which is which ?—F. Howard Thomas (Port Talbot).

Three coils are required to be adjusted. The oscillator (the adjustment is on the right side rear of the chassis and is marked OSC trimmer), the aerial and the R.F. coils. These are on either side of the front valve on the right side as viewed from the rear, adjust top and bottom cores. No other adjustments are necessary. The I.F. of the CV87 is sound 9.8 Mc/s, vision 13.3 Mc/s, Ekco T217, vision 16 Mc/s, sound 19.5 Mc/s.

ULTRA 1815

A black band creeps up from the bottom of the picture, and it extends for about 1in., but the rest of the picture is perfect except sometimes there is very thin lines about ¼in. apart which

(*Continued on page* 321)

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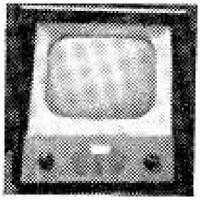

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TV SETS

12in. UNTESTED TABLE MODELS Note some of these sets are working, mostly on Channels I or III. Most makes available, but please state an alternative. These sets (except for a few Pye types) all contain miniature valves and are nearly all latest A.C./D.C. types. **£3/15/-**

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T.V. SETS, less only valves, speakers and tubes, 9 and 10in., **10/-**; 12in., **15/-**. Carr. & packing 9/-.

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6F12	6/6	ECC81	7/6	KT33C	7/6	U201	7/6
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6F14	11/-	ECC83	7/6	KT61	9/6	U404	7/6
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6J6	4/6	ECC85	9/-	LZ319	8/6	UAF42	9/-
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6SN7GT	6/6	EF39	5/-	PCF82	11/-	UF41	7/6
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10F1	9/6	EF41	8/6	PL36	15/-	UL44	9/6
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20D1	9/6	EF50(B)	4/9	PL82	8/6	UU8	11/-
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350/352, FRATTON ROAD PORTSMOUTH

I think is flyback lines. I would very much appreciate it if you could enlighten me on these points.—G. Hathway (Bristol).

You should suspect the right side 20P3 frame output valve. If the valve is not at fault, it is possible that an associated component is at fault, but we are more inclined to suspect the valve.

McMICHAEL TM317

I have just acquired secondhand the above, together with a converter by the same manufacturer. When the brilliance was advanced the picture went out of focus, swelled and disappeared. This appeared to be a failing EHT rectifier and I have changed the EY51. This has made some improvement, but I cannot now get a really sharp focus even with low brilliance settings. When the brilliance is advanced the picture still goes further out of focus and enlarges, particularly in height. If the aerial is disconnected, the raster brightens up to a certain setting as the brilliance is advanced and then reduces slightly. If left at the maximum setting, the raster gradually fades away. The picture tube, a MW 43-69, so I am informed, was renewed about nine months ago and should be all right.

Advancing the contrast control from minimum turns the picture negative, and so does the control marked "spotter," when switched to BBC, but this contrast control makes no marked change on Channel 9. The aerial is in the position marked "Dist," the next lowest position produces a very poor picture.

I notice that the lower left-hand valve in the "cage" containing the timebase valves has been running so warm that the type number can no longer be read. Could you tell me the type number of this valve, please ?—R. Steer (Woking).

You should have the valves in the "cage" tested. These are a PL81 and a PY81. Also check the ECL80 line oscillator and the condition of the H.T. metal rectifier. Also check both 1 KΩ resistors wired in series to the PL81 pin number 8.

Ensure that the ion trap magnet on the tube neck is correctly adjusted for maximum brilliance.

FERGUSON 968T

I am troubled by a black line appearing at the bottom of the screen after the set is warmed up. I have replaced ECL80 for the frame fault, but a new valve has not cleared the trouble. I have also had tested valves PZ30, PL31, PY31 and all have been passed O.K.—S. Bradley (Beeston).

Make sure that the ECL80 in the far left-hand corner of the chassis, when viewing from the rear of the chassis, has been checked by substitution. This is V13 on the maker's circuit. If this valve is definitely in good order (a fault in this is usually responsible for the trouble), check that the mains selector on the set is adjusted to suit the mains voltage. If this is correct, then a variation in value of a resistor associated with V13 should be suspected.

If necessary, also check V12 (ECL80 to the right of the deflector coils) and related parts. The triode section of this valve forms part of the frame multivibrator.

MARCONIPHONE MODEL VT151

A black band creeps down the picture for about ¾in. and up from the bottom for about 1in., which has the effect of squeezing the picture.—H. H. Pearce (Truro).

