AMATEUR COLOUR TV

PRACTICAL TELEVISION

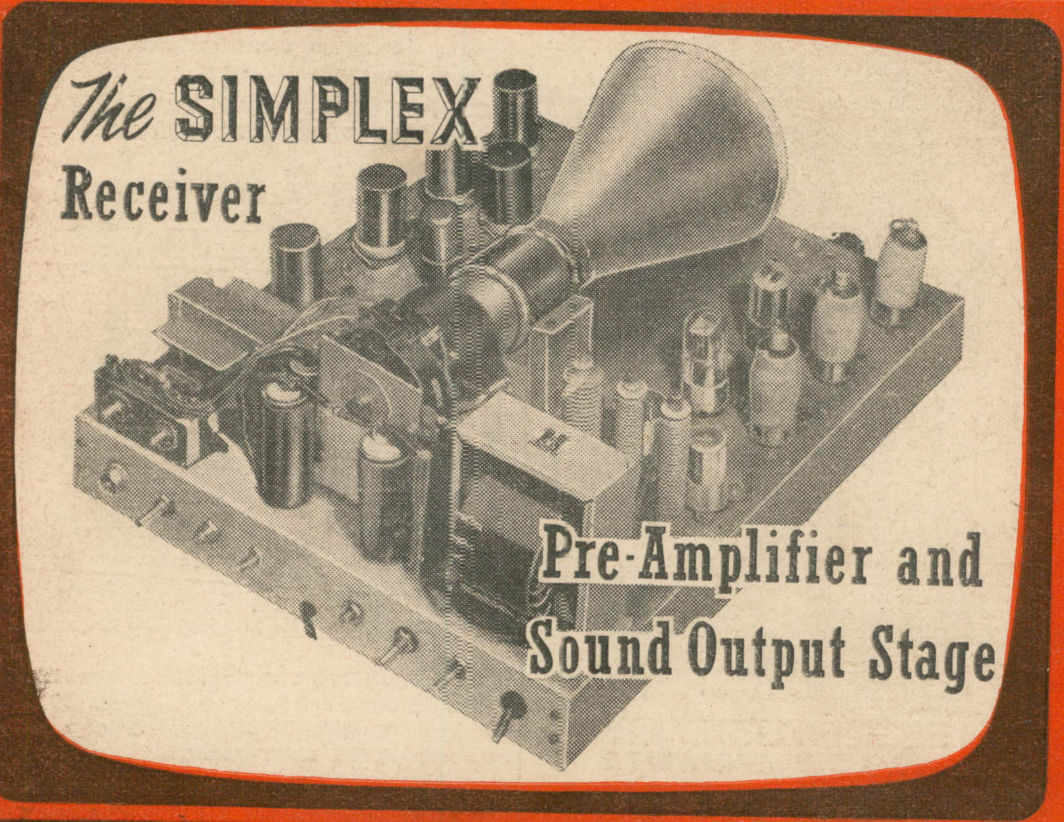
AND TELEVISION TIMES

1/-

EDITOR F. J. CAMM

A NEWNES PUBLICATION

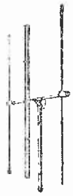
Vol. 4 No. 48 MAY, 1954



FEATURED IN THIS ISSUE

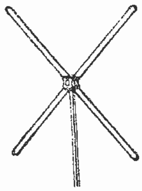
- A Simple Wobbulator
- The Causes and Cure of Foldover
- The Radio Trades Examination Board
- Remote Control Tuners
- Fault Symptoms
- Pages from an Engineer's Notebook
- Modifying the R.3118

AERIALITE AERIALS
are designed for
HIGH PERFORMANCE



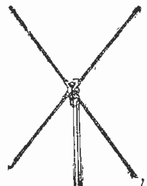
AERFRINGE. For long distance reception this range has the high electrical performance which is essential. The robust construction ensures long service even in the most exposed conditions. The range is available with 10' or 14' alloy mast and double chimney lashings or arrays only. Prices from **£12.15.0** complete Model 63).

Model 63A. Forward Gain 6dB. Front/back Ratio 21.6dB. Acceptance Angle 55°.



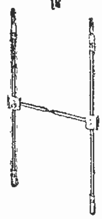
DUBLEX. Special folded dipole construction plus driven array connections make the Dublex the highest gain aerial in this price bracket. The Dublex (as supplied to the B.B.C.) is available with 7', 10' or 14' masts or as an array only. The Dublex 77S (7' mast single lashing bracket) is **£4.8.6** complete. (Mast and array is only 3.2 lbs.)

Model 77. Forward Gain 6dB. Max/min Ratio 25dB. Acceptance Angle 96°



UNEX. Light in Weight, high in performance, the Unex combines excellent forward gain with robust, construction at a low price. The cross-connected elements give a driven array which is extremely easy to erect. The Unex 83S (with 6' alloy mast, single lashing chimney bracket) is only **£3.14.6** complete.

Model 83. Forward Gain 3dB. Front/back Ratio 25dB. Acceptance Angle 176°.



AERFOLD. Where conditions do not allow an outdoor aerial to be fitted the Aerfold provides a high gain aerial which has excellent directivity. It is easy to fit and by rotation, will eliminate or substantially reduce interference. Price **£1.5.0.**

Model 71. Forward Gain 3.75dB. Max/min Ratio 40dB. Acceptance Angle 120°.

ACCESSORIES
Coaxial plugs, sockets, connector boxes, matching boxes, gutter brackets, tile clips, lightning arrestors, etc.

H.F. CABLES
All types, including coaxials, twin feeders and screened balanced twin. Applications cover T/V and radio down-leads, etc.

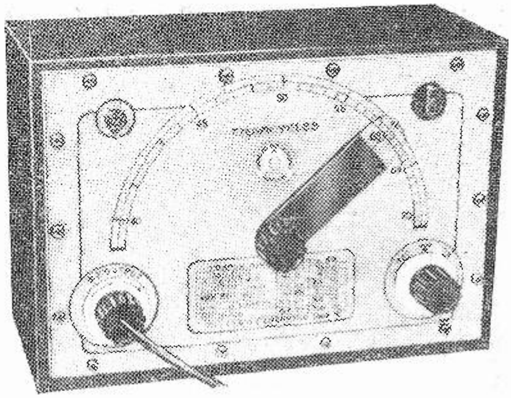
CONNECTOR WIRES
P.V.C. insulated single conductor and multi-strand types. Also, screened and sheathed electronic cables and H.T. connecting wires.

THE AERIAL'S RIGHT IF IT'S AN AERIALITE

Aerialite LTD.

CASTLE WORKS STALYBRIDGE CHESHIRE
Depots at London, Bristol, Birmingham, Manchester, Newcastle and Glasgow.

PATTERN GENERATOR TYPE 4

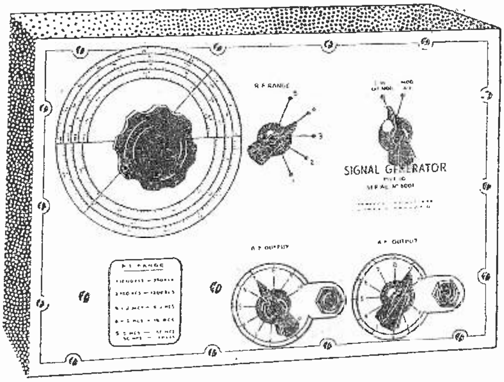


Price £8.0.0 (Postage and packing 3/6 extra.)

● 40-70 Mc/s ● A.C. mains operation ● Direct calibration. CHECKS: Frame and line time base frequency and linearity ● Vision channel alignment ● Sound channel and sound rejection circuits ● Vision channel bandwidth, etc.

EASY PAYMENT TERMS AVAILABLE ON ALL OUR INSTRUMENTS.

SIGNAL GENERATOR TYPE 10



Price £7.10.0 (Postage and packing 3/6 extra.

● 100 Kc/s to 100 Mc/s ● Modulated or unmodulated carrier ● Direct calibration ● Adjustable 400 c.p.s. AF signal ● Stable RF oscillator ● Large, easily read scale ● A.C. mains operation.

Obtainable only direct from the manufacturers. Send for full technical details or call at address below.

HOMELAB INSTRUMENTS LTD.,

615-617, HIGH RD., LEYTON, LONDON, E.10

Telephone: LEY 5651

HOME BUILT TELEVISION

SIMPLEX

STAGE 1. Vision and Sound Section.
VALVES. EF50, 7/6. EA50, EB34, 3/6 each.
RESISTORS. Kit of 12. All labelled, **4/-.**
CONDENSERS. Kit of 16, **10/-.**
500 pf. 5 pf. 15 pf. .001 mfd. **6d.** each.
25 pf. .1 mfd. **9d.** each.
25 mfd. 25 v. **2/-.**
POTENTIOMETERS. 25k Carbon, **4/6.**
2 meg. with SP switch, **6/6.**
COIL FORMERS. Aladdin ⅜in. with core, **10d.** each. Aladdin ¼in. with core, **9d.** each.
VALVE HOLDERS. B9G, **9d.** each.
EA50 and International Octal, **6d.** each.
SUNDRIES. Pye Plug and Socket, **2/-.**
Knobs. Set of two, engraved. Small, **2/4.** Large, 3/-.
SUNDRIES KIT. Contains all wire, cable, nuts, bolts, Solder, Solder Tags, Tag Strips for the whole set, **13/-.**
STAGES 2, 3 and 4. Send for our fully detailed list.

VIEW MASTER

WIDE ANGLE CONVERSION

Full instructions for Wide Angle Conversion are now available. Price 3/6 post free.

KIT OF COMPONENTS AND VALVES. **£17/15/-.** H.P. Deposit, **£5/19/-.**

KIT OF COMPONENTS, VALVES AND ENGLISH ELECTRIC CATHODE-RAY TUBE. **£42/15/-.**

Fully detailed list available.

COMPLETE WIDE ANGLE SET.

We have fully detailed lists available for the construction of a complete Wide Angle View Master. Please state model required.

FULL HIRE PURCHASE FACILITIES

are available for complete or part kits. Send for full details.

TERMS. Cash with order or C.O.D. Postage extra on orders under £3.

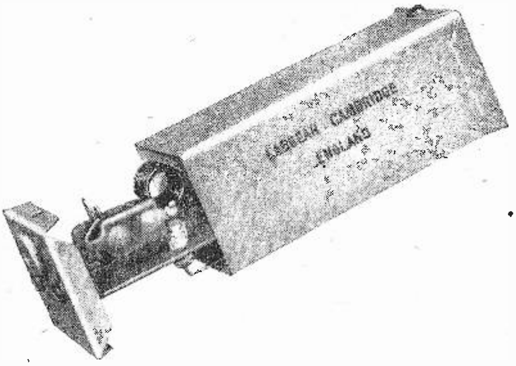
RETURN OF POST SERVICE.

WATTS RADIO (WEYBRIDGE) LTD.

8 BAKER STREET, WEYBRIDGE, SURREY. *Telephone Weybridge 2542*

DO YOU GET AN ANNOYING PATTERN ACROSS YOUR SCREEN ?

If this is due to break-through by a nearby transmitting station, connect a LABGEAR ANTI-SWAMP FILTER to your set.



Makes an outstanding improvement against interference from transmitters on frequencies lower than the TV channels. One required for co-ax aerial feeders, two for balanced twin-lead. Price **10/6**, plus 9d. P./P. only, direct from :

Labgear (Cambridge) Ltd.

WILLOW PLACE, CAMBRIDGE.

Tel. 2494—2 lines.

MONEY BACK GUARANTEE — **DUKE & CO** — Tele: GRA 6677 — CWO or COD

621 ROMFORD RD. LONDON, E.12.

12" TUBES £5

Not Ex-W.D.

3 MONTHS GUARANTEE

MAZDA CRM 121-A-B. and other makes at £5 Guaranteed. Ins., Carr., 15/6. Personal shoppers can see tube working. Post orders, Tube certified O.K. and money back guarantee. Special offer of used tubes with ion burns. Ideal for testing and standby. 12in., 30/- ; 9in. and 10in., £1.

VALVES

6F15, 6BE6, 6BW6, 6BA6, 6V6, 8D3, 807, 10F1, 10P13, at 8/9 ; 1A5, 1T4, 1S4, 1S5, 6K7, 6F6, ECC91, EL91, UF41, 6AM5, at 6/9 : 3V4, 12Y4, 210VPT, 77, EB91, E1436, KTW61, OZ4A, at 5/9 ; 1LD5, 1LN5, 4D1, 6AB7, 7H7, 37, CV6, UM4 (M.eye), SP2 (5-pin), at 3/9 ; AR6 and D1, at 1/9. Up to 6 valves 1/- postage.

RECTIFIERS

Selenium type. 180 volt at 40 mA., 3/9. Metal recs., 300 v. 200 mA. Also 200 v. 80 mA. ; either at 8/9. P. & P. on Recs., 9d.

P.M. 12" 10" SPEAKERS 8" 6"

12in. Truvox P.M. 3 ohms, 47/6 ; 10in., 25/9 ; 8in., 18/6 ; 6½in., 14/9 ; 5in., 13/9. All 3 ohms. Best makes. P. & P. 1/9.

CONDENSERS

1,000 mfd. 12 v. D.C., 3/9 ; 100 mfd. 50 v. D.C., 3/9 ; 30-30 mfd. 425 v. D.C., 4/9 ; 24-32 mfd. 350 v. D.C., 3/9 ; .01 mfd. 3,000 v. D.C. cardboard, 1/-. Post on all conds., 6d.

INTERFERENCE AND NOISE SUPPRESSORS

Outdoors, are you interested ? 8/9. Spotlights, 8/9, post 1/3. Sidelights, or rear, infra red glass easily changed. 1/9. Post 9d.

STAMPS ONLY FOR CATALOGUE.

PRACTICAL TELEVISION

& "TELEVISION TIMES"

Editor : F. J. CAMM

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.

Vol. 4 No. 48 EVERY MONTH MAY, 1954

Televiews

Increased Licence Fee

THE increase in the cost of TV/Radio licence fees from £2 to £3 was foreshadowed in November, 1953, by Sir Ian Jacob, the BBC Director-General. It is obvious that the increases would have taken place whether commercial television were introduced or not. Sir Ian made it clear that the increase was necessary in order to improve the service, but whether such improvement would have taken place but for the imminence of commercial TV is a matter for conjecture. So far as the payment of £750,000 to the new Corporation is concerned, the Postmaster-General has stated in the House of Commons that this is purely to meet a specific point raised by Lord Waverley and the Archbishop of Canterbury. It is the price of compromise !

But free enterprise offered to introduce an alternative commercial television service with full transmitting equipment at no cost to licence holders. It is our view, however, that commercial TV in the emasculated form proposed will not prove attractive to advertisers since it is hedged round with restrictions prompted by inhibitions. However, in a comparatively short time we shall be able from the programmes themselves to judge whether commercial TV provides an answer to the BBC monopoly.

TV Relayed by Wire

BRITISH Relay Wireless and Television is now operating the first multi-channel TV relay system in this country at Lambeth. It has now been working several weeks and provides up to four vision channels and five sound channels. The latter may soon be increased to six.

The company plans to extend TV relay in the London area and may shortly sign an agreement with the London Transport Executive to take over the disused tram ducts in the road in which to lay its cables. This will provide a ready-made main distribution system as underground ducts between the rails were employed in nearly all London's former tram routes.

The TV and sound signals will be sent from a central station in Southwark and the multi-channel system will permit the existing BBC TV service, commercial TV and later the BBC alternative service to be available to subscribers. The system will also be capable of handling coloured pictures when transmitted.

At present B.R.W. picks up on its own special aerial the TV service of the BBC, but plans are in hand to receive the transmission by direct cable, thus eliminating all interference. The relay sets contain only nine valves instead of the usual minimum of about 18, although it is hoped that after operating experience has been obtained to produce a relay set containing about only five valves. Programme selection is by a simple switch for both sound and vision.

The weekly subscription for a four-programme radio and multi-channel TV relay is 11s. with a 9in. TV screen and 13s. 6d. for a 12in. screen. Installation fee in both case is £2 10s. The next installation is planned for Huddersfield.

Coin-in-the-Slot TV

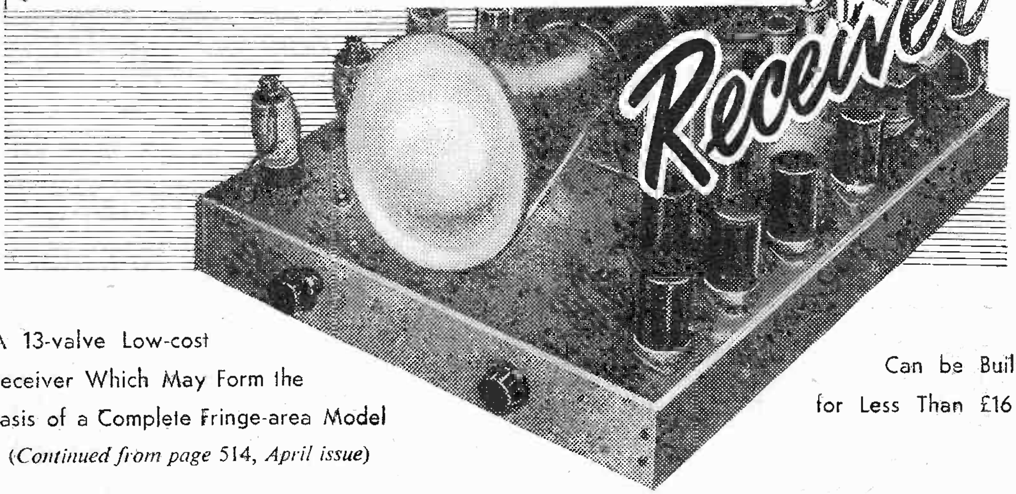
TELEMETER, or coin-in-the-slot television, has steadily extended since it was introduced last November at Palm Springs, California. When the system was opened on November 28th, 1953, 512 TV sets were connected to the Palm Springs Community Television System, of which 71 were connected with telemeter. By January this year, the number had risen to 614, of which 148 had telemeter.

With the telemeter system, viewers at home insert coins into special meters attached to their sets and thus receive programmes they would not otherwise get on the ordinary television service. The International Telemeter Corporation has averaged 10 dollars a month for each set. The Paramount Picture Co. has a 50 per cent. interest in it.

End of Volume IV

THIS issue concludes Volume IV and indexes for it, price 1s. 1d. by post, will shortly be available. Whether you have your copies bound or not, we advise every reader who keeps his journal for reference purposes to obtain a copy so that information can rapidly be traced. Indexes are available for the three previous volumes as also are binding cases.—F. J. C.