This symptom is probably caused by an alteration in the characteristics of the frame amplifier valve as it warms up. The trouble is sometimes aggravated, however, by low mains voltage, and shows up more during the winter months if the mains selector on the receiver is not adjusted accurately to suit the applied mains voltage.

FERGUSON 953T

Can this set be converted to receive the new station shortly be be opened here ?

If so, the firm who would supply the converter.

Shall I have to alter my aerial? This is now vertical.

The make and type of tube in this set.—R. Brewer (Peterboro').

This is a T.R.F. model fixed tuned to Channel 4. It cannot be retuned easily and without altering all the coils and realigning, and it is not suitable for use with a multi-channel converter. It uses a Mullard MW31-18 or MW31-16 picture tube.

DEFIANT 1252TR/TA

The set is six years old, converted to Band 3 with a "Cyldon."

The fault consists of a cramping down the left side of the picture which comes on with the circle of test card C flat on one side like the letter D.

When set has warmed up centre fills out, but leaves first row of squares on left drawn out around edge of tube.

Intermittently, set refuses to come on; when this happens half the valves do not light up, these are 20D1/two ECL80/20P1/U281/U25.

Further symptoms noticed, when advancing Band I sensitivity on tuner, the 10F1 in centre of chassis glows red all over.

The set also makes a whining noise like warming up which turns to a roar if volume is turned up. Nearly all valves have been changed.—G. T. Williams (Caerphilly).

First check the condition of the metal H.T. rectifier, as the symptom described is often caused by low H.T. voltage. If this is in order, check the emission of the line amplifier valve and replace if low.

QUERIES COUPON

This coupon is available until JANUARY 21st, 1959, and must accompany all Queries sent in accord with the notice on page 317.

PRACTICAL TELEVISION, JANUARY, 1959.

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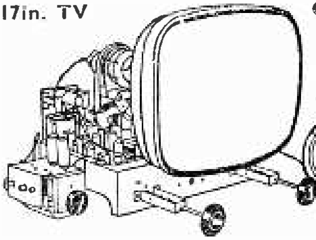
17in. TV CHASSIS, TUBE & SPEAKER, £19.19.6.



17in. Rectangular Tube on modified chassis. Supplied as single channel chassis covering B.B.C. channels 1-5, or incorporating Turret Tuner which can be added as an extra, at our special price to chassis purchasers of 50/-, giving choice of any 2 channels (B.B.C. and I.T.A.). Extra channels can be supplied at 7/6 each. Chassis size 12 x 14½ x 11in. less valves. Similar chassis are used by well known companies because of their stability and reliability. With Tube and Speaker, £19.19.6. With all valves, £25.19.6. Complete and working with Turret Tuner, £28.9.6. 12 months guarantee on the Tubes. 3 months guarantee on the valves and chassis. Ins. carr (incl. Tube), 25/-.

14in. TV CHASSIS, TUBE AND SPEAKER, £15.19.6.

As above with 14in. Rectangular Tube. 12 months guarantee on Tube. 3 months guarantee on chassis and valves. Chassis with Tube and Speaker (less valves), £15.19.6. With all valves, £21.19.6. Complete and working with Turret Tuner, £24.9.6. Ins. carr. (incl. Tube) 25/-.

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Plessey. Tested. I.F.s 10.5 Mc/s sound, 14 Mc/s vision. 8 valve holders. Less valves. Size 8½ x 5 x 4½in. Circuit incl. The Tuner unit plugs directly into this chassis. P. & P. 2/6.

SOUND/VISION AND I.F. STRIP, 10/6.

Salvaged. Complete sound and vision strip. 8 valve holders. Less valves. I.F.s 16-19.5 Mc/s. Size 8½ x 4½ x 4½in. Drawings free with order. P. & P. 2/6.

SOUND/VISION AND I.F. STRIP, 10/6.

Salvaged. Superhet. 8 valve holders. Less valves. I.F.s 7.25 Mc/s sound, 10.75 Mc/s vision. Vision complete from input up to video output. Sound complete from input to A.F. Amplifier. P. & P. 2/6.

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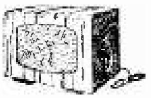

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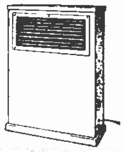

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POWER PACK AND AMPLIFIER, 19/6.

Tested. Output stage 6V6 with O.P. trans. (3 ohms) choke Smoothed H.T. 350 v. at 250 m.a., 6.3 v. at 5 amp., 22 v. at 3 amp., 6.3 v. at 4 amp. and 4 v. centre tapped. Less valves. Ins. carr., 5/6.