The "SIMPLEX" Receiver



A 13-valve Low-cost Receiver Which May Form the Basis of a Complete Fringe-area Model

Can be Built for Less Than £16!

(*Continued from page* 514, *April issue*)

CONDENSER C16 should be fitted on the end of the large tag strip and the remainder of the sound output wired up, using the screened cable to carry the sound out of the chassis.

The video correction choke, L8, should be wound with 34 turns of 28 s.w.g. wire, unless a standard component is purchased, as already mentioned.

Fit the mains flex and then check the whole of the circuit carefully with the blueprint.

Testing

Make sure that the mains transformer input is at the correct voltage tap. Connect a 6-volt bulb across any valve heater pins and a 4-volt (or 3.5) across the C.R.T. heater. Connect the output flex to the mains and switch on.

If the 4-volt bulb " blows," then carefully check the C.R.T. network. If the 6-volt bulb " blows," then carefully check the H.T. and heater network.

If all is in order, then disconnect the mains plug and mount the C.R.T. The best method of doing this is to use a rubber mask of the type designed for the VCR97 ; it greatly enhances the appearance of the completed televisor, though it can be omitted on grounds of cost.

When a rubber mask is used, cut a portion of aluminium strip as in Fig. 5. It should be bent into the shape shown and fitted round the edge of the mask and bolted to the chassis. It will be found that the tube is firmly fixed and the chassis can be stood on its side (the side where the mains transformer is fitted), enabling access to be obtained to the components underneath the chassis.

If no mask is used, bind the periphery of the C.T.R. with rubber strip (a portion of old cycle inner tube will do) and cut the aluminium strip as in Fig. 5, but one inch shorter. Shape the strip and then mount the tube.

It was not found necessary to fit a mu-metal screen to the tube, though some tubes seem more sensitive to external influences than others, and if the raster on the screen is pulled at all, then try the effect of a screen.

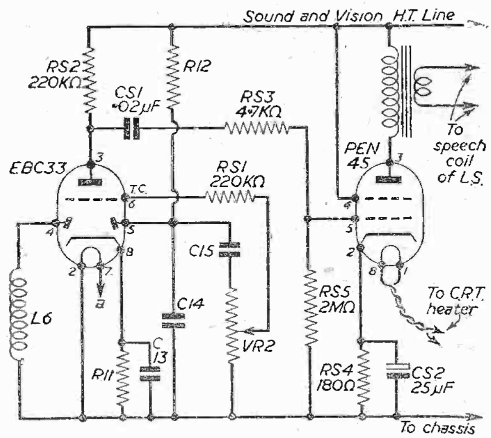


Fig. 6.—The separate sound section. A wiring diagram of this is given in Fig. 8.

ADDITIONAL COMPONENTS FOR FIG. 6.

One EBC33 in lieu of EB34
One Pen 45

Two 220 K Ω resistors		(RS1, RS2)	½ watt
One 4.7 K Ω	,,	(RS3)	½ watt
One 2 M Ω	,,	(RS5)	½ watt
One 180 Ω	,,	(RS4)	1 watt
One .02 μF 350 v.w.		(CS1)	
One 25 μF 25 v.w.		(CS2)	

Sundries : One Loudspeaker with transformer to match
One Mazda Octal Valveholder
One Screened Cap for EBC33

Insert all the valves and turn all controls to zero. The brilliance control should be turned so that maximum resistance is in circuit.

Switch on !

As soon as the receiver has warmed up, turn up the brilliance control until a blurr appears on the screen. Adjust the focus control until the lines of the "raster" are clearly defined. Operate the shift controls until the raster is correctly centralised. Reduce the brilliance control until the raster appears only faintly. Adjust the frame hold until the raster is practically stationary.

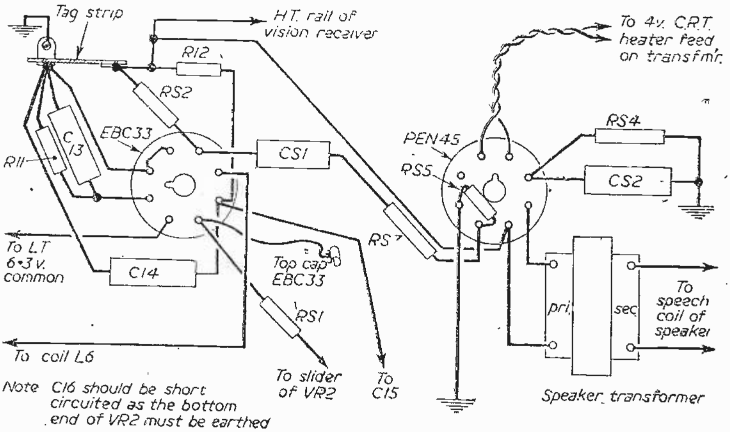


Fig. 8.—Practical wiring diagram of the sound section.

Plug in the aerial ; operate the contrast control to maximum (=minimum resistance) and adjust the cores of the vision coils until a pattern appears on the screen. If the pattern flickers up or down, hold it by adjusting the frame hold control. Now adjust the line hold control carefully until the pattern resolves itself into a picture. Adjust contrast and brilliance controls to obtain the best contrast. Adjust the cores of the vision receiver to obtain maximum picture strength.

Now plug the sound output into the pick-up sockets of a broadcast receiver. Adjust the volume control on the televisor to max. and adjust the volume on the receiver to its usual position.

Trim the cores of the sound section to receive the sound. This may require some adjustment of L1 and L2 as well.

With sound and picture present, finally adjust the cores of the coils for best picture quality and best sound. L7 should be adjusted so that no sound breaks through on the vision.

Notes

As this is a straight R.F. receiver it is not intended to work at extreme ranges. If the signal is not strong enough improve the aerial system, and, if necessary, fit the pre-amp. This is wired in the spare position next to V1 and the wiring carried out in the same manner.

If undue hum is experienced in the broadcast receiver, try reversing the pick-up socket connection and/or the mains plug.

Should difficulty be experienced in getting sound and vision, connect a pair of phones in series with R6 and the anode of V5 and listen for the signal. It sounds like a rough mains hum. It should then be tuned to maximum volume as quite an appreciable volume is required to operate the C.R.T.

The final adjustments are to the width and height controls which is best done when the clock is being transmitted so as to obtain a correctly proportioned picture.

Adding a Sound Output Stage

Adding a sound output stage is quite a simple matter. The EB34 is replaced with an EBC33. A Pen 45 is used for the output valve, and the heater current for this valve is obtained from the same supply as the C.R.T. heater.

The new valve should be mounted in the spare position next to V7.

A 5in. or 6in. loudspeaker with matching transformer can be used and it can be mounted in any position except next to the C.R.T. If fitted anywhere near to the tube, the loudspeaker should be of the special TV type with a restricted field.

Many commercial receivers of the table model type mount the speaker on the side, a grill being provided in the cabinet.

Fig. 6 gives the circuit diagram and Fig. 8 the wiring diagram.

Note that C16 is not required and the bottom end of the volume control should therefore be taken directly to the chassis.

Adding a Pre-amplifier

The circuit of a pre-amp is given in Fig. 7. It follows the same principles as the other R.F. valves and is, in fact, a duplicate of V1 circuit. The valve should be mounted in the spare position by the side of V1 and the wiring diagram as given in the blueprint for V1 should be followed for wiring up the new valve.

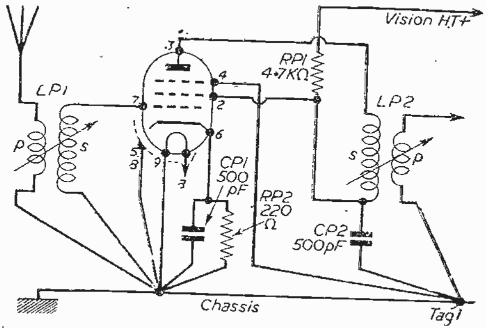


Fig. 7.—This is an R.F. stage which may be added for fringe-area reception.

LIST OF COMPONENTS FOR FIG. 7.

One EF50 Valve
One EF50 Valveholder
One 4.7 K Ω Resistor (RP1) } ½ watt
One 220 Ω ,, (RP2) }
Two 500 pF Condensers (CP1, CP2)
Two ⅜in. Coil Formers with cores
One 2-way Tag Strip
One Screen (made up as for the screen for V1)

LP1 is wound exactly as L1 and the aerial connection is taken to the primary of LP1 instead of L1.

LP2 is wound exactly as LP1 and the primary "live" end is taken directly to the primary of L1.

Note that LP2 is LP1 in reverse and the smaller insulated winding is wound on last and couples to L1.

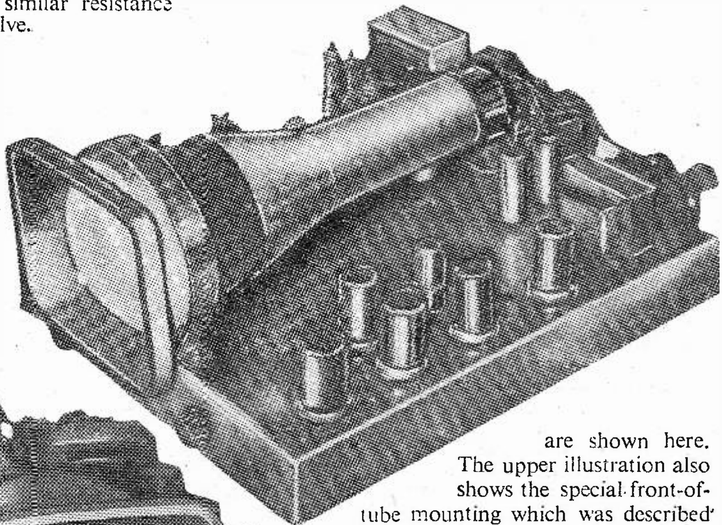
A screen must be erected across the valveholder as for V1 and another screen erected between the new valve circuit and the first sound R.F. stage.

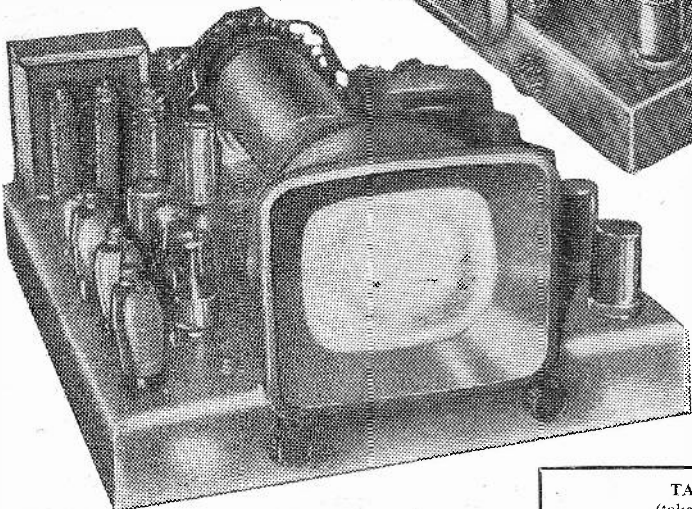
If difficulty is encountered with regeneration, then connect a 4.7 KΩ ½ watt resistor between the grid of the new valve and earth, and a similar resistance between pin 2 and pin 3 of the valve.

Final Notes

Before concluding there are one or two points which have arisen from the constructional work and details which have been given in the past two issues. First, the great demand for components has resulted in a shortage of several of the specified parts. Condensers C29, C30 and C31, for instance, appear to be no longer available from any of the main dealers. As a result, alternative types will have to be used. A .1 μF condenser rated at 1.5 kΩ does, however, appear to be in fairly good supply at the time of writing and may be used as an alternative here. Similarly, the type of rectifier which was employed was an ex-Service unit which, again, has disappeared from the general market. The RM3 units which may be used are larger than the originals, and it will be found that they are not easily mounted in the positions occupied by the originals, as they are larger in diameter. Accordingly, an alternative type of mounting will have to be adopted—the simplest plan being to mount them on small plates in a horizontal position.

With regard to the coil data the tap on coil L7 should be two turns up from the lower end in Fig. 2 in the March issue.





Two views of the complete receiver with mask fitted.

Special Items

Before giving the test voltages taken on the prototype it might be mentioned that a number of firms have arranged to supply either the original parts or special items either separately or in kit form. Amongst these may be mentioned the mains transformer which Messrs. Elstone are prepared to supply, with a 4-volt winding to replace the 5-volt 3-amp. winding and thus avoid the difficulty of stripping down the transformer as described. The price of this special transformer is 46s. 6d. The receiver should, of course, be provided with a suitable mask, two views of which are shown here. The upper illustration also shows the special front-of-tube mounting which was described in the last issue as distinct from the centre-tube mounting shown in previous illustrations. Mayco Electric, of 43, Rosebery Avenue, E.C.1, can also supply a 6 in. magnifying lens at 17s. 6d. to produce the effect of a larger picture.

Test Voltages

The following table gives the actual measurements taken on the prototype:

TABLE OF TEST VOLTAGES
(taken with Avometer 500 volt range)

	A	SG	C
V1	230	230	1.7
V2	230	240	1.9
V3	240	250	4.2 (Contrast Minimum)
V5	230	265	0.9
V6	230	230	2.2
V7	—	—	0.3
V8	—	—	—
V9	280	—	9.0
V10	300	25	—
V11	80	180	—
V12	75	175	—
V13	85 Anode 1	80 Anode 2	—

Current through earthy end of bleeder, 0.35 mA.
Timebase H.T. rail, 350 v.
Vision and sound H.T. rail, 265 v.
Current drawn by timebase, 12 mA.
Current drawn by vision and sound section, 45 mA.
Current drawn from rectifier, 60 mA.
Surge voltage, 450 v.

A Simple WOBBULATOR

CONSTRUCTIONAL DETAILS OF AN EASILY BUILT INSTRUMENT SUITABLE FOR ALIGNING TELEVISION RECEIVERS

By S. C. Murison

THE virtues of a wobbulator for ganging television receivers make it a valuable instrument to the constructor or service mechanic. Superficially, the principle is simple. The input frequency fed to a receiver is varied smoothly and in synchronism with the horizontal deflection of a cathode-ray tube while displaying the output from the receiver on the vertical axis of the tube. The instrument to be described retains this superficial simplicity without losing in utility as a result. Its construction is much less troublesome than that of most receivers—sound or vision.

Before describing the construction of this wobbulator it may be helpful to consider the basic idea behind wobbulators in general. Such a consideration will help to show that however simple a wobbulator seems at first sight, the realisation of a practical instrument is not simple.

Let us consider first the frequency wobbling process: A total deviation of 4 Mc/s would be suitable if only single-sideband receivers were to be tested. For double-sideband receivers, a total deviation of 8 Mc/s is necessary. Double-sideband receivers are only likely to be encountered in the London area; and then less frequently than single-sideband ones—yet they must be catered for. If the wobbulator is to be capable of being tuned easily from one channel to another, the need for the greater deviation at the lowest frequency may complicate matters. Whether this complication arises will depend on the wobbulation method.

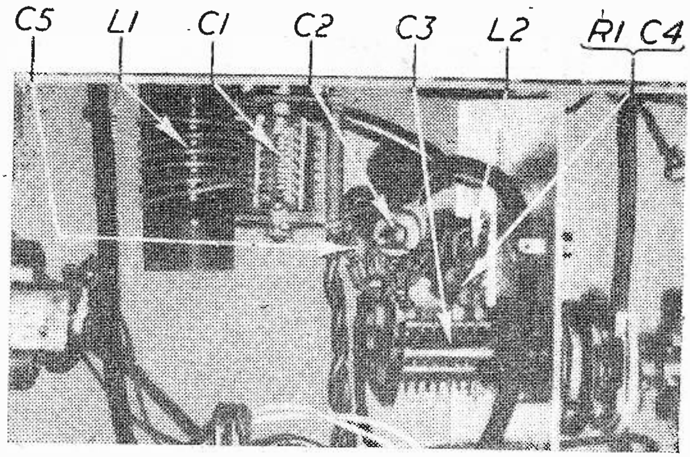
Wobbulation Methods

Basically there are two methods of wobbulation: electronic and mechanical. Usually, electronic methods rely on so-called "reactance valves," by which is meant a valve circuit in which the output from the valve is fed back to its input with a particular phase relationship. According to the phase relationship, the input of the valve presents an apparent capacitance or inductance to whatever circuit it is connected. When the mutual conductance of the valve is varied, the value of the apparent capacitance or inductance varies. Such arrangements are not suitable for an amateur-built wobbulator for television work, so we need not consider them further here.

Mechanical methods fall into two broad categories: vibratory and rotary. Vibratory capacitors have been (and still are) used in radio altimeters of the frequency modulation kind. Some time ago these components were available in small quantity on the surplus market. As they are not now available and the construction of substitutes from small loudspeakers is not simple, they need not be considered further here. A rotary capacitor is a normal component, and its continuous rotation by an electric motor a simple matter. It is only necessary to ensure that the capacitance variation is adequate for a ± 4 Mc/s deviation at 45 Mc/s.

Because of the extreme simplicity of this method, it is used in the instrument to be described. The rotary capacitor is a short-wave tuning capacitor of quite normal design, the electric motor being an easily obtainable inexpensive type designed for a rim-driven gramophone.

Having decided on the method of getting the deviation, the problem is still far from solution. It is of paramount importance to make sure that the output voltage from the wobbulator remains constant when the frequency is varied. Standard signal generators provide an output voltage meter and an output voltage control, so that as the manual tuning is varied the output can be reset by the output voltage control. For a practical wobbulator it is not possible to gang an output voltage control to the rotating capacitor. The only practical method is to arrange an effective automatic amplitude limiter in



View of a portion of the underside showing main layout.

the oscillator circuit itself. Accordingly, this instrument uses an effective grid leak-capacitor arrangement as its amplitude limiter.

Display Methods

Having produced a constant amplitude R.F. signal which is being wobbled over the desired band, the problem of displaying the receiver output remains. Three general methods of solving this are available: The first uses contacts which operate once in each revolution of the rotating capacitor, the contacts being used either to discharge a timebase capacitor directly or being used to produce a sync pulse which has the same end effect. Although superficially attractive this method causes many practical snags, not the least of which is the constructional work. Another snag of this method is that slight variations in the speed of rotation cause either variations in the horizontal amplitude, or loss of sync.

The second possible method consists of feeding the generated R.F. signal to a frequency discriminator of the same kind as is used in F.M. sound receivers and then using the output of the discriminator to sweep the horizontal axis of the tube. Although capable of excellent results, this method was discarded for the present instrument because of the difficult setting-up which it calls for.

The third method, which is the one used, is to rotate a potentiometer capable of complete rotation in synchronism with the rotary capacitor. The ends of this potentiometer track are fed with a direct voltage and the sweep voltage taken off between the wiper and one end of the track. A simple modification is made to standard wire-wound potentiometer to make it capable of 360 deg. rotation, only 170 deg. of which play an active part in the horizontal deflection. The reason for using only 170 deg. of the travel is that most conventional short-wave tuning capacitors have most of their variation in such an arc. The remaining 190 deg. is in two parts: 20 deg. during which there is very little variation of capacitance and 170 deg. in which the capacitance variation is *nearly* a mirror image of its variation in the other 170 deg. arc. If the two 170 deg. arcs were *identical* mirror images of each other it would be worthwhile to try to make use of both. Because they tend to differ slightly, only one is used. During the active 170 deg. arc the trace is brightened; during the idle 190 deg. arc the trace is blacked-out. By this method

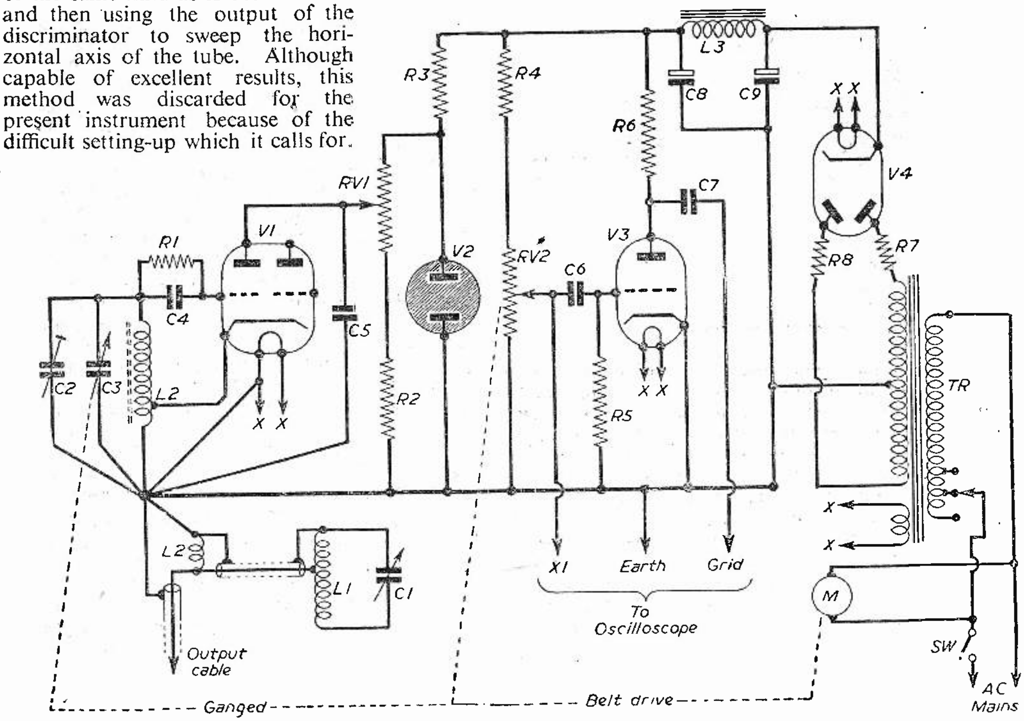


Fig. 1.—Theoretical circuit of the wobbulator.

LIST OF COMPONENTS

C1—4 to 20 pF variable	TR—Secondaries: 6.3 v. at 3 A, 300-0-300 v. at 60 mA	R1—3.9 KΩ ½ w.	L1, L2 } See Fig. 2
C2—3 to 30 pF pre-set	M—Shaded pole rim drive gram motor	R2—10 KΩ ½ w.	L3—10 h. 40 mA choke
C3—4 to 20 pF variable	RV1—50 KΩ carbon	R3—25 KΩ 3 w.	SW—Single pole QMB
C4—50 pF mica fixed	V1—ECC91	R4—33 KΩ 3 w.	RV2 — Linear, wire-wound. Any value from 50 K. upwards. See text for modifications.
C5—0.001 μF	V2—7475	R5—2.2 MΩ ½ w.	
C6—0.001 μF	V3—6J5	R6—100 KΩ 1 w.	
C7—0.1 μF high voltage (see text)	V4—6X5	R7—100Ω ½ w.	
C8, C9 } 16-16 μF 450 v wkg.		R8—100Ω ½ w.	

an internally generated sweep voltage is made available which has the advantage that any slight variations in the speed of the motor have no effect on the trace, if we ignore very slight variations in brightness. The law relating frequency to the horizontal deflection is not linear; but this need introduce no difficulty if a stable frequency marker is provided.

An absorption wavemeter provides the frequency marker in preference to the manually tuned oscillator

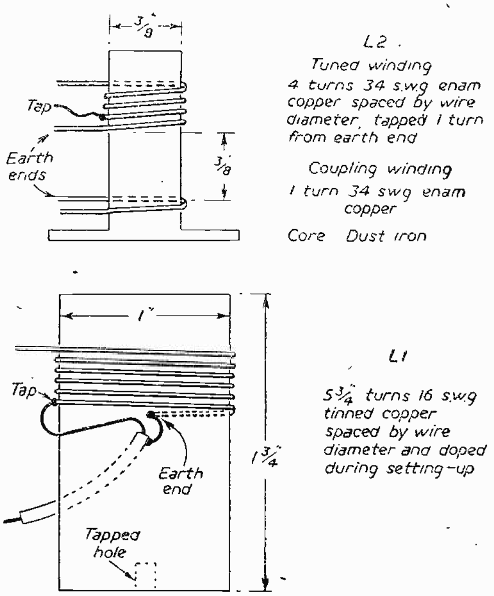


Fig. 2.—Details of the coils used.

sometimes used. The use of a manually tuned oscillator would introduce frequency stability problems which are a needless complication, apart from needing a valve. The absorption wavemeter arrangement consists of a tuned circuit coupled to that of the wobbulator. When the wobbling brings the oscillator frequency to that of the wavemeter, the oscillator is loaded and a considerable decrease in its output voltage results. Because the wavemeter is a passive circuit, its setting-up and use are simple. On the other hand, the tuned oscillator arrangement requires some care if its harmonics are not to complicate matters.

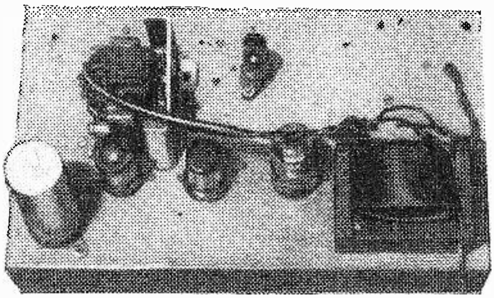
Oscillator Circuit

Fig. 1 shows the circuit, from which it can be seen that the simplest possible arrangement is used. A Hartley oscillator employing one-half of an ECC91 is used. Details of the coils are given in Fig. 2. It is important that the spacing shown between the two windings of L2 be rigidly followed. The former used for L2 can be of the commonly used Alladin type, although the older style of polystrene former is shown in the photographs. The windings on L1 should not be doped until the setting-up process is finished. The values for C4 and R1 may appear unusual, the values having been chosen to result in the least amount of spurious amplitude modulation as the frequency is wobbled. A maximum output of 200 milli-volts is available into 80 ohms. As the construction of a really effective attenuator is far beyond the facilities of the average constructor, the actual amplitude of the oscillation is varied. RV1 is the output voltage control, its effect on the frequency of oscillation being negligible. A neon stabiliser is used for the oscillator H.T. supply. Apart from the usual advantages, it materially assists in decoupling the oscillator from the sweep generating circuit.

The amount of deviation depends on the ratio of the value of C2 to that of C3, while the frequency about which wobbling takes place is set by the value of L2. The setting of these three is to some extent interdependent, but the setting-up is quite simple if it is done in the correct order. The capacitor used for C3 can be any type having a minimum capacitance variation of 16 pF, provided always that it is capable of complete rotation. The one used in the original instrument was bought cheaply as Government surplus. It is believed to have been made by Polar.

The motor used was bought from Lasky Radio, who advertise it in these pages. It is supplied with a small brass pulley on its shaft. This pulley is used in conjunction with an ordinary 2½in. wireless dial drive pulley to provide belt-drive to C3. The resulting speed of rotation of C3 is about 1,200 r.p.m., corresponding to a wobbling frequency of about 20 c/s. An ordinary elastic band has proved most satisfactory on the original instrument as the belt. Apart from its ready availability, a rubber band gives two other advantages: it allows lateral movement of the motor shaft (this is necessary with the type of motor used); and it prevents random vibrations from the motor reaching the rotary capacitor via the drive. It is, of course, most important to prevent random frequency modulation such as would be produced if C3 were subjected to vibrations. Equally important is the need to prevent spurious amplitude modulation. The only likely cause of this is a microphonic valve. Fortunately, the type ECC91 appears to be very free from such effects and will not respond to vibrations many times greater than those to which it is subject in this instrument. This is true of several samples of various ages tried in the original instrument. No anti-vibration mounting of any component has been found necessary.

Turning now to the horizontal sweep circuits: RV2 is the modified potentiometer from whose wiper the sawtooth waveform is taken to the X1 plate of the oscilloscope. Because the sawtooth is at a low frequency, it must reach the X1 plate through circuits having a very good low frequency response. The easiest method, if it is practicable with the oscilloscope



Top-of-chassis view showing the driving motor.

to be used, is to connect the wiper of RV2 directly to the X1 plate and arrange for horizontal shift with the X2 plate.

The sawtooth waveform from the wiper of RV2 is fed to the grid of V3, C6 and R5 being a differentiating circuit. As readers will know from television synchronising circuits, a differentiating circuit is one which produces an output voltage proportional to the *rate* of change of its input voltage. During the active 170 degrees of rotation the *rate of change* of applied waveform is constant. Consequently, a rectangular waveform is developed across R6 during the active part of the rotation. During the other 190 degrees of rotation the *rate of change* is again constant; but this time at zero, because during this time the wiper is moving over a short-circuited part of the track. A spike appears across R6 at the instant when the wiper passes over the small gap left in the short-circuiting metal to prevent short-circuiting the whole track. This spike is removed by the limiting which takes place in the circuit of V3. Because V3 has no standing bias and a low effective anode voltage, it operates as an amplitude limiter, thus removing any random variations in amplitude due to imperfect contact of the wiper as it moves over the track. From the anode of V3 a positive-going rectangular waveform, whose duration corresponds to the active 170 degrees, is taken and used to provide brightening of the trace on the cathode-ray tube. Because of the long duration of this brightening waveform, the time-constant of the coupling circuit to the grid of the cathode-ray tube should be about 0.2 sec. Thus if the C.R.T. grid resistor has a value of 2 megohm, the value of C7 should be about 0.1 μF. A great measure of latitude is possible here; but if the trace gets progressively dimmer from left to right, this time constant should be suspected.

Capacitor C7 is subjected to the H.T. voltage (positive) *plus* the E.H.T. voltage of the oscilloscope (negative). Consequently, a sound component of adequate working voltage should be used. If the E.H.T. voltage of the oscilloscope is 1 kV, C7 should be of at least 1.5 kV working. Although C7 is shown on the circuit, a suitable component probably is already fitted inside the oscilloscope. It is safer to mount it in the oscilloscope; if this is possible, for then the wire to it no longer carries E.H.T.

Potentiometer Modifications

The modifications to the potentiometer consist of doing two things: removing the arc limiting stop and short-circuiting part of the track. A Colvern potentiometer was used for the original instrument. The method given here applies to such a potentiometer; but from it readers using other makes will be able to arrive at the desired result by following the same general plan.

Constructors need not be disheartened by the thought of the modification. A potentiometer can be completely modified in a quarter of an hour without any special tools. For those who may not be familiar with the inside of such potentiometers, Fig. 3 is given to aid the recognition of parts involved.

First remove the paxolin back cover. An easy way to do this is to scratch away the varnish round its edge. Then pierce the paxolin $\frac{3}{8}$in. away from the middle tag along a radius from the middle tag. This ensures that the tool making the hole will not damage the track or the wiper. A bradawl is an excellent, if unconventional, tool for the purpose. Having pierced the paxolin with it, the bradawl can then be used in the manner of a corkscrew to pull off the paxolin plate.

When the back is off, remove the circlip around the shaft beside the threaded collar. Care should be taken in removing the circlip because it has to be replaced at the end of the modifications. A small screwdriver can be used to open the circlip which can then be pulled out of its groove with a pair of pliers. Now the wiper arrangement should be removed, taking care not to damage the C-shaped spring which bears on the underside of the wiper arrangement at its centre.

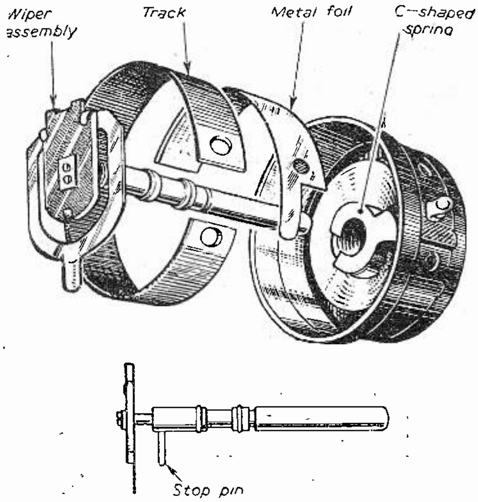


Fig. 3.—Modification details of the potentiometer.

Having removed the wiper arrangement with the shaft, remove the two screws at the ends of the track. Withdraw the paxolin strip carrying the track, taking care not to damage the wire of the track. Inside the track housing lay a strip of thin (0.005 to 0.01in.) copper or aluminium foil. This strip should extend over 100 degrees of arc measured from one of the ends. Beyond this end allow 1in. of foil to project. Now replace the track and replace its holding screws. The piece of foil projecting from one end of the track should now be bent to follow the path which the wiper will take across the gap between the two ends of the track. It will be necessary to be careful in doing this to ensure that the foil does not touch the terminal for the wiper. Trimming of the foil will be necessary during this part of the process. The foil should be cut off about 0.01in. (this is not critical) from the other track end to that from which the foil came. If the foil will not hold itself in position, a spot of coil dope, or the like, will serve—but the adhesive must be kept off the surface on which the wiper will bear. The object of this piece of foil which carries over between the two track ends is to allow the wiper to maintain contact for the greatest amount of arc.

The pin through the shaft acting as the stop is either driven out or filed off. It is usually easier to file it off. Now replace the wiper assembly, the circlip and the rear cover. *(To be continued)*

FAULT SYMPTOMS

THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

By Gordon J. King, A.M.I.P.R.E.

(*Continued from page 519, April issue*)

BEFORE we leave the subject of synchronising we will first briefly examine the flywheel method adopted by Thorn Electric, Ltd., in their recent Ferguson television receivers. The appropriate circuit of the model 991T is shown in Fig. 44. Here, three valves are used; V2 is the line generator valve, which is electron coupled in the cathode circuit by means of winding L2 on the transformer T1. This forms a fairly conventional type oscillator, and although the voltage across the grid winding L1 is sinusoidal, owing to the operating conditions of V2, governed by the values of the anode and screen resistors, the output appearing across the anode load resistor is of square waveform. This output voltage is applied through a suitable correcting network to the control grid of the line output valve to produce a linear current rise in the deflector coils in the normal way.

The frequency of oscillation is controlled by two main factors; one being the tuned frequency of the oscillator transformer itself, and the other is the shunting effect offered by V1—since it will be observed that the anode of V1 is directly connected to the grid winding of T1. V1 is, in fact, arranged in the form of a reactance valve. That is to say, that it can be made to appear to the oscillator inductor either as inductive reactance or capacitive reactance depending on the positioning of C1 and R1. In this instance it is arranged to possess a virtual capacitive reactance, the magnitude of which is readily altered by modifying the effective gain of the valve, e.g., by varying the control grid bias. Thus, a simple way of adjusting the oscillatory frequency of V2 is by altering the bias on V1.

In this circuit the discriminator is centred round a double-diode valve, instead of the two metal rectifiers used for the same purpose in the Pye circuit. Furthermore, a sample of the oscillator voltage for phase comparison with the sync pulses is picked up by virtue of a separate winding, L3, on the oscillator transformer itself, while the sync pulses gain entry to the discriminator through the centre tap connection on L3. Nevertheless, the resulting function is of similar nature, and the potential developed across the load resistors R7 and R8 is conveyed through R1 to the control grid of V1, and acts as a control bias for varying the frequency of oscillation.

The line generator frequency can be adjusted manually by the line hold potentiometer R5, and is initially set so that the line oscillator frequency coincides with the sync pulse repetition frequency and any future frequency wandering on the part of the oscillator will be brought under immediate control due to the ability of the discriminator to produce a suitable corrective bias.

In order to prevent a sync pulse, which may be heavily laden with noise, from detracting from the desired action of the network by producing rapid fluctuations in control bias, a low-pass filter, comprising C5, R9, is incorporated in the control bias feed circuit.