POWER PACK AND AMPLIFIER, 19/6.

Output stage PEN45. O.P. trans. choke. Smoothed H.T. 325 v. at 250 m.a. 4 v. at 5 amp., 6.3 v. at 5 amp., 4 v. at 5 amp. centre tapped. Valve base for rectifier, octal or 4 pin. Output is taken from standard plugs. Less valves. Ins. & carr. 5/6.

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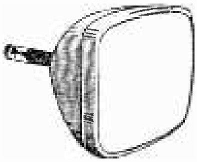

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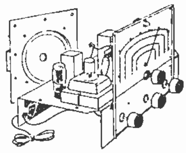

5 valve superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning w/change switch). Four w/bands with position for gram p.u. and extension speaker. A.C. Ins. carr. 5/6.

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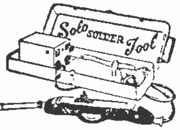

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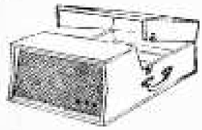


39/6

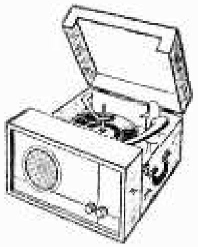
Latest contemporary style rexine covered cabinet in two-tone colour scheme. Hinged clipped lid, carrying handle. Space available for all modern amplifiers and auto changers, etc. Size 19½ x 15½ x 9in. Carr. & Ins. 4/6.

49/6

A practical cabinet, nicely designed, cloth covered two-tone (brown and coffee). Size 15 x 17 x 8in. deep. Takes B.S.R. 4-speed autochanger and 6½in. round or elliptical speaker. Carr. & Ins. 4/6.

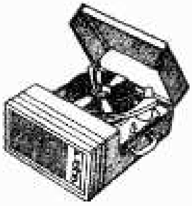
59/6

A well-designed cabinet in brown leatherette. Strong clip fasteners, easy carrying handle. Takes B.S.R. Monarch and space for a 4 x 7in. elliptical speaker. Can be made up into an ideal Record Player. Size 16 x 14½ x 8½in. deep Carr. & Ins. 4/6.



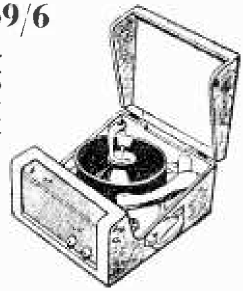
79/6

A delightful-looking cabinet 14¾ x 17¾ x 8¾in. deep, in two-tone leatherette. Will take a B.S.R. Monarch 4-speed autochanger and 6½in. round speaker. Carr. & Ins. 4/6.



79/6

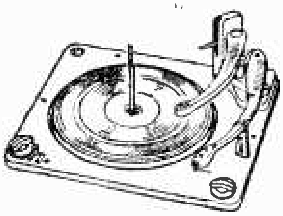
Stylish cabinet by famous manufacturer. Cloth covered in contrasting colours (red & grey). Grilled front controls panel. Size 15 x 19 x 8¾in. deep. Beautifully made. A cabinet you can really be proud of. Takes 4-speed B.S.R. autochanger. 6½in. round or elliptical speaker. Room for any amplifier of your own choice. Carr. & Ins. 4/6.



69/6

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot grey cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½in. deep. Will take a B.S.R. Monarch 4-speed autochanger and 4 x 7in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6.

Many other types of beautifully designed cabinets in stock at similar prices to the above.



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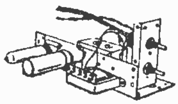


12 months' guarantee

PORTABLE AMPLIFIER MARK D.1. 59/6

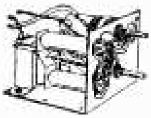
Brand new. Latest design with printed circuit. Dimensions 7 x 2¼ x 5in. A.C. only. Mains isolated. 2-3 watts output. Incorporating EL84 as high gain output valve. Volume and tone controls. Knobs, 2/6 extra. P. & P. 3/6.

PORTABLE AMPLIFIER MARK D.2. 79/6

Printed circuit. Latest design. Dimensions 7 x 2¼ x 5in. A.C. only. Mains isolated 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume and tone controls. Knobs, 2/6 extra. P. & P. 3/6.

PORTABLE AMPLIFIER MARK D.3. 89/6

De luxe model. Printed circuit. Latest design. Dimensions 7 x 2¼ x 5in. A.C. only. Mains isolated 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume, treble and bass control. Knobs, 3/6 extra. P. & P. 3/6.