In practice, this circuit does really exhibit a flywheel

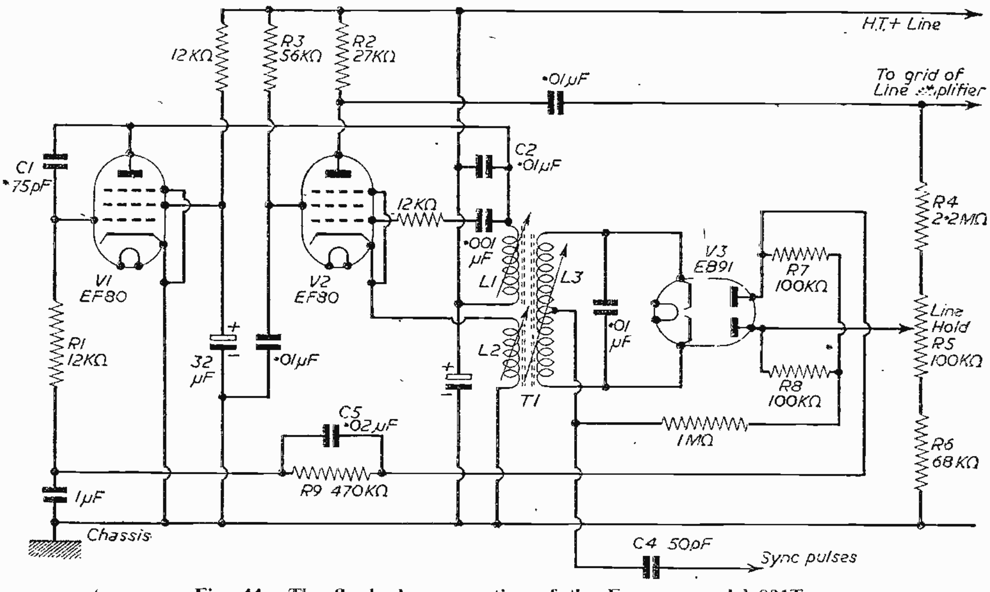


Fig. 44.—The flywheel sync section of the Ferguson model 991T.

effect, for it is possible to hear the characteristic line timebase whistle diminishing in amplitude, even for a few seconds after switching the receiver off! Furthermore, once the scan is synchronised—after first switching on the receiver—it is impossible to unlock it by adjustment to the line hold control. Extensive adjustment to this control simply alters the horizontal position of the entire picture on the screen, and it works after the style of a horizontal shift control, though it is important to remember that to use the control for such a purpose is bound to impair the efficiency of line synchronising, and picture distortion may result.

It should, therefore, be ensured that the picture is centred accurately on the screen by means of the normal shift adjustments located close to the focusing unit on the neck of the picture-tube, *after* the correct setting of line hold control has been ascertained. One way of establishing the correct line hold setting is by reducing the contrast control to a low level, consistent with synchronising, and adjusting the line hold to somewhere near the centre of its range. After this, the aerial should be removed from the receiver and then quickly reconnected, when a correct setting of hold control will be evidenced by the picture immediately jumping into line sync. If, however, line synchronising is destroyed when a signal is applied to the receiver, the line hold control should be readjusted and the same procedure adopted until a setting of line hold is found where the picture locks immediately on reconnecting the aerial.

Phasing

As will be seen, the three windings on transformer T1, Fig. 44, are shown to employ variable tuning by iron-dust cores which can be adjusted in the usual way. L1 and L2 determine the frequency of the oscillator, and they are initially set in the factory so that when the sync pulses are disconnected from the discriminator, for the purpose of this test, an approximate mid-setting of line hold control (R5) will cause the oscillator frequency to correspond to that necessary for accurate synchronism. It is possible, however, due to ageing valves and components after the receiver has been in service for a while, that the oscillator tuning will need to be readjusted to centre-up on the range of the hold control the correct oscillator frequency. This can be performed fairly easily by removing the sync pulses (by disconnecting C4, for example); setting R5 to its mid position, and then carefully adjusting L1 until the picture is seen to resolve horizontally in the centre of the raster. This is an extremely critical adjustment since it necessitates finding the correct oscillator frequency without the aid of the sync pulses; nevertheless, as will be discovered, the desired setting is fairly easy to establish.

On reconnecting the sync pulses the picture will lock, but it may be found to be displaced to one side or other within the raster. This can be corrected by adjustment to L3, though it is important to ensure that the initial picture centring adjustments, as described earlier, have been correctly performed before attempting to adjust L3.

"S"-shaped Verticals

Receivers employing flywheel synchronising methods tend to be much more sensitive to any residual phase or frequency modulation of the line frequency, occasionally present on certain transmissions of the BBC, than receivers using the more conventional synchronising arrangements. Such modulation is at 50 c.p.s. and shows on the received image in the form of curved or "S"-shaped vertical content; the effect being precisely the same as that due to hum on conventional receivers (see Fig. 11—"Fault Symptoms," October, 1953).

The cause of the occurrence becomes obvious when it is realised that the discriminator section of a flywheel circuit is, in effect, a phase demodulating system, very similar to that used in F. M. receivers. Thus, any 50 c.p.s. phase modulation present on the vision signal is demodulated and appears in the form of a hum voltage at the control grid of V1—Fig. 44. The effect of the ripple voltage is also aggravated due to the necessary long time-constant of C5 and R9.

Unfortunately, little can be done to alleviate the symptom at the receiver itself without upsetting the inherent desirable properties, though it is understood that the BBC are studying the problem from the transmitting aspect at the present time.

Picture distortion in this form is generally most marked on certain morning transmissions of the "cross" and test card C. At certain times it is extremely disconcerting and often creates a strong impression that all is not well with the receiver. Indeed, unless one is well versed with this symptom and cause, a strong temptation exists to analyse extensively the receiver in an endeavour to trace the source of the hum voltage in the vision sections.

To complicate matters a little various defects *can* and do sometimes exist in the flywheel section to aggravate the symptom of hum. It is just as well, however, to check a receiver displaying this symptom on two or three different transmissions before finally deciding that the receiver itself is at fault.

Now, as we have already seen, a slight change in bias potential at the control grid of V1—Fig. 44—tends to alter the phase relationship between the sync pulses and the oscillator output voltage. Slight potential changes—within the potential range of the line hold control, for instance—alter the horizontal position of a picture within the raster proper. The actual direction (left or right) of picture displacement due to this cause depends on whether the potential changes positively or negatively. For we have already seen that, provided the picture is correctly centred, magnetically, it should set in the centre of the screen when the phase between the two voltages corresponds. And that line hold control adjustment—which effectively modifies V1 control grid potential and thus the phase relationship—simply alters the apparent horizontal position of the picture on the tube face.

Clearly, from this reasoning, we can see why a diminutive hum voltage on the control grid of V1 will impress its mark on the picture in the form of an exaggerated vertical ripple. But, apart from the discriminator detecting small phase or frequency modulated voltages present on the transmission, hum produced in associated circuits of the receiver also manifest on the picture in similar form.

In an earlier part of this series we considered the general cause of hum effects, so here we shall deal with those arising from a defect in the flywheel synchronising network proper. The main offender in this respect is the reactance valve (V1—Fig. 44) itself. In the Ferguson receiver an EF80 is used, and this has frequently been known to develop a diminutive inter-electrode leakage to modulate internally the electron stream to give rise to the effect. The degree of leakage is nearly always insufficient to render the valve inoperative in a less susceptible section of the receiver, however, so interchanging the valve with one of similar type from another section represents an economical way of effecting a remedy in this case.

A deterioration in efficiency of the associated smoothing circuits is also sufficient to prompt the ripple effect, and in this respect it is most important to ensure that the value of the electrolytic capacitor decoupling the screen grid of V1 is well up to standard.

Interlace Performance

On commercial receivers particularly poor interlacing is generally more of a secondary symptom accompanying the main symptom of a critical or weak framehold. In such cases, therefore, the "normal degree of interlace" is restored without further bother once the cause of the main fault has been established and satisfactorily corrected.

The "normal degree of interlace" is a rather ambiguous term for it is, of course, well known that certain commercial receivers exhibit a degree of interlace that is far superior to that displayed on other receivers. This means, then, that an interlace which may be considered good on a receiver of a particular type may be considered well below standard on a receiver of a different type.

This reasoning applies mainly when a receiver of current design is compared with an "older" style receiver of three- to four-year vintage. Modern receivers, particularly those using wide-scanning angle, large screen picture-tubes, and projection types, each achieve a remarkable degree of stable interlace.

Another important point which should be watched on the relatively "older" receiver is that the degree of interlace can be made to vary considerably—between non-interlace and good interlace—by rotating the framehold control within the range where the picture remains locked vertically. With this in mind, therefore, it may be a good idea to check the interlace on your receiver as soon as possible for, as said before ("Timebase Synchronisation," PRACTICAL TELEVISION, April, 1952), a receiver that is not interlacing is displaying only one-half of the transmitted picture! Adjust the frame (vertical) hold control, within the limits of the range of vertical synchronism, for optimum interlace.

A surprisingly large proportion of the older style receivers investigated by the writer were displaying a very poor degree of interlace, not because a fault existed in the receivers to provoke the symptom, but mainly because a considerable number of viewers simply adjust the framehold control for picture lock, and once that condition existed have had no further interest in the control. This is all very well where the receiver is of modern design, for then interlace is automatically achieved irrespective of the setting of the framehold control within the locking range; where the receiver is not so modern, however, it is a different matter.

The Degree of Interlace

The actual degree of interlace is often computed as a ratio. Fig. 45, for instance, shows a magnified section of a synchronised raster in which a 50-50 interlace is occurring. This is generally interpreted as meaning that 50 per cent. of the space between successive lines of the "*odd*" *frame* occurs on either side of the lines of the "*even*" *frame* which, overall, comprises a *complete picture* of two interlaced frames.

Fig. 46 shows a good interlace, as compared with the previous illustration of a perfect interlace. This ranges from 45-55, where, for example, 45 hundredths of the space is above the interleaving line and 55 hundredths is below it, to 40-60 which should be taken as the outside limit of a good interlace, and a higher ratio than 40-60 must come under the category of bad or non-interlace. Such a condition is illustrated by Fig. 47, which shows the interlaced lines more or less touching or "pairing." In practice this condition is readily seen, since the lines appear very broad and the spaces between them are much narrower than the lines themselves.

When a picture or synchronised raster is scrutinised in an endeavour to determine visually the degree of interlace occurring the lines assume an elusive flickery character; this is particularly so where the screen persistence is short—the effect being that while the gaze is being concentrated on one line, it is fading out, and a fresh line is being traced close to it.

Interlace Checking Aids

Various ocular methods for checking interlace are available to the experimenter, and even though these methods, together with the subject of interlace, have recently been considered from a more general angle (see "The Interlace Problem," PRACTICAL TELEVISION, January, 1954) it may, if only from the completeness aspect of this series, be desirable to review them again—this time from a slightly different viewpoint.

In the first place it should be fully realised that the more efficiently a receiver is interlacing, the more difficult it is to detect, owing to the fact that the whole line structure appears to be alive and drifting up or down the screen. *(To be continued)*

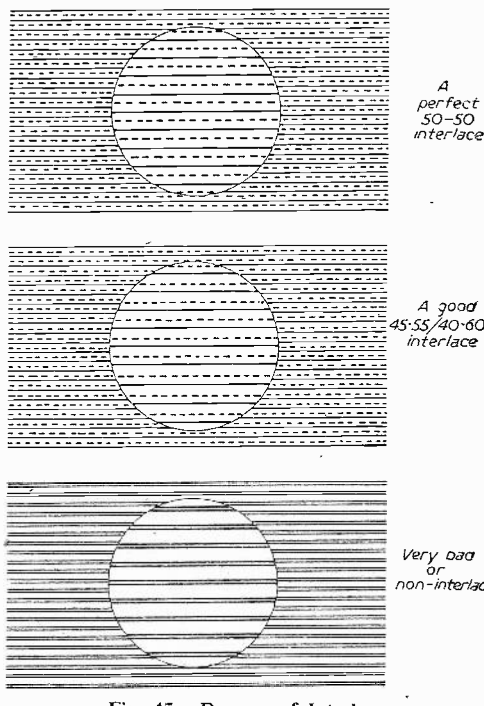


Fig. 45.—Degrees of Interlace.

Remote Control Tuners

SOME SUGGESTIONS FOR INTRODUCING REMOTE CONTROL FEATURES FOR TWO-BAND RECEIVERS

By W. J. Delaney

MANY viewers are already getting ready for the proposed alternative programmes and a large number of queries have been received by us concerning proposed modifications to existing equipment. It is quite obvious that one point which is going to prove rather difficult is the changing from one station to another. It is highly probable that on some occasions doubt will arise in the mind of the viewer as to which of two simultaneous programmes will offer most attraction. Consequently after looking at one programme for a few minutes it might be decided that the alternative may be better and the set will have to be retuned. After a short period it might then be decided that the other station was better after all, and again the process of retuning will have to be adopted. In most receivers this will entail getting up and making the necessary adjustments, but it would be very much more convenient if the changes could be made from the viewing position.

Remote Control

Apart from the necessity of tuning in to the new frequency there is the problem of the aerial (which it may, or may not, be necessary to change) and, what is more important, the contrast control will almost certainly have to be adjusted in most areas. Theoretically the brilliance control should not need readjustment, as it is used in most receivers to adjust the picture tube to its correct working position.

We have already described in these pages various methods of providing remote control of contrast, which is very useful in remote areas where fading is experienced and no automatic picture control or similar circuit refinement is provided. Basically, such a control consists of an extension lead to the variable resistor used to adjust the bias on the R.F. stage or stages, and ordinary coaxial lead may be used for the extension and being on the "earthy" side should not introduce any ill effects. However, such a procedure cannot be used very easily for retuning a receiver and, therefore, some alternative idea will have to be considered here.

Separate Tuners

Probably the final arrangement, which may become universal, will be the provision of a complete tuner, in the form of a small box, mounted either on a small stand or designed to hang on the arm of a chair. As the majority of receivers will have to operate on the superhet principle to enable tuning from one band to another to be carried out most satisfactorily, the remote control unit would conveniently consist of the frequency-changer, plus one or two R.F. stages preceding it. This would provide conveniently for easy tuning and would present no more difficulty than would be met with if the tuner were included in a receiver. The contrast or gain control would obviously form part of this tuner and would thus be handy, and all that would remain would be the aerial arrangement and the method of feeding the receiver proper.

It has already been pointed out in these pages that a separate aerial will have to be used in practically all cases, due to the wide difference in frequency between Band I and Band III. In its simplest form two separate feeders will be used and these would have to be brought to the tuner. A selector switch could then be provided to change from one aerial to the other and such a switch could be ganged with the tuner or station selector switch. It will now be seen that a fairly comprehensive cable would be required to connect the tuner to the receiver, the cable containing two aerial feeders (it being assumed that the aerial feeders would most conveniently be plugged initially into sockets provided on the receiver), power supply leads, and the output leads. Apart from screening such a cable would tend to be a bit heavy and awkward to dispose of. A slight reduction in the number of leads may be possible by using only a single aerial feeder, connecting the top of the feeder to a matching unit, designed to provide correct matching to each aerial. No switching would then be necessary. The matching unit may present a difficulty but it should not be insurmountable. On the output side, the most obvious idea would be to use a single lead from the "hot" end of the I.F. transformer, the earthy end being connected to the contrast control or A.P.C. circuit which would be a common lead already existing. Coaxial might be possible for this single output lead, but at the higher frequencies on Band III some difficulty may be experienced here with normal coaxial as used for Band I.

Receiver Modifications

In the receiver itself modifications will obviously be necessary if the above scheme is adopted, and the existing frequency changer would not be required. In some cases it might be possible to utilise the valve itself in the new tuner, but it will, in most cases, not be of a suitable type. The first I.F. transformer will, therefore, have to be converted to the input from the remote control unit and this will probably mean modifications of such a nature that the receiver would not be readily usable in its original condition. A possible alternative would be to take the existing "hot" lead from the first transformer and connect this to a small plug and socket panel, so that when the tuner is to be used the plug may be inserted into the appropriate socket, but this should not prove much of a drawback as a power input socket will also have to be provided for the new tuner. This could have its own power unit, but even so mains input leads would then have to be included. The remote tuner could, however, be made as part of the permanent installation, the cabinet being recessed or cut away so that the tuner could be put in position and form part of a permanent set-up, and withdrawn, pulling out its cable, when it is desired to make use of the remote control facility.

As will be seen, therefore, there are a number of interesting possibilities open to the experimenter, and already the manufacturers themselves are getting down to the problem, but until transmissions actually commence it is not possible to say what type of control will be in general demand by viewers.

THE CAUSE AND CURE OF FOLD-OVER

AN EXPLANATION OF A VERY COMMON PICTURE FAULT

By L. B. Moore

THE newcomer to TV is confronted with a bewildering array of new terms, and it is essential to understand fully the meaning of the terms, especially when fault-finding is undertaken.

A lot of time can be wasted by searching for a fault under its wrong name ; foldover is an example of this, and correspondence has shown that it is often confused with incorrect line-lock—two entirely different faults.

Foldover is where the edge of the raster is folded back on itself like the fold of a curtain. In the line timebase it usually occurs at the left-hand edge and in the frame timebase at the top.

In order not to confuse the issue we will deal with the horizontal (line-scan) case first.

Appearance

The most obvious evidence of foldover is that there is a bright band of light on the left-hand edge of the raster. The bright *band* must not be confused with a bright line due to insufficient damping ; in the latter case, the line exists at a point from the left-hand edge, while foldover exists from the very edge and inwards.

The width of the band varies with the degree of flyback delay and can stretch for an inch or more in bad cases to a mere strip in mild cases.

If the raster is observed closely, the edge will be seen to be folded back on itself like the fold of a curtain. Fig. 1 gives an enlarged view of a small section of the raster showing the fold.

The fault can be most easily recognised when a figure (or lettering) is entering from the left side of the picture. The figure will be seen to start from A, move to B (i.e., to the left) and then to the right towards C. In a picture not suffering from foldover, the figure would appear to start from B and move to C.

The movement from A to B is in reverse : for example, if the letter E was travelling across the screen from the right to the left (this is the usual direction of travel for wording), then it would appear as an E until it got to the left-hand edge and then would appear reversed as Ǝ as it travelled from B to A.

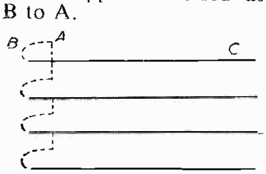


Fig. 1.—Section of raster showing foldover on line.

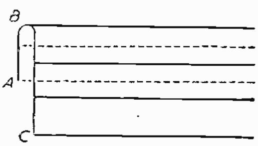


Fig. 2.—Foldover on the frame scan.

On Frame

When foldover occurs in the frame circuit, the top of the raster is partially folded back, as in Fig. 2. In this case, supposing a letter Y was travelling from the bottom to the top of the screen, then from C to B it would appear as Y, but from B to A it would appear upside down : ⅄.

Foldover must not be confused with cramping, though sometimes the two appear together. Cramping in the frame circuit, for example, would cause the Y to shrink suddenly as it got to the top, but would not cause it to start travelling back down the screen again upside down.

The fault must not be confused with false frame or line lock. There is a certain type of false line lock which makes *part* of the picture appear as a very much elongated wraith superimposed backwards on top of the main picture. Too fast a frame speed will give a somewhat similar condition, part of the picture being superimposed on the other part (example, the full figure of a man could appear as in two halves, the waist upwards being superimposed on the waist downwards so that his head appears between his legs !).

The cause of foldover is quite simple to understand. Let us consider a single line of picture : when the line is due to commence the bias on the picture tube is reduced so that the spot appears and moves from left to right, we do not see it as a travelling spot but as a continuous line.

When the extreme right-hand edge has been reached the TV signal causes the bias on the tube to increase so much that the spot is blacked out. The line sync pulse is then applied and the line oscillator is triggered so that the blacked-out spot flies back to the left-hand

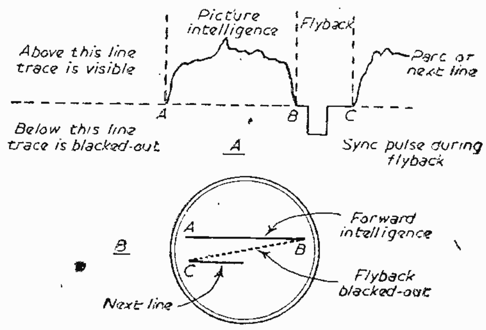


Fig. 3.—Waveform for one line.

side of the screen ready to start the next line. Fig. 3 shows the condition existing for one line.

If the flyback time is longer than the duration of the blacked-out period, then the spot will not reach the left-hand edge before the intelligence of the next line is received.

In Fig. 4 we have the conditions existing when the flyback time is prolonged and it will be seen that the flyback period extends into the next line. The practical result is shown in the tube face as in Fig. 4b.

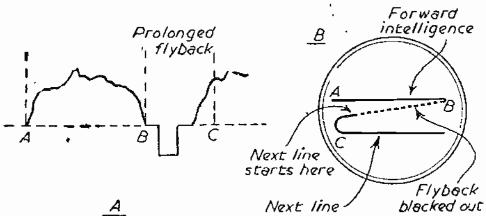


Fig. 4.—Waveform when flyback is late.

In the simple case the cure of the fault is obvious : reduce the flyback period by reducing the value of the condenser or resistance in the flyback circuit.

With electrostatic circuits this will usually effect a cure. With electromagnetic circuits, however, the fault is not so easy to remedy.

One common cause of the trouble in home-constructed circuits is the overdamping of the line coils. Fig. 5 shows a typical circuit, where C and R damp the oscillations which result from the return of the spot to the left of the picture. Too low a value of R or too high a value of C will overdamp the circuit and foldover will be experienced.

Critical Values

The value of C and R must be so chosen that neither overdamping nor underdamping is caused and for this reason R is usually separated into two parts—a fixed component and a variable component, the latter being labelled " Line Linearity."

Too little damping will cause the left-hand edge to be stretched and in the limit will show as a broad white band, set in a little from the edge of the picture.

Too high a bias on the output valve will also cause foldover. In this case the valve will not start its forward drive soon enough, due to overbiasing, and so picture intelligence will commence before the output valve becomes operative.

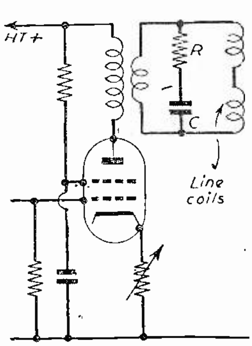


Fig. 5.—Line output stage with damping components.

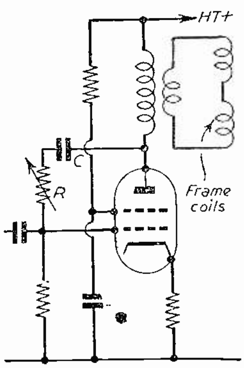


Fig. 6.—Frame output stage with feedback.

In this case the cure is to reduce the bias, but care must be taken in home-constructed circuits to check that this is the real cause and not to risk under-running the valve.

If the screening grid voltage is too low the results will be similar, but once again the position should be checked carefully. The screening grid of the output valve should not be run red-hot or the valve will be damaged.

Self-driven timebases can suffer from foldover, especially where the flyback pulse is used for production of E.H.T. It is essential to ensure that the valve is working on the correct portion of its curve to prevent foldover.

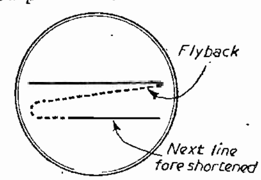
Where a circuit of this nature has been functioning satisfactorily previously then the development of foldover is usually due to a fall in the emission of the valve, or a loss of voltage on the H.T. rail.

Foldover at the Right

This fault is not so common as foldover at the left. When the fault occurs on the right it is usually accompanied by cramping.

At the extreme right the output valve is delivering its maximum power. If the fault develops in what was previously a good picture, then the most likely cause is falling emission of the output valve.

Fig. 7.—Effect of the flyback being too fast.



In a newly-built circuit attention should be paid to the biasing of the output valve to ensure that the full drive is available.

The trouble can also originate in excess driver valve output, if one is used, or in the employment of incorrect values in the linearising circuit.

Where a recovery diode is used to supplement the H.T. it should be checked for loss of emission.

Foldover at the Top

Fig. 6 shows a typical frame output stage. Correction of linearity is usually effected by a feed-back circuit as shown by C and R.

When foldover occurs at the top, the valve is on the anode-cut-off portion of its curve and any variation due to low H.T. volts, incorrect bias, or loss of emission will cause the trouble.

The bias should be checked and if a new circuit has been built, then suspect overbiasing of the valve.

Too low a screen voltage will have a similar effect by shifting the operating point of the valve on its characteristic curve. Note also in this case that the screen voltage must not be made too high and it must never be run red-hot.

Foldover at the Bottom

Some correction here is usually gained by the linearity correction arrangements. The cause is similar to cramping at the top and the two faults often accompany one another. The frame output valve *must* work on the correct portion of its curve.

In a new circuit the biasing should be checked to ensure that it is not too low (top foldover is generally opposite to this ; bias too high). Check also the H.T. rail voltage and the voltage to the screen.

Modifying the R3118 and the ZC8931

CONVERSION DETAILS FOR A POWERFUL SOUND AND VISION RECEIVER

By B. L. Morley

THE units R3118 and ZC8931 are identical except that the R3118 contains its own power supply for 200-250 volt mains. It is the better " buy " inasmuch as no extra power equipment is required, and it is completely self contained on its own chassis. The ZC8931 requires a separate power supply.

As the conversion details refer to the tuning stages and no work is required on the power section the data given below serve for both units.

The cost of the R3118 is about £5 and only a few extra shillings are required to make it a complete sound and vision section. Unfortunately, like many other useful items, supplies are apt to be a bit irregular. The U.E.I. Corpn. have supplies from time to time and various firms, including Britain's Radio, have the ZC8931. It is also possible to obtain the units from time to time from local dealers ; they are well worth looking for.

Originally designed for 1½ metres they can be easily adapted as a first-class vision and sound receiver, the band-width of the I.F.s being given as 4 Mc/s.

One unusual feature (so far as TV is concerned) is that the usual R.F. pentode, pentode mixer and triode oscillator have been replaced by two R.F. pentodes with a *diode* mixer and triode oscillator (see Fig. 1).

At the very high frequencies used by the unit originally the normal pentode mixer becomes rather inefficient and introduces losses rather than a gain. The diode becomes a better mixer as, although no gain is obtained, the losses are less than those of the pentode.

The same problems will be occurring when Band 3 is opened up for TV service and the circuit in Fig. 1 will be found to be quite useful in this new band.

The I.F. and output circuit of the unit will be given next month.

As received the R3118 can be very quickly altered to receive Wenvoe or Sutton Coldfield channels ; all that is necessary is simply to add an 0-30 pF condenser across each coil in the R.F. section. If an aerial is now connected, and the socket labelled " Gain " is short circuited, a positive or negative picture or sound signal can be picked up on the sockets so labelled.

The other channels can be tuned in by adding about 50 pF across the coils in addition to the variable condenser, but this method is not very satisfactory as there is too much capacitance in the circuit.

First Steps

While the above method gives a rough and ready result it is better to do the job properly and to rewind the coils in the R.F. section.

To do this the complete section should be removed.

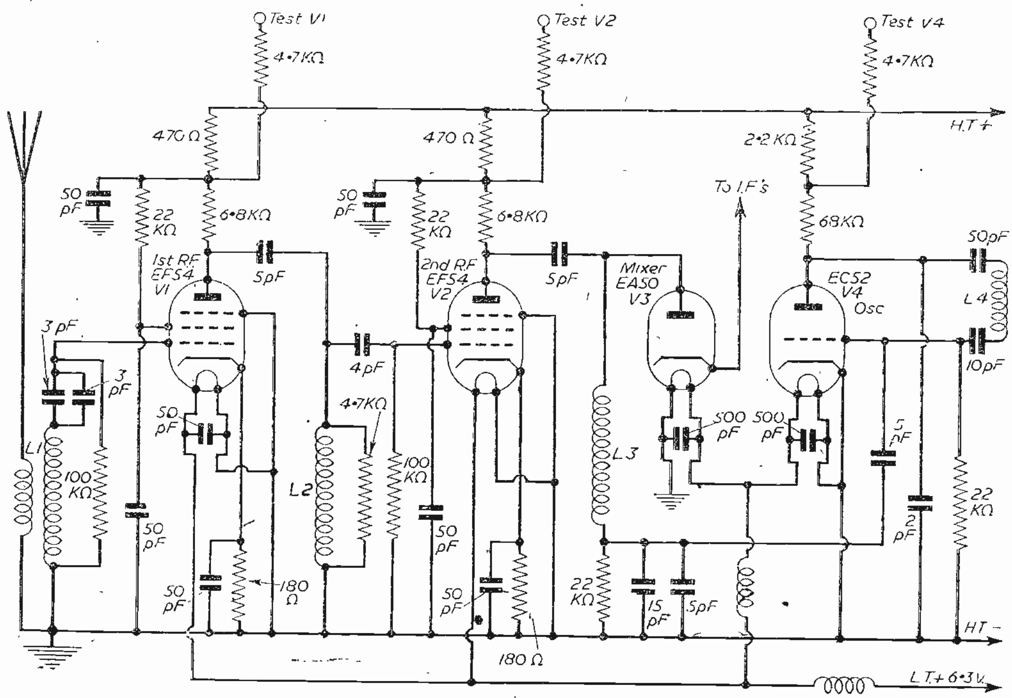


Fig. 1.—Circuit of the final R.F. section.

It will be found that a plate is fitted to the side of the sub-chassis held in position by screws. If the screws are removed, then the wiring link between the main chassis and the sub-chassis will be exposed. All the wires are colour coded and it is an easy matter to see which wire runs to which terminal. They should be unsoldered.

Now undo the tuning couplings to the tuning knobs and then by releasing six screws the complete unit can be removed from the chassis.

The coils should be rewound according to the data given in the coil table ; note that it is not necessary to alter the primary of L1.

The wire used should be about 28 swg enamelled.

After altering the coils short circuit or remove the 3 pF condensers feeding the grid of V1 and connect the coil direct to the valve.

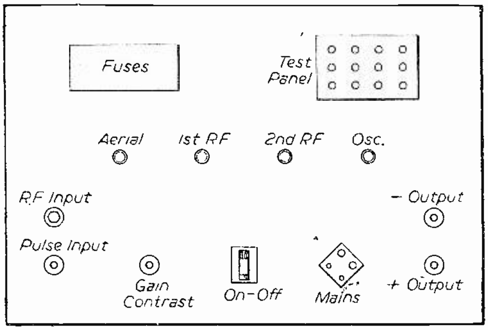


Fig. 2.—Layout of front panel.

2nd R.F.

Short-circuit or remove the 2 pF condenser between the coil and grid and connect the coil direct to the grid. The 4.7 KΩ resistor can also be removed.

Oscillator

This coil need not be rewound as an 0-30 pF condenser across it should enable any channel to be covered. If difficulty is found with the lower channels (1 and 2), then a further 25 pF can be connected in parallel with it.

Mixer

No modifications are required here.

The completed modifications will give a circuit similar to Fig. 1 with the exception of the direct connections between coils and valve grids.

Testing

At this point it is a good idea to test the work done so far. Return the unit to the main chassis and connect it up. Connect an aerial to the aerial socket and a loudspeaker (with transformer) to, preferably, the negative output socket. With the gain control short circuited it should be possible to tune in the local TV station.

COIL DATA

L1 Aerial	L2 R.F.1	L3 R.F.2	
13	13	13	Channel 1
11½	11½	11½	„ 2
10	10	10	„ 3
9	9	9	„ 4
8	8	8	„ 5

L12.—34 turns pile wound between cheeks ⅛in. apart on ¼in. former, 30 s.w.g. enamelled and silk-covered wire.

NOTE : A 5 pF condenser can be added to any coil which will not peak to the signal.

Mechanical rearrangements

The next step is to modify the vision I.F. stages, but first the front panel must be rearranged.

Fig. 2 shows the front panel. The "Pulse Input," "Gain," "+ Output" and "– Output" are fitted with sockets for which plugs are not generally available.

The "Pulse Input" socket should be fitted with a normal Pye aerial socket and this becomes the video output. The "Gain" socket is recovered and in its place is fitted a small strip of paxolin or metal on to which is mounted a 5 KΩ potentiometer ; this becomes the contrast control.

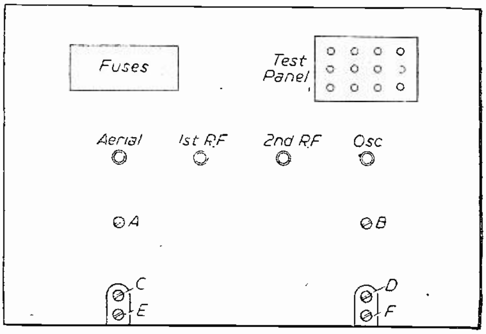


Fig. 3.—Indication of screws which have to be loosened.

The "+ Output" socket is removed and a 500 KΩ potentiometer of the miniature type is fitted. The "– Output" socket is replaced with a Pye aerial socket and this becomes the loudspeaker output.

To do this work the front panel is removed. It is not entirely disconnected, as a wiring form is fitted to it. The magic eye tuning indicator is not required and can be removed ; if now the screws "a, b, c, d" in Fig. 3 are removed, then the panel can be slid aside. It will be found that the unwanted sockets are held by sunken screws and are easily removed. A short strip of paxolin or metal can be fitted across the holes which are left and used for mounting the new outlet sockets, etc.

Vision I.F.s

We now begin the main work of conversion. Three of the existing I.F. stages are used for the vision signal and the pulse input diode (V8) is used as the video detector. The fourth I.F. valve becomes the video output valve.

The sound I.F. section is formed from the remainder of the stages. The fifth I.F. valve becomes the first sound I.F. and the previous video amplifier (V12) becomes the second sound I.F. The original detector V11 becomes the sound detector, while the clamping diode V14 becomes the interference limiter. The rectified sound is fed into V13, which was originally a cathode follower, and the audio output from this valve is fed to a power output valve, a 6V6 which is mounted in the position previously occupied by the magic eye.

(To be continued.)

Pages from a TELEVISION ENGINEERS Notebook

16.—REFLECTIONS AND GHOST IMAGES

WHEN ghost images result from direct reflections from structures in the vicinity of the receiver, the reflecting medium need not be metallic in nature, although the reflection coefficients of such structures are usually greater than objects constructed of stone or wood. A displacement current is set up in the structure by the action of the direct wave from the transmitter, and re-radiation occurs as a result. Any surface will therefore act as a reflector, if its dimensions are equal to, or greater than, a half wavelength: that is, about 10ft. for the general frequencies concerned at present.

If the transmitter is within a mile of the receiver site and a vertical plane surface is located between the two and in sight of both, the signal strength and the time delay will depend upon the dimensions and the orientations of the three units as usual, but the reflections will only give difficulty for locations very close to the transmitter, perhaps within half the above distance. Consequently, for the majority of receivers which will be located at distances greater than a mile from the transmitter, where trouble from reflections is experienced, the reflecting surface will lie in a plane which is not vertical to the earth. A vertical surface will only give trouble when the polarisation of the wave itself has changed sufficiently to make the proper relative angle with the reflector, and this is usually more common at fringe distances.

Reflections are not always evil, however, and it is quite often possible to receive a reflected signal which is much stronger than the direct wave. This sort of thing happens when there are hills or very woody areas in the direct line of sight between the transmitter and the receiver, the direct wave consequently suffering severe attenuation. A reflected wave may then be received which has by-passed the hills or the woodland by virtue of the angle shown in Fig. 1, and this wave may be considerably stronger than the direct radiation. When a weak ghost image *precedes* the main image on the tube screen, therefore, it is quite likely that the reflected wave is the better of the two inputs, and a suitable re-orientation of the aerial away from the transmitter direction but towards the points of reflection will effect a cure by eliminating the ghost.

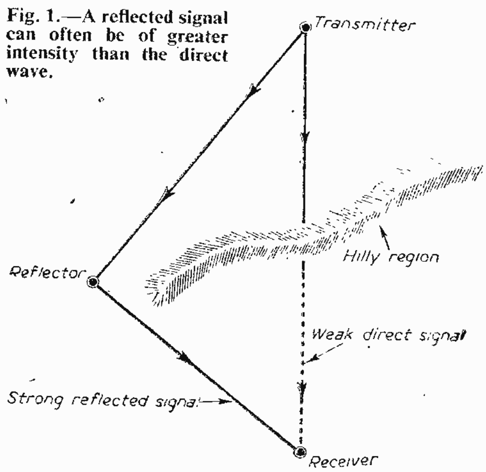
So many amateurs fight shy of trying out alternative orientations for their aerial systems that many ghost troubles persist where they could be easily eliminated. The writer has had a recent experience of this in a receiver which showed a strong ghost displaced by a distance which indicated that it was roughly half a mile to the reflecting body. By rotating the aerial some 30 deg. a point was found where the main signal was negligible and the reflected wave (the true ghost) provided a clear and steady image on the screen. The reflecting body itself was not determined from a consideration of the surrounding district, but it was probably due to a ridge of very low hills, fairly heavily wooded, lying some mile or so distant.

It is possible, of course, to check up on all the possible reflections in a particular district by a properly designed aerial system and a special receiver, but the results obtained are in the main academic and for the individual, orientation and experiment to his aerial array is the only satisfactory solution.