PORTABLE AMPLIFIER MARK D.4 69/6

Brand new. By famous manufacturer. Especially built for portable record players. Dimensions 4½ x 3½ x 4in. A.C. only. 2 valves—EL84 as high gain output valve, EZ80 as rectifier. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

Televox Telephone Amplifier 89/6

Invaluable in a noisy office or workshop. 3 valves UY41, UF41, UL41. 3in. speaker and a suction type vibration microphone. A.C./D.C. Size of amplifier 7 x 11 x 3in. Fits any type of G.P.O. telephone. P.P. & Ins., 4/6.

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C.R.T. ISOLATION TRANSFORMER

Type A. Low leakage windings. Optional Nil, 25% and 50% boost on secondary. 2 v. or 4 v. or 6.3 v. or 10.8 v. or 13.3 v. with mains primaries ... **12/6.**
Type B. Mains input. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Boost 25% and 50%. Low capacity ... **21/-.**
Type C. Low capacity transformer for 2 volt Tubes with falling emission. Mains Primary. Output 2-2½-2¾-3 volts at 2 amps., **17/6.**

TRIMMERS, Ceramic. 30, 50, 70 pf., **9d.**; 100 pf., 150 pf., **1/3**; 250 pf., **1/6**; 500 pf., 750 pf., **1/9.**
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 to 5 meg. Ω, **9d.**
5 watt / 10 watt / 15 watt **WIRE-WOUND RESISTORS** 25 ohms–10,000 ohms **1/3**, **1/6**, **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 1,200 ft. Plastic Tape on 7" Plastic Reels. Quality Guaranteed, 21/-.
"Instant" Bulk Tape Eraser. 200/250 v. A.C., for any make or size of tape, **27/6.**

O.P. TRANSFORMERS. Heavy Duty 50 mA., **4/6.** Multiratio, push pull, **7/6.** Miniature, 384, etc., **4/6.**
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STANDARD, 250-0-250, 80 mA., 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. ditto, 350-0-350 ... **22/6**
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MIDGET, 220 v. 45 mA., 6.3 v. 2 a. ... **15/6**
SMALL, 220-0-220, 50 mA., 6.3 v. 3 a. ... **17/6**
STANDARD, 250-0-250, 65 mA., 6.3 v. 3.5 a. ... **17/6**
HEATER TRANS. 6.3 v. 1½ amp. ... **7/6**
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp., **8/6**
Ditto, 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,** ¾in. sq. x 2⅛in. and ⅝in. sq. x 1⅛in., **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. & 5in., **17/6.** 8in. Plessey, **19/6.** 7in. x 4in. Goodmans, **21/-.** 10in. Goodmans, **18/6.** 10in. R. & A., **30/-.** T.S.L. Tweeter, LSH75, **8/6.** 12in. Plessey, **30/-.** Stentorian HF1012, 10in., 10 wt., 3/15 ohm, **99/6.** 12in. Baker 15 watt 3 ohms, or 15 ohms, **105/-.**
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**
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SPEAKER FRET. Expanded Metal Silver, 15½in. x 9½in., **2/-** each.
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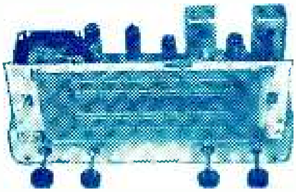
All Boxed VALVES 90-day Guarantee.

1R5	8/6	6K8	8/6	EABC80	10/6	HABC80	12/6
1S5	8/6	6L6	10/6				
1T4	8/6	6N7M	7/6	EB91	6/6	HVR2A	7/6
2X2	3/6	6Q7	10/6	EBC33	8/6	MU14	10/6
3S4	8/6	6SA7	7/6	EBC41	10/6	P61	6/6
3V4	8/6	6SJ7M	10/6	EBF80	10/6	PCC84	12/6
5U4	8/6	6SN7	8/6	ECC84	12/6	PCF80	11/6
5Y3	8/6	6V6G	7/6	ECF80	11/6	PCL82	11/6
5Z4	10/6	6X4	7/6	ECH42	10/6	PEN25	6/6
6AM6	8/6	6X5	7/6	ECL82	12/6	PL82	10/6
6B8	5/6	12AH8	10/6	EF39	7/6	PY80	10/6
6BE6	7/6	12AT7	9/6	EF41	10/6	PY81	10/6
6BH6	10/6	12AU7	9/6	EF50	5/6	PY82	10/6
6BW6	10/6	12AX7	9/6	EF80	10/6	SP61	5/6
6F1	7/6	12BE6	10/6	EF91	8/6	UBC41	10/6
6F6	7/6	12K7	8/6	EF92	5/6	UCH42	10/6
6H6	3/6	12Q7	8/6	EL32	5/6	UF41	10/6
6J5	6/6	35L6	9/6	EL84	10/6	UL41	10/6
6J6	7/6	35Z4	9/6	EM81	12/6	UY41	10/6
6J7	8/6	80	10/6	EZ40	10/6	U22	10/6
6K6	6/6	954	1/6	EZ80	9/6	VR105	8/6
6K7	5/6	EA50	1/6	E1148	1/6	VR150	8/6