Other Methods

Apart from simple orientation of an existing aerial, there are a few other methods of ghost elimination which can be tried out in obstinate cases. Shielding the aerial from the source of reflection can sometimes be accomplished by mounting it on the side of the house instead of on the chimney or roof, or by careful placing relative to existing conductors such as iron guttering, coping and piping which are found about the house structure generally. Usually such experimentation is tedious, and in such cases the use of an unloaded dipole (essentially a reflector element) tried at various positions in relation to the main aerial can

Fig. 1.—A reflected signal can often be of greater intensity than the direct wave.



be of value. The present television frequencies make the aerial arrays a clumsy proposition at best, and it is not easy to obtain directivity with a neat looking or easily erected system.

In serious cases, where multiple reflections are concerned, it is worth while to investigate not only

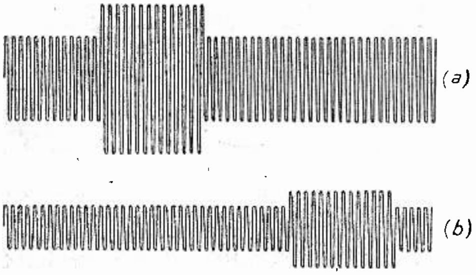


Fig. 2.—Two signals, the direct and reflected waves respectively, showing a region of peak white delayed by the extra distance of travel.

the aerial orientation and reflectors, etc., but also the actual feeder to the receiver and its termination at that point; this was outlined in last month's article.

Negative Ghosts

Ghost images, particularly those caused by the presence of aircraft and other moving bodies, are not normally objectionable except to those viewers situated close to airports, but it is interesting to study them in view of their curious properties in relation to phase and position.

A ghost received from a fixed reflector will, of course, remain stationary on the screen, but a ghost received from a moving reflector will constantly change its position. In addition, the change of phase in the two signals arriving at the receiving aerial will produce a signal which is of opposite polarity to the normal output. Position is determined by *time* differences, polarity by *phase* differences; in the moving reflector, both time and phase is changing, and so the ghost image is constantly undergoing the effects of displacement and polarity changes.

When the reflected wave arrives at the receiver in antiphase to the direct signal, the position is roughly as depicted in Fig. 2(a) and (b), where (a) shows the direct signal wave with a peak white section and (b) shows the reflected signal, the peak white section being displaced to the right by the normal time delay. The reflected wave is assumed to be attenuated in this case. The signals are assumed to be antiphase and the result at the receiver is then as shown in Fig. 3(a), this being the subtraction of (b) from (a) in Fig. 2 above. In addition to the general fall in level, the original peak white section has fallen into the grey region, and a ghost image well into the black region has appeared to the right of the main signal by an amount depending upon the time delay.

When the waves are in phase, the resultant of (a) and (b) of Fig. 2 is as shown in Fig. 3(b). The waves are now additive and the ghost image is now seen to be approaching peak white.

For the moving aircraft, therefore, where the path length of the reflected wave is constantly changing and the phase conditions at the aerial are similarly undergoing changes, positive and negative ghost images will appear in succession on the screen, and the general level of the picture will fluctuate violently, giving rise to the well known " flutter " effect. As

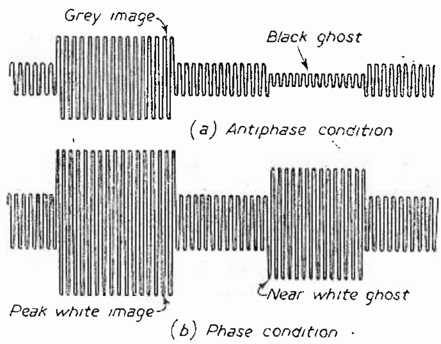


Fig. 3.—Conditions of antiphase and phase obtained by subtracting or adding the signals of Fig. 2.

the frequencies allocated to television become higher, such flutter will tend to increase in intensity as the strength of the reflected wave will be greater and the changes from in-phase to antiphase conditions will become more rapid for a given rate of change of the reflected path length.

A ghost resulting from a fixed reflector may, of course, be of negative polarity if the phase conditions are such as to produce this.

STUDIO D MODIFICATIONS

STUDIO D, the first of the Lime Grove studios to be used by the BBC for television production and which has been undergoing extensive modification since August, 1953, is now back in service.

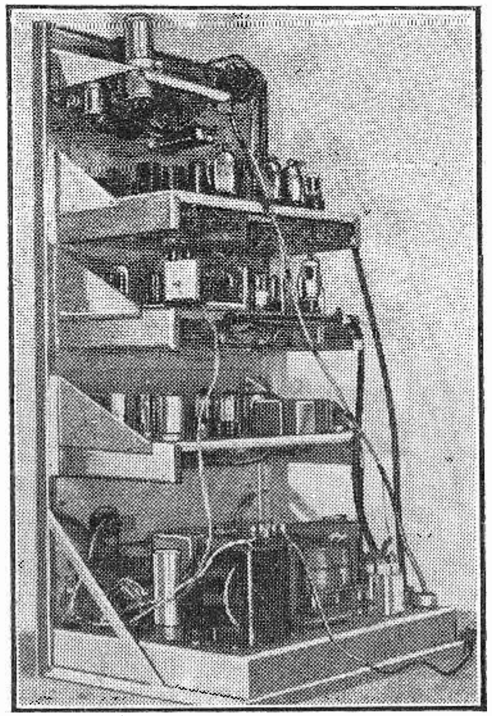
Studio D was equipped on an austerity basis in May, 1950, and the modifications which have now been made provide improved technical facilities and better working conditions. They include the building of new and separate vision and sound control rooms.

The control rooms have been entirely refitted, and the original vision mixing unit has been replaced by modern and more flexible equipment. Another camera channel has been added to the existing C.P.S. Emitron cameras, thus giving the studio four working cameras and a telecine channel.

BOOK REVIEW

" Television Receiver Servicing : Volume I : Timebase Circuits " by E. A. W. Spreadbury, M.Brit.I.R.E. Published by Trader Publishing Co., Ltd., and distributed by Iliffe & Sons, Ltd., on 19th March, 1954. Size 8¾in. x 5½in. Price 21s. (postage 8d.). 310 pages. 187 illustrations.

THIS book is mainly intended for the professional radio service engineer who, having already become skilled in the art of fault tracing in radio receivers, wishes to extend his activities to television servicing. Others interested in television will, however, also find it a fund of information not available in other current books on the subject. It does not attempt to teach the principles of radio servicing, but extends them to the more complex circuits and techniques of television.



Rear view of the Pulse Generator and Control Rack.

decided to concentrate on a " live " colour camera as the tube possessed a substantially panchromatic photocathode.

Standards

For the sake of economy it was decided to use no screen larger than 5in. diameter and with this in mind a figure of 150 lines sequentially scanned was chosen as giving sufficient detail for experimental work. The frame frequency was also kept as low as possible but experience showed that 100 cycles, giving 33⅓ colour pictures per second, was the minimum acceptable to avoid an objectionable colour flicker.

Line Frequency

The line frequency is thus 15 Kc/s and although this is more than the 10,125 cycles of standard television the increase is not unduly large and the extra scanning power can often be taken from the existing line and frame output valves, with minor alteration to circuit values. (Note.—Commercial colour television receivers often use two valves in parallel for line output when running at 30 Kc/s line frequency. The system is, of course, not compatible.) The video wave-form from this equipment also differs from the BBC standard in that the frame sync pulse consists of a few cycles of square wave at line frequency. No provision is made for identifying any particular one of a series of three consecutive colour frames.

The Colour Discs

With economy still the keynote, the colour discs themselves are made from stage lighting filters of the three primary colours ; the material is a cellulose plastic and the sectors are cut out and cemented together with acetone. Gelatine filters are cheaper, but would require mounting between two layers of thin Perspex for rigidity. As the frame frequency is locked to the mains the colour discs are driven by synchronous motors ; the one in the camera runs at

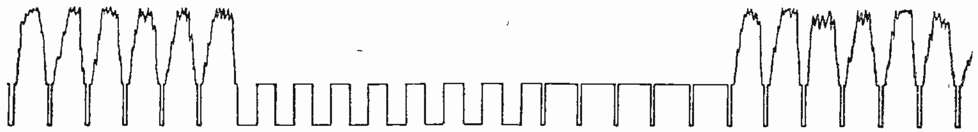


Diagram showing the form of frame sync pulse employed.

1,500 r.p.m. and drives a shaft at 500 r.p.m. through a 3 : 1 reduction chain drive. This shaft carries a 12-sector colour disc. In the monitor a 3in. Magslip transmitter is fed with suitably phased A.C. to its stator, and a small selenium rectifier is connected across its rotor terminals. A push-button short-circuits the rectifier to allow the motor to slip out of synchronism temporarily for the purpose of phasing the colours correctly. A further vernier control of phasing is obtained by rotating the whole body of the Magslip.

The Control Rack

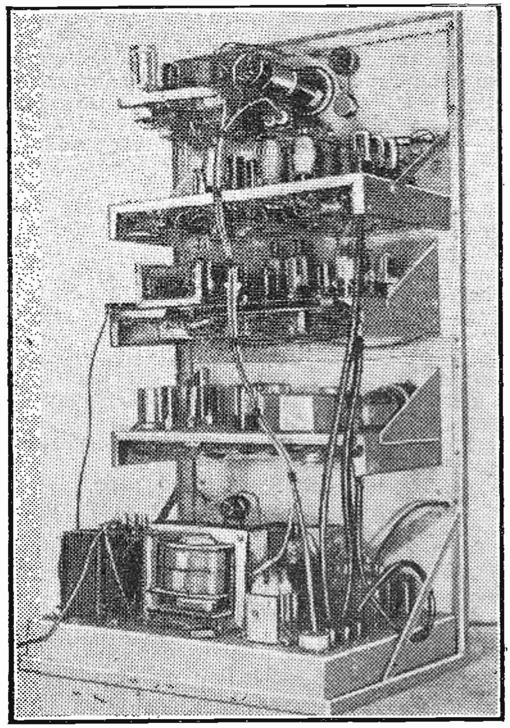
The main control unit is a 19in. rack, 36in. high, having five panels. The lowest unit is a voltage

regulated power supply giving a 200-volt H.T. line. There is also a separate unregulated supply, heater supplies, and a 1 Kv E.H.T. supply in the same unit.

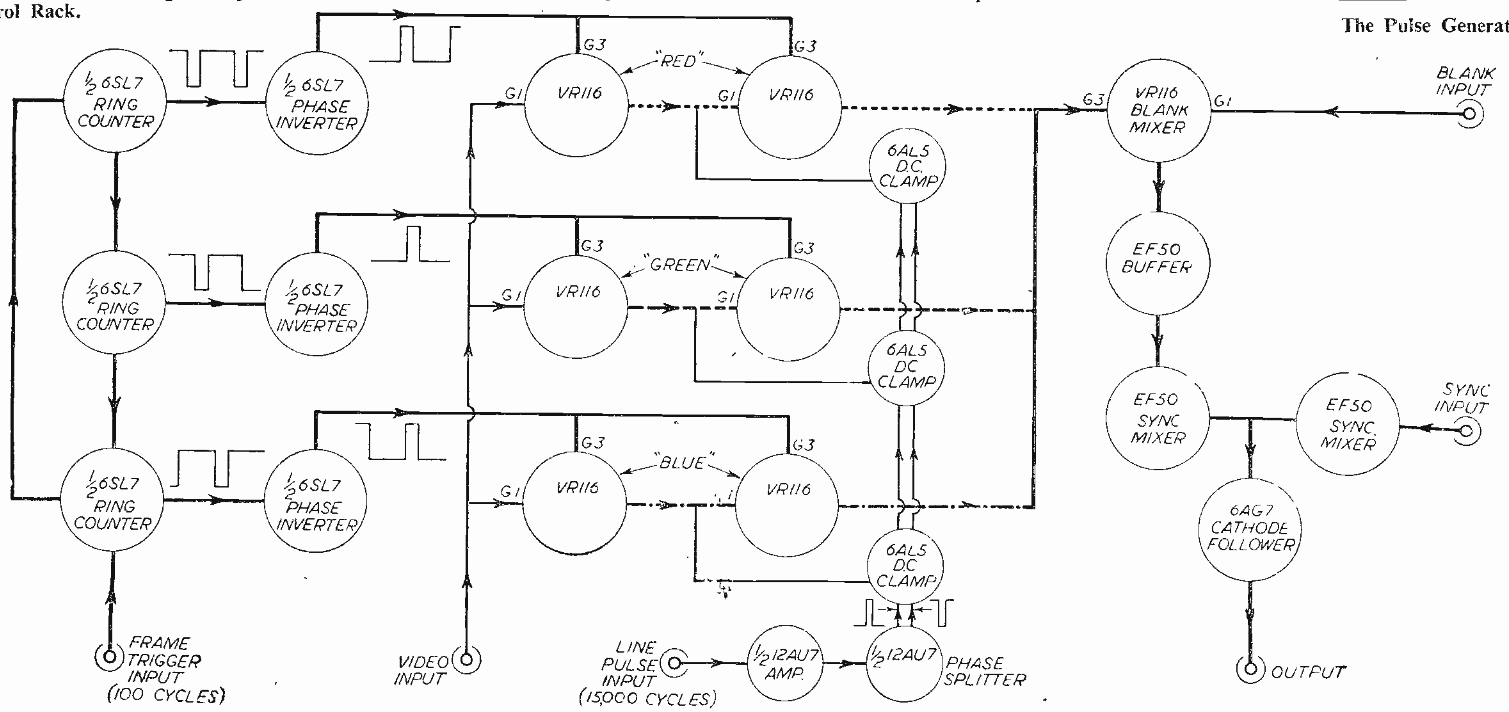
The second chassis carries the timing unit, which consists of a chain of phantastrons dividing the output from a self-running Miller transitron oscillator at 15,000 cycles down to 50 cycles. The signal from the last stage is compared with the mains, and the error signal is fed back to the original oscillator. The 50-cycle signal used for comparison comes from the stator of a 2in. Magslip transmitter which is fed from the mains and is used as a 360 deg. variable-phase transformer : in this way the local frame sync pulse can be varied in phase with respect to the mains, and this is used to phase the disc in the camera.

The third unit is the pulse generator. Line and frame trigger pulses are received from the timer unit below. The frame trigger operates the frame synchronising and frame blanking generators, which are double-triode flip-flops. The line trigger locks the line blanking multivibrator and after these blanking pulses have been through a delay line they are used to lock the line synchronising multivibrator and the line " square wave " multivibrator. As mentioned earlier, square waves take the place of the line pulses during the frame synchronising pulse. The various pulses are mixed in a double gate circuit using two VR116's with a common anode load. The line and frame blanking pulses are mixed in a 6SA7, and both pulse trains are fed out through cathode followers.

The next panel carries the colour control unit in which blanking and synchronising pulses are mixed with the final video signal. The signal arriving from the camera is fed to three VR116's with their grids in parallel, and each of these is fed to a second VR116, the second three having a common anode load. Thus there are three separate channels down which the video signals can travel. These channels are gated in sequence by a three-stage ring counter driven from the frame sync pulse. The anode waveform of such a counter is of wrong polarity, so each stage of the ring has a phase inverter valve to give the correct polarity pulse to the VR116's. (In practice the gating pulses are generated by three 6SL7's.) It was found that these gating pulses tended to upset



The Pulse Generator and Control Rack seen from the other side.



Blanking pulses, generated by the ring counter and inverters, gate the pairs of VR116's in sequence. Thus each pair constitutes a colour " channel." The gain of each channel is controlled by cathode degeneration in the first valve. The relative D.C. levels of the three channels are controlled by a pulsed clamp on the grid which is returned to a variable negative voltage. The blank signal drives the next stage beyond cut-off to provide a stable reference level to which the sync can be added. STANDARDS : 100 c/s frame, 33⅓ colour pictures/sec. Frame sequential system, 15,000 c/s line.

the commencement of the frame sync pulse in the final signal, presumably due to stray capacity, so a delay valve was built into the deck below to invert the frame sync pulse and trigger the ring counter from its trailing edge instead of its leading edge: thus colour change occurs in the middle of the frame interval. The gain of each channel is controlled by feedback across a cathode resistor in the first VR116, whilst the D.C. level of each channel is controlled by using a pulsed D.C. clamp at the grid of the second VR116, the clamp being returned to a variable negative voltage. This D.C. level control of the three colours enables the receiver's screen to be balanced for white. The video signal is then passed on to a stage where it is gated by the blanking signal to remove any spurious inter-line or inter-frame signals and finally the sync pulses are added. Output is then via a cathode follower.

The top panel carries a small oscilloscope for waveform monitoring. At present it has two ranges and provisions for external input, but ideally it would operate on three switched positions

1. Two lines—to show line sync pulse.
2. Three frames—for amplitude balancing.
3. Detailed view of frame pulse.

Some experiments were carried out using an elliptical timebase for examining the frame sync pulse, but, although quite successful, this was not incorporated in the above unit.

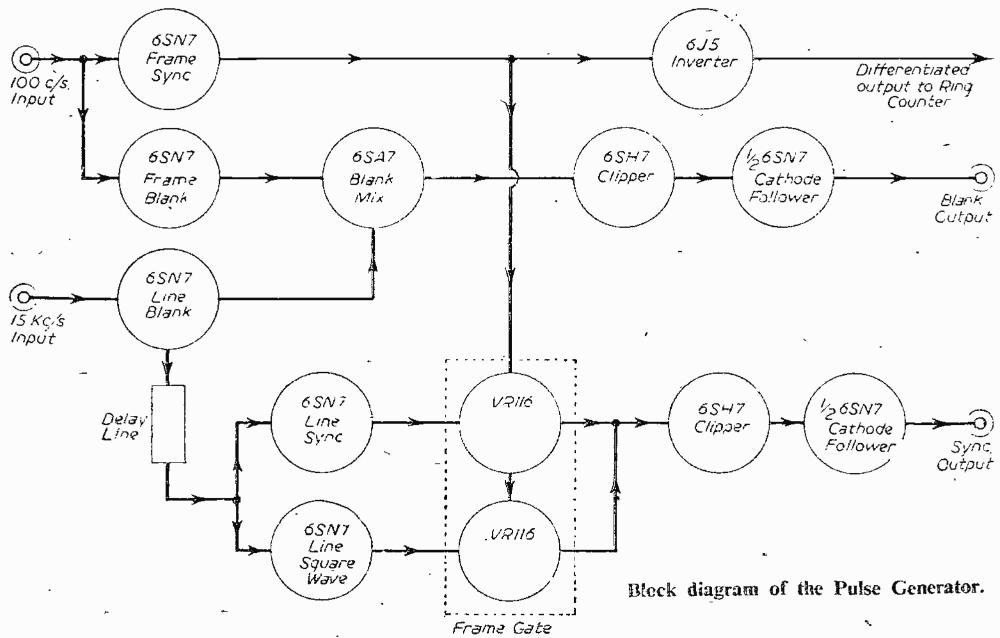
The Camera

This is mounted on a tubular steel tripod with telescopic adjustment for height, and at the base is the power supply. The leads to the camera carry the A.C. mains, line sync pulses and frame sync pulses. The power pack in the base contains two voltage-regulated supplies, one for the video amplifier, one for the timebases and a current regulated supply for the camera focusing coil. The camera itself houses the disc, motor, timebase chassis, camera tube, video amplifier and viewfinder tube. For this latter a VCR138 3½in. green screen tube is used to give a monochromatic picture. The tube has a 4in. diameter lens mounted in front of it to give a slightly enlarged picture, and a detachable viewing tunnel to cut out extraneous light, as the brilliance of the image is not great when viewing in daylight. Almost immediately under the viewfinder tube is the camera tube, mounted on a small truck running on a pair of rails. A rack and pinion arrangement from a well-known constructional toy is used to move the truck and thus control the optical focusing. The single lens, an f4.5 anastigmatic camera lens, is mounted in a fixed position on the front of the camera, and between this and the camera tube the 12-sector disc rotates in its own housing. The potentials for the camera tube are controlled by knobs on the rear panel, as there is no separate camera control unit.

An interesting feature is that a cathode follower input stage using a 6AK5 is built-up against the photo-cathode end of the camera tube so that the input lead is only 1in. long. A screened lead carries the signal at low impedance to the video amplifier strip which lies beside the viewfinder tube. There are two outputs from this strip, one to the control rack, and the other, at a higher level, to the grid of the viewfinder tube.

The Monitor Unit

The monitor unit uses an ACR8 5in. electrostatic tube running at 3,300 volts, and is grid modulated. The circuits are quite conventional. The timebases are Miller-transitrons followed by amplifiers, and the frequency controls are brought out on the front panel together with focus and brilliance adjustments. A lens is used to enlarge the picture but the filters absorb so much light that it is best seen in a darkened room. As mentioned previously, the colour disc has six sectors, runs in its own housing, and is



Block diagram of the Pulse Generator.

Amateur COLOUR *Television*

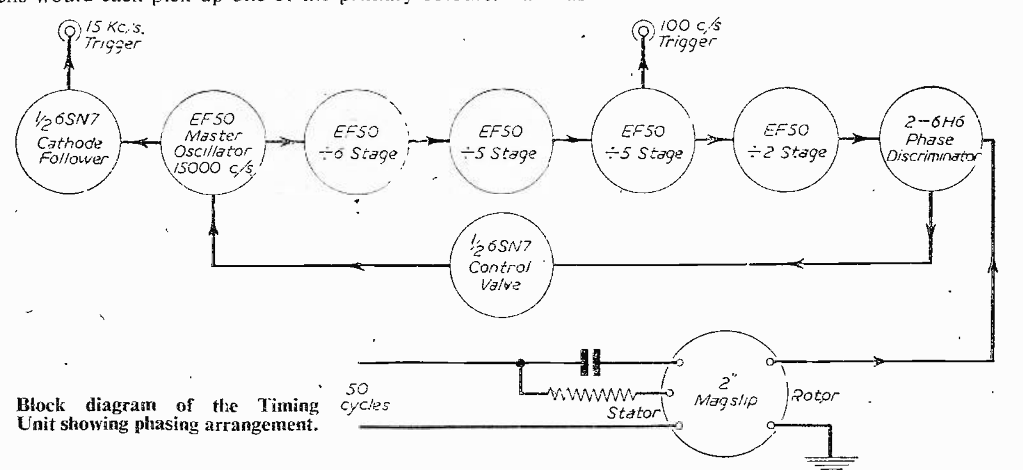
DETAILS OF AN AMATEUR EXPERIMENTAL INSTALLATION

By C. Grant Dixon, M.A.(Cantab.)
(Chairman of the British Amateur Television Club)

AMATEUR television is comparatively new, but has already branched out in various directions. Some people have been attracted by the goal of perfect pictures, whilst for others the lure of pictures in colour, even if of low quality, has been strong. The following is an account of the apparatus built by the writer for the transmission of colour pictures. It is an essentially amateur enterprise and certain sacrifices have had to be made, both for reasons of expense and for reasons of available space.

From the amateur point of view the line-sequential and dot-sequential systems are out of the question as viewing tubes capable of being electronically switched for colour are not on the market in this country. The frame sequential system with its rotating colour filter discs seemed an obvious choice because of its essential simplicity, and the writer had already had some experience with rotating discs when constructing a 30-line scanning disc receiver in 1934. In addition, it meant that results could be obtained without triplication of the camera tube or monitor C.R.T. Only closed circuit working has been attempted, so no mention will be made of modulation systems.

When it was first decided to experiment with colour television, a flying spot scanner was built up using a 5in., white screen, electrostatic C.R.T. (ACR8) and it was hoped that three 931A photomultiplier cells would each pick up one of the primary colours. The raster on the C.R.T. was to be focused on to a colour transparency, a rotating colour disc interposed, and the light received on the three 931A photocells each covered with a primary colour filter, e.g., red, green and blue. Thus, only the "red" cell would respond when the red sector of the rotating disc was over the raster and so on. This optical "switching" proved quite satisfactory and the individual colour gains were controllable by variation of the H.T. voltage applied to each cell. Unfortunately, the 931A is very insensitive in the green part of the spectrum and gives almost zero signal in the red. Efforts were made to remedy this by converting the red light to green using an infra-red image convertor cell but the signal-noise ratio was still too low and this method was abandoned. A number of sub-standard studio-type camera tubes were made available to the British Amateur Television Club, and as the writer was allocated one of these it was



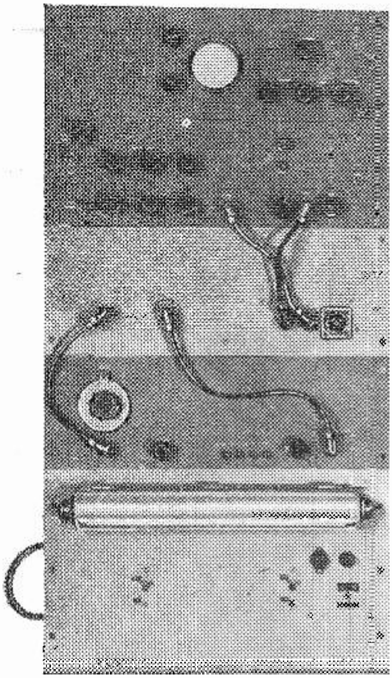
Block diagram of the Timing Unit showing phasing arrangement.

driven at 1,000 r.p.m. by a 3in. Magslip running as a synchronous motor.

The necessity for running the two discs at the same speed and phase is obvious, but it is not always appreciated that the phase must be controllable at the camera as well as at the monitor. The mosaic of the camera tube is a storage device and the disc must be phased so that the division between colour sectors follows the scanning spot, thus exposing the mosaic to the next colour for the whole of the time between successive dischargings of the screen elements. Incorrect phasing is revealed on the monitor screen as colour contamination and the primary colours on the test chart are rendered incorrectly.

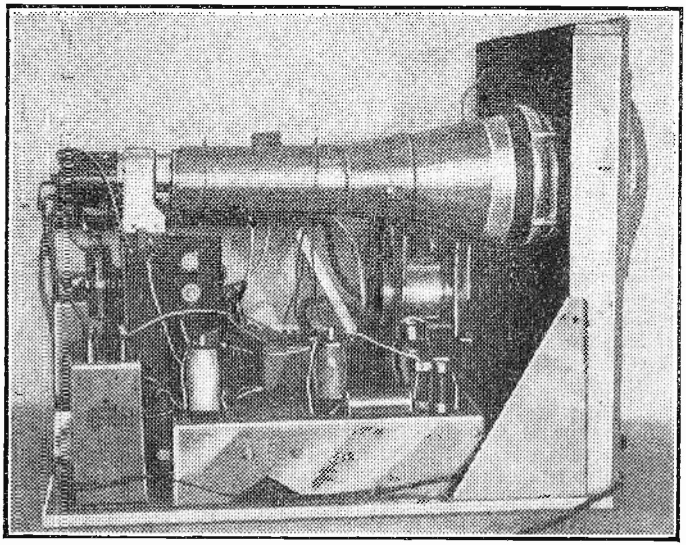
One of the refinements which has not so far been incorporated is a gamma control circuit. This is essential to true colour rendering at all levels and its absence may cause a change of colour balance with increasing scenic brightness. It is intended to incorporate this later.

At the present time crude colour pictures have been transmitted. The object used was a coloured test card illuminated by two 60-watt "Silverlight" lamps, and it was found necessary to open the lens to full aperture (f4.5) as the "exposure" is 1/100 sec. with a 100 cycle frame frequency, and the filters absorb a lot of light.



Front view of the Pulse Generator and Control Rack.

In addition to the disadvantages inherent in the frame sequential system, such as colour fringing and colour break-up associated with moving objects, the major difficulties seem to be the lighting requirements for coloured subjects under studio conditions, and the lack of brilliance of the received image. The writer is of the opinion that this latter difficulty might be eliminated by the use of a 5in. aluminised cathode-ray tube similar to those used commercially as camera viewfinders—the price of these is, however, the main drawback.



A view of the Monitor Unit with timebase chassis in the foreground.

A 9in. tube would be easier to acquire but the size of the colour disc, and of the cabinet, is prohibitively large for a home workshop. Despite this, the apparatus is very satisfactory for general experiments and future work will be directed towards improving the various units. It is also intended to build a scanner for colour transparencies ; if possible avoiding a rotating colour disc by using dichroic mirrors or other similar device.

In conclusion, the writer wishes to offer sincere thanks to the manufacturers whose help with equipment and information has been most valuable. Other amateurs are becoming interested in this fascinating aspect of the hobby, but it is believed that the above is the first amateur colour television apparatus to send pictures over a closed circuit.

The Radio Trades Examination Board

THE 1953 EXAMINATION PAPER AND A REPORT ON THE RESULTS BY THE CITY AND GUILDS OF LONDON INSTITUTE, DEPARTMENT OF TECHNOLOGY

IN order to assist those readers who are interested in obtaining the Television Servicing Certificate issued by the City and Guilds Institute, we give below the two papers set at the 1953 examination, and following this a detailed summary on the results.

First Paper

The maximum number of marks obtainable is the same for each question.

All six questions must be answered.

Questions may be attempted in any order, but the answers must be clearly numbered.

1. Draw a block diagram of a superheterodyne television receiver. Name each section, indicating its input and output waveforms. State whether the final video signal shown is suitable for cathode or grid modulation.

2. Write brief notes on the connection between:
(*a*) picture frequency and flicker,
(*b*) picture definition and bandwidth,
(*c*) picture size and viewing distance.

3. Sketch the electrode assembly of a cathode-ray tube. Indicate the approximate voltages applied to the various electrodes of direct viewing and projection tubes.

Show the appropriate longitudinal and radial positions on the neck of the tube for line and frame coils, focusing and ion trap magnets.

4. Describe the symptoms of:
(*a*) vision on sound,
(*b*) low flying aircraft,
(*c*) sound on vision,
(*d*) diathermy radiation,
(*e*) corona discharge.

What steps could be taken to reduce these forms of interference?

5. Describe six different checks that can be made on a television receiver, using the Test Card "C" transmission.

6. What is the necessity to separate
(*a*) synchronising pulses from picture content,
(*b*) the line and frame pulses from each other?

Draw a suitable circuit and describe its action, showing where each part of the process occurs.

Describe the effect of poor synchronising pulse separation.

Second Paper

The maximum number of marks obtainable is the same for each question.

All six questions must be answered.

Questions may be attempted in any order, but the answers must be clearly numbered.

All questions refer to a television receiver, the circuit diagram of which is attached to this paper.

1. Is the circuit shown that of a superheterodyne or a T.R.F. receiver?

Give a list of the functions of each valve.

2. Give the title of each of the following controls: R1, R14, R29, R34, R48, R54, R59, R60, L5, L8, L16.

What are the functions of the Metrosil, Thermistor and M.R.1?

3. What would be the effect on results obtained from the receiver in each of the following cases?
(*a*) R15 open-circuit,
(*b*) C33 short-circuit,
(*c*) C26 open-circuit,
(*d*) C51 short-circuit,
(*e*) R52 open-circuit,
(*f*) R33 open-circuit.

4. Describe in detail the line time base and E.H.T. circuits.

5. What would be the symptoms if the following components broke down as indicated?
(*a*) heater-to-cathode short-circuit on cathode-ray tube,
(*b*) R11 open-circuit,
(*c*) C55 short-circuit,
(*d*) C21 open-circuit,
(*e*) L15 open-circuit,
(*f*) V9 heater open-circuit.

6. What adjustments or component tests would you carry out in each of the following circumstances?
(*a*) sound on vision,
(*b*) poor horizontal linearity,
(*c*) poor vertical linearity,
(*d*) abnormal sibilants on sound,
(*e*) poor focus.

(The circuit which was supplied was of a well-known commercial receiver but is not reproduced.)

Report on the Results

The following general report is given on the papers as a whole and is not necessarily applicable to the work from individual schools.

Year	Candidates	Passed	Referred Practical	Failed	Percentage Passing
1951	78	46	16	16	59.3%
1952	130	66	40	24	50.6%
1953	135	64	36	35	47.4%

General

The standard of the answers to the first paper was very low, which seems to indicate that more time should be devoted to the teaching of basic television principles. Twenty per cent. failed in the first paper, whereas only 2 per cent. failed the second paper which deals with practical fault-finding.

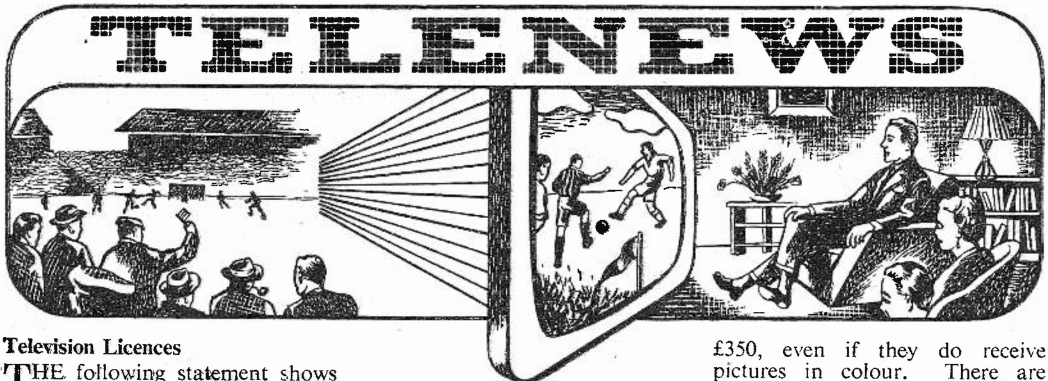
First Paper

Question 1. The block diagrams were satisfactory, but the waveforms were often lacking in detail or missing altogether. A number of candidates did not appreciate the change in phase brought about by using a video amplifier.

Question 2. Although most of the candidates seem to have fairly sound ideas on these points, not enough detail was given in answers.

Question 3. The first part of this question was dealt

(*Concluded on page 576.*)



Television Licences

THE following statement shows the approximate number of television licences issued during the year ended February, 1954. The grand total of sound and television licences was 13,350,136.

Region	*Number*
London Postal ...	916,087
Home Counties ...	345,522
Midland	620,561
North Eastern... ...	415,266
North Western ...	438,406
South Western ...	134,429
Wales and Border ...	153,242
Total Eng. and Wales	3,023,513
Scotland	139,975
Northern Ireland ...	9,536
Grand Total	3,173,024

Advertising the Arts

IT is believed by many authorities that television can be one of the best means of advertising the arts.

Speaking at the Devonshire Club recently, Sir Malcolm Sargent said, "Television will not keep people away from serious music. It will make them go to it."

"Piped" TV for Kennington

SIXTY families living in Kennington, London, S.E., recently became the first London viewers to receive their pictures by the "piped" relay system.

The service is sponsored by British Relay Wireless and Television, Ltd., at a combined rental for radio and television of 11s. to 13s. 6d., according to the size of the tube employed. Some local councils in South London are allowing the company to set up networks on new building estates while construction work is still under way.

It is also claimed that the relay system will eventually afford an interference-free service.

First Cameras

PICTURES of early television programmes at Alexandra Palace were shown during the "Farewell to Ally-Pally" party last month, and their clarity is quite remarkable when it is considered that they were taken by the first all-electronic TV cameras used by the BBC.

They were supplied by E.M.I. when the world's first public TV service began in this country in 1936 and have been in continuous use since, apart from the war years.

Colour Hopes Dimmed

ALTHOUGH it was hoped by many in the American television trade that colour receivers would arouse great interest some manufacturers have reduced their plans to make colour tubes on a grand scale.

Surveys indicate that the American public do not particularly care for 12in. sets costing £350, even if they do receive pictures in colour. There are almost 30 million black and white receivers in the States and the idea of scrapping them merely for the extra novelty of colour does not appeal to the general public.

Resolution Passed

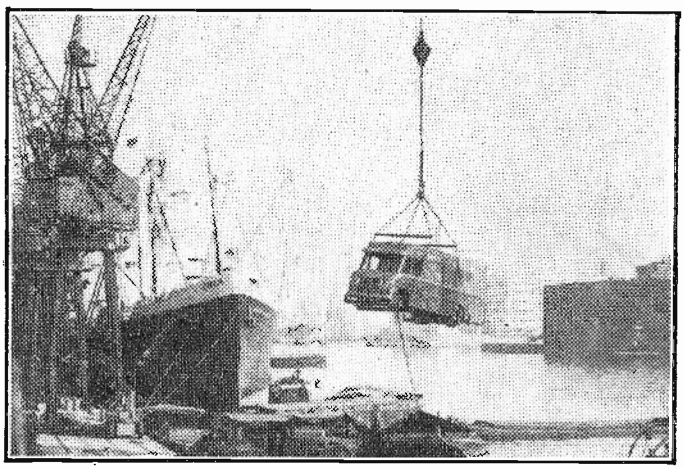
A RESOLUTION has been passed by the Scottish annual meeting of Equity calling for a mobile television van for Scotland.

At present the region has to share a television van with the north of England.