FINEST VALUE



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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 12½in. x 5¼in. horizontal or vertical 10in. x 4½in. 2 Pilot Lamps, Four Knobs, Walnut or Ivory. Aligned and calibrated. Isolated Chassis.

£9.10.0 Carr. & Ins. 4/6.

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

UA8 World's Finest 4-Speed Autochanger
OUR PRICE **£6.19.6**

TERMS: Dep. **£3.10.0** and four monthly of **£1.**

COLLARO Mixer Model RC456
HIGH-FIDELITY AUTOCHANGER
4-SPEEDS—10 RECORDS
With Studio "O" pick-up
BRAND NEW IN MAKER'S BOXES
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BUILD THIS REPRODUCER BARGAIN SINGLE PLAYER KIT

Ready for immediate assembly.

4-speed Collaro "Junior" Unit	£4 12 6
Handsome case, 17¼ x 13½ x 7in., with room to play 12 in. records	£2 5 0
Ready-built 3-watt amplifier with two valves and loudspeaker ...	£3 12 6

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TRANSISTORS, GENUINE PYE GOLTOP. V10/15a, Audio, **15/-.** V6/R2 R.F. (3 Mc/s average), **24/-.** Complete data sheets supplied.

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6 transistors, printed circuit, Ferrite aerial. Loudspeaker. All parts and cabinet, **£12.19.6.**
We include 6 Pye Goltop Transistors for maximum performance. Plans 9d.

GARRARD 4-SP. SINGLE PLAYER

AUDIO PERFECTION

Designed to play 16, 33, 45, 78 r.p.m. Records 7in. 10in. 12in. Lightweight Xtal pick-up. GC2 turnover head, two separate sapphire styli.
OUR PRICE £8.0.0 each. Post Free.
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Long spindles. Guaranteed 1 year. Midget 5K ohms to 2 Meg. No Sw. **3/-** D.P. Sw. **4/9**
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80 ohm CABLE COAX

Semi-air spaced Polythene insulated ¼in. dia. Stranded core. Losses cut 50%. **9d. yd.**
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. 1/6. 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, 2¼in. 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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4/450	2/-	250/25	2/6	[illegible]	4/-
8/450	2/3	500/12	3/-	[illegible]	5/6
8/500	2/9	8+8/450	4/6	[illegible]	4/-
16/450	3/6	8+8/500	5/-	[illegible]	5/-
16/500	4/-	8+16/450	5/-	32+32/350	4/6
32/500	6/-	8+16/500	5/6	50+50/350	7/-
25/25	1/9	16+16/450	5/6	64+120/275	7/6
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50/50	2/-	32+32/500	7/6	100+200/350	12/6

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% of above.
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CONTACT COOLED 250 v. 50 mA., **7/6**; 60 mA., **8/6**; 85 mA., **9/6.** 14RA1-2-8-3, **27/6.**
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TELETRON. L. & Med. T.R.F., with reaction, **3/6.**
FERRITE ROD AERIALS. M.W., **8/9**; M. & L., **12/6.**
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JASON F.M. TUNER COIL SET. 26/-. H.F. coil, aerial coil, Oscillator coil, two I.F. trans 10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6AM6, **2/-.**
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MULLARD 3-3 AMPLIFIER READY BUILT. Spare Power for Tuner, etc., **£7.17.6.**

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 amps., **17/6**; 4 amps., **22/6.** Circuit included.
VALVE and T.V. TUBE equivalent books, **5/-.**
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, or 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, or 1 p. 12-way long spindle ... **3/6**
VALVEHOLDERS. Pax. Int. Oct., **4d.** EF50, EA50, **6d.** B12A, CRT, **1/3.** Eng. and Amer. 4, 5, 6, 7 and 9 pin, **1/-.** **MOULDED MAZDA** and Int. Oct., **6d.** B7G, B8A, B8G, B9A, **9d.** B7G with can, **1/6.** B9A with can, **2/6.** **CERAMIC** EF50, B7G, B9A, Int. Oct., **1/-.** B7G with can, **1/9.**

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