Children's First View of TV

MANY hundreds of spastic children in Australian hospitals have had the thrill of their lives by watching, on television screens, the arrival of her Majesty the Queen and H.R.H. the Duke of Edinburgh, and their subsequent tours through Australian cities.

To these children it was a "first time ever," as there is as yet no television service in Australia.



A general view of the scene in Victoria Dock, London, as a mobile outside-broadcasts television van is hoisted by floating-crane on to the "Torr Head" for shipment to Canada, where it will be used for outside broadcasts.

The project, organised by Amalgamated Wireless (Australasia), Ltd., used equipment manufactured by Marconi's Wireless Telegraph Co., Ltd., of Chelmsford.

Meet the Groves

IT took 273 auditions to decide who would play television's new family—an equivalent of radio's "The Archers" and "Mrs. Dale's Diary." They are known as the Groves (after Lime Grove, of course) and are now a regular Friday night feature.

The family consists of Mr. and Mrs. Grove, son Jack aged 20, daughter Pat 21, Daphne 13, Lennie 12 and Grandma. There is also Mr. Next Door, the neighbour.

More Viewers Up North

A CENSUS taken by the Coal Utilisation Council recently shows that working-class families in Lancashire and the north spend more time looking in at TV than in any other area in the country. It is also revealed that they hold more television parties and spend more on furniture for the TV room.

The council add that fuel consumption increases in the average home when a receiver is bought, due to longer evenings by the fireside.

Chairman of B.R.E.M.A.

MR. M. M. MACQUEEN, manager of the radio and television department of The General Electric Co., Ltd., was elected chairman of the British Radio Equipment Manufacturers' Association at a meeting held in March.

Mr. Macqueen has been on a business visit to the U.S.A.

Chepstow Deception

MANY well-known local personages of Chepstow were completely deceived recently when a young man calling himself Alan Davies and professing to be a BBC official visited the town on the pretext of arranging the broadcast of a programme in a new television series to be called "Historic Places of Great Britain."

He interviewed a local magistrates' clerk, a vicar, a veterinary surgeon and leading tradesmen, telling them that they would all be needed to appear in the edition which was to be handled by BBC commentator Richard Dimbleby.

The big hoax lasted three days. The manager of the hotel in which Davies was staying became suspicious and informed the police. But the "BBC official" had vanished.

Here come the Groves, television's new family. This group picture includes : Father (Edward Evans), Mother (Ruth Dunning), Jack, elder son (Peter Bryant), Pat, elder daughter (Sheila Sweet), Daphne, young daughter (Margaret Downs), Lennie, a young son (Christopher Beeny) and Grandma (Nancy Roberts).

Crystal Palace Station

THE BBC announces that it has placed a contract with Marconi's Wireless Telegraph Co. Ltd. for the design, supply and setting to work of the main transmission line system at the new Crystal Palace Television Transmitting Station. This comprises two transmission lines, each of which will feed sound and vision power to half the aerial system.

The contract also covers the development and installation of the vision and sound transmitter output combining units and test loads, together with their associated switchgear, for the new station.

Schools Equipped to See Contest

AT the request of the BBC Hadley Bros., Ltd., of Birmingham, installed a G.B. 4ft. by 3ft. screen rear projection television receiver in the hall of a boys' school at Solihull, Warwickshire, to give a complete two-way link with a girls' school in Cardiff for a television transmission of a "Top of the Form" contest between the two schools. In addition, Hadley Bros. also installed Ekco T205 14in. screen sets in the school's sick bay, masters' common room and domestic quarters.

"It's a Small World"

IT is understood that the film, "It's a Small World," which was scheduled for March 28th and then postponed, will be shown to viewers on April 25th.

Danger to Children

BEFORE a talk on children's television had finished, a firm of builders rang the BBC warning them that the idea featured in the talk of mixing sand and cement with the hands to make flower boxes was dangerous.

At the end of the programme an announcer was able to give the necessary warning.

Hollywood Relents

THE impact of television has been severely felt by the cinema industry in the past and Hollywood has tended to shun all that is connected with its rival medium.

When the film Academy Awards for 1953 were announced, however, executives decided that one of the biggest boosts that the cinemas could give itself would be to allow the televising of the presentations complete with dancing girls, revolving rostrums and gay lights in the form of a gala variety show, instead of the usual very formal ceremony.

BUILDING THE "SIMPLEX"?

Thousands of enthusiasts are building the "Simplex" Televisor, now being featured in "Practical Television." WHY NOT YOU? **CONSTRUCTOR'S ENVELOPE**, containing full constructional details and Blue Print, additional notes and suggestions, and Query Service form, sent for ONLY 5/-. All components available ex stock as follows:

ALUMINIUM CHASSIS.—18 s.w.g. DRILLED, with screens and tube holder bracket, **27/6**. PLAIN, with screens and tube holder bracket, **20/-**.

TRANSFORMER.—350-0-350 v. 150 ma., 6.3 v. 5 a., 5 v. 3 a. tapped at 4 v., ONLY **32/6**. (Postage 2/-.)

RECTIFIERS.—RM3 **5/-** ea., K3/40 **6/-** ea.

VALVES.—EF50 **6/6**, SP61 **4/-**, 6SN7 **11/6**, 6J5 **5/6**, EB34 **3/6**, EA50 **3/6**.

VALVEHOLDERS.—B9G/(EF50) **10d.**, I.O. and M.O. **6d.**, Diode (EA50) **6d.**, VCR97 **2/6**.

VCR97 TUBE.—Tested full screen, **42/6**.

CONDENSERS.—Electrolytics 25 mfd. 25 v. **1/10**, 16 x 8 mfd. 450 v. **5/6**, 32 x 32 mfd. 450 v. **6/-**, .1 mfd. 2,500 v. **4/6**. Mica, silver mica, and tubulars, 350 v. **6d.** each.

POTENTIOMETERS.—All values preset **1/9** each, long spindle **3/-**, with switch, **4/6**.

RESISTORS.—¼ watt **4d.**, ½ watt **5d.**, 1 watt **6d.**, 1.5 K. 5 watt, **1/6**.

COIL FORMERS.—⅜in. **8d.**, ⅝in. **10d.**

SPEAKER.—6½in. ROLA P.M. with trans. **17/6** (postage 2/-).

All Components Brand New and Unused. Full Price List available on request.

VALVES

1G5	6/6	7A7	8/6	1R5	8/-
1G6	6/6	7C5	8/6	5Z4	10/-
1E7	6/6	7F7	8/6	5U4	10/-
1LH4	8/-	7W7	8/6	6AC7	6/6
1LN5	8/-	12H6	8/6	6K7GT	5/6
1L4	7/6	12J5	6/-	807	7/6
2B7	8/6	12AH7	12/6	ECH35	12/6
3A4	9/-	12SG7	7/6	EA50	3/6
3B7	8/6	12SK7	8/6	EBC33	8/6
6AG5	7/6	12SR7	7/6	EB34	3/6
6AK7	9/6	28D7	7/6	EF36	6/6
6B4	7/6	32	7/6	EF39	6/6
6B3	7/6	36	7/6	EF50	6/6
6C8	8/-	50Y3	8/6	.. Red Sylvania	8/6
6G6	6/6	58	8/6	EF55	12/6
6H6	5/-	1622	11/-	EK32	6/6
6K6	9/-	1625	7/6	EL32	7/6
6L7	7/6	1626	4/-	SP61	4/-
6N7	7/6	1299A	7/6	MU14	10/6
6R6	8/6	VR150/30	8/6	RL37	6/-
6U5	8/6	VR137	5/9	VS70	7/6
6V6	10/6	KT44	8/6	954	6/-
6SA7	8/6	KT2	5/-	955	6/-
6SG7	7/6	VP23	6/6	9003	6/-
6SH7	7/6	HL23DD	6/6	9004	6/-
6SJ7	8/6	TP25	8/-	931A	50/-
6SK7	7/6	1S5	8/-		
6SL7	9/-	1T4	8/-		
6SS7	7/6				

RECEIVER R 3118.—A further supply of the very popular unit we sold out of a few months ago. Ideal for conversion to TV, having a built-in A.C. Mains Power Pack for 180-240 volts. Is tremendously powerful, employing 7 I.F. stages of 12 mc/s with 4 mc/s band-width, and has 16 valves: 6 of VR65, 4 of VR92, 2 of VR136, and 1 each VR137, P61, 5Z4 and Y63 "Magic Eye." In new condition, ONLY **97/6** (carriage etc., 7/6).

TRANSFORMERS.—Manufactured to our specifications and fully guaranteed Normal Primaries. 425-0-425 v. 200 ma. 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a., **ONLY 50/-**; 350 v.-0-350 v. 160 ma., 6.3 v 5 a., 6.3 v. 3 a., 5 v. 3 a., **ONLY 42/6**; 250 v.-0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., **ONLY 32/6**. 350 v.-0-350 v., 150 m.a. 6.3 v. 5 a., 5 v. 3 a. **ONLY 32/6**. The above are fully shrouded, upright mounting. 5.5 kV. E.H.T. with 2 windings of 2 v. 1 a., **ONLY 72/6**; 7 kV. E.H.T. with 4 v. 1 a., **ONLY 82/6**. PLEASE ADD 2/- POSTAGE FOR EACH TRANSFORMER.

E.H.T. TRANSFORMER FOR VCR97 TUBE.—2,500 v. 5 ma., 2-0-2 v. 1.1 a. 2-0-2 v. 2 a. **37/6** (postage 2/-).

INDICATOR UNIT 233 chassis, containing VCR97 holder, 11 assorted valve holders, condensers, resistors, etc. NEW CONDITION. ONLY **7/6** (carriage etc., 3/6).

RECEIVER R 1355 chassis, containing 10 assorted valveholders, I.F. transformers, condensers, resistors, etc. NEW CONDITION. ONLY **7/6** (carriage etc., 3/6).

Open until 1 p.m. Saturdays, we are 2 mins. from High Holborn (Chancery Lane Station), 5 mins. by bus from King's Cross.

Cash with order, please, and print name and address clearly. Include postage as specified and on Component Orders under £2.

U.E.I. CORPN.

THE RADIO CORNER, 138, GRAY'S INN ROAD, LONDON, W.C.1.
(Phone TERminus 7937.)

ARTHURS HAVE IT!

LARGE STOCKS OF VALVES AND C.R.T.s.

AVO METERS IN STOCK

Avo Model 7	£19	10	0
Avo Model 8	23	10	0
Electronic Test Unit	27	10	0
Electronic Test Meter	40	0	0
Valve Characteristics Meter	60	0	0
★ Cossor Oscilloscopes Models 1052	104	0	0
" " " 1049	132	0	0

Full range Taylors Meters. List on request.

Leak—TL/10 Amplifier and "Point One" Pre-amplifier — Complete	28	7	0
Specification on request.			
Leak Tuning Unit	35	6	3
Chapman Tuning Units	17	6	8

LATEST VALVE MANUALS

MULLARD, OSRAM, & BRIMAR No. 5, 5/- each. MAZDA 2/- each.

ART and SCIENCE in SOUND REPRODUCTION. By F. H. BRITTAIN, D.F.H., 2/6 each.

Postage 6d. each extra.

Terms C.O.D. OR CASH with order and subject to price alterations and being unsold.

Arthurs Est. 1919

PROPS: ARTHUR GRAY, LTD.

OUR ONLY ADDRESS: **Gray House, 150-152 Charing Cross Road, London, W.C.2**

TEMple Bar 5833/4 and 4765.

TELEGRAMS—"TELEGRAY, WESTCENT, LONDON."

CABLES—"TELEGRAY, LONDON."

IT'S 60% CHEAPER!!

To Construct Your Own Television Aerial

SUMMER TIME IS THE RIGHT TIME TO CONSTRUCT AND ERECT AN AERIAL

WE SHALL BE PLEASED TO SUPPLY INFORMATION, IF REQUIRED, ON ELEMENT LENGTHS AND SPACINGS WITH FULL ASSEMBLY INSTRUCTIONS. ALL WE NEED IS THE CHANNEL NO. AND TYPE OF AERIAL TO BE CONSTRUCTED

All fittings are die-cast, using high quality aluminium and are fully guaranteed.

14ft. 16 s.w.g. 2in. Aluminium Poles.	Inc. Carr.	**50/-**
½in. 18 s.w.g. D/H Alloy Tubing	Per ft.	**10d.**
1in. 18 s.w.g. D/H Alloy Tubing.	Per ft.	**1/4½**
INSULATORS. Unbreakable, waterproof, (standard 1in. x ½in. fitting).	Each	**6/9**
INSULATORS. Unbreakable. For "In-line" Aerials. 1in. x ½in. fitting.	Each	**8/9**
MASTHEAD MOUNTINGS. 2in. Pole fitting, 1in. Cross Boom.	Each	**8/6**
MASTHEAD MOUNTINGS. 1in. Pole fitting, 1in. Cross Boom.	Each	**6/-**
REFLECTOR AND DIRECTOR ROD HOLDERS for ½in. Elements, 1in. Cross Boom.	Each	**3/9**
BRACKETS. Heavy Duty. 2in. Pole fitting, double lashing.	Set	**40/-**
BRACKETS. Lightweight. 1in. Pole fitting, single lashing.	Set	**25/-**

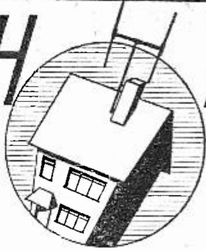
Write for Illustrated Price List. C.W.O. Carriage & Packing 1/6 extra.

Fringevision Ltd.

ANGEL YARD WORKS, MARLBOROUGH, WILTS.
'Phone 605.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

TV IN THE CINEMAS

THERE is no sign of a diminution in apprehension of the effects of television by the film industry. As a matter of fact, the boot is on the other leg! Years ago, the late Capt. A. G. D. West, one-time Head of BBC Research, visualised the general use of large screen television in cinemas, fed either by land-line or very-short-wave radio links. His ideas seemed rather revolutionary at the time, but now are beginning to take a practical form. This was disclosed in a paper read by Mr. T. M. C. Lance before the Television Division of the British Kinematograph Society—*Microwave Transmissions to Cinemas*. Mr. Lance outlined a comprehensive scheme in which radio relay links in the super high-frequency band, in the region of 7,000 Mc/s would be used. Transmissions on these frequencies can easily be beamed or directed in the required direction and the minimum of power would be required, with a maximum bandwidth of 22 Mc/s. This would deal with colour transmission as well as black and white, and wide and panoramic screen aspects are also under consideration. For 3-D transmission, a wider bandwidth would be required. These schemes sound somewhat grandiose, but, as a matter of fact, they were started most successfully on the occasion of the Coronation, when five cinemas in London were able to put on excellent big screen television of the BBC transmission. National and sporting events are envisaged as the most suitable material for developing this type of television, but the circulation of multiple film transmissions from one or two prints instead of the sixty or seventy required for film releases is another long-range objective. Secrecy would be secured by scrambling the sound, thus ensuring that only the cinemas properly equipped would be able to make use of the transmissions.

SUPERSTITIONS OF THE THEATRE

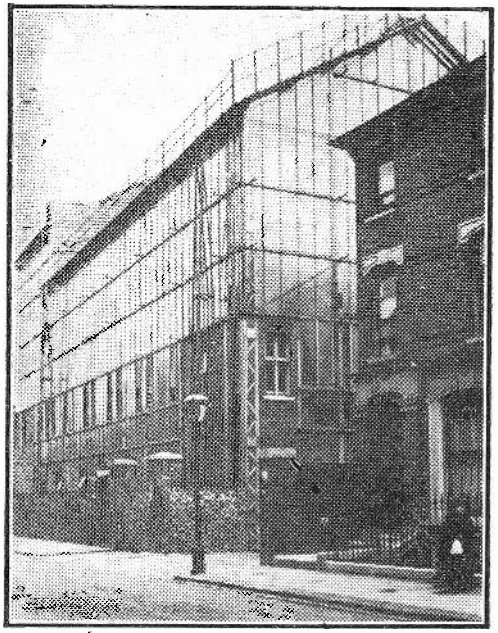
SHOW business is famous for its superstitions. Actor-laddies of the old days gloried in them—and many of these superstitions live on. These range from aversions to first performances on Friday nights or the thirteenth of the month, from the use of peacock's feathers in costumes to the premature delivery of a play's tag lines. The theatrical saying: "The flag—and Mother saved many a dud show" is probably a profound truth. The eternal triangle was always rated high as a reliable plot framework, provided the locale of the story was planted in familiar places. Regional or parochial plays were held to have limited appeal, though many big successes could be quoted against this belief. "Hobson's Choice" and "Hindle Wakes" are two such examples.

THE REGIONAL PLAY

TELEVISION has yet to build-up its own particular set of good and bad luck theories, but it is evident that the producers at Lime Grove studios are not to be deterred from indulging frequently in the regional play. *Boyd's Shop* was an example of the regional play, in which the main appeal, as written, is the folklore characteristic of life in an Ulster village. St. John Ervine undoubtedly captured this in the play, produced nearly twenty years ago. The Lime Grove version seemed to miss it entirely, due, possibly, to the strange mixture of accents, some of which were difficult to decipher. If attention wandered when Joseph Tomelty, an ideal Boyd, was off the screen, it was not altogether the fault of Sheila Morahan, Harry Towb or Robin Bailey, the principal supporting players. The fact is that transport and communications have improved to such an extent (including television itself) that few viewers are able to believe in the tittle-tattle and storm-in-a-teacup situations of a village—unless, for some reason or other, it is set in the Hebrides. There, anything can happen and whimsy can take its course.

A TV SAGA

QUEEN'S FOLLY, by Elswyth Thane, was in quite a different category. This was a two-hour play which covered four different periods in the history of a family—and a house. The newspaper critics were not very kind to this ambitious episodic play, but I found great charm as well as excitement in it.



Exterior of original "glasshouse" type studio built at Lime Grove by the Gaumont Co., Ltd., in 1914. Additional "dark" and soundproof stages were added in 1928.

Perhaps it was a mistake to pack all the episodes into one evening's entertainment, but the four separate playlets would not have lent themselves kindly to serialisation. The highlight of *Queen's Folly* was undoubtedly the well-arranged duel scene, a thrilling and hair-raising sequence worthy of Douglas Fairbanks senior, who would have particularly appreciated the introduction of the staircase. All the best sword duels seem to require an ancient staircase! Andrew Cruikshank played in all the episodes with quiet sincerity, but was at his best in the earlier costume periods. *Queen's Folly* was a polished, well-mounted production —and the producers responsible were Ian Atkins and Andrew Osborn.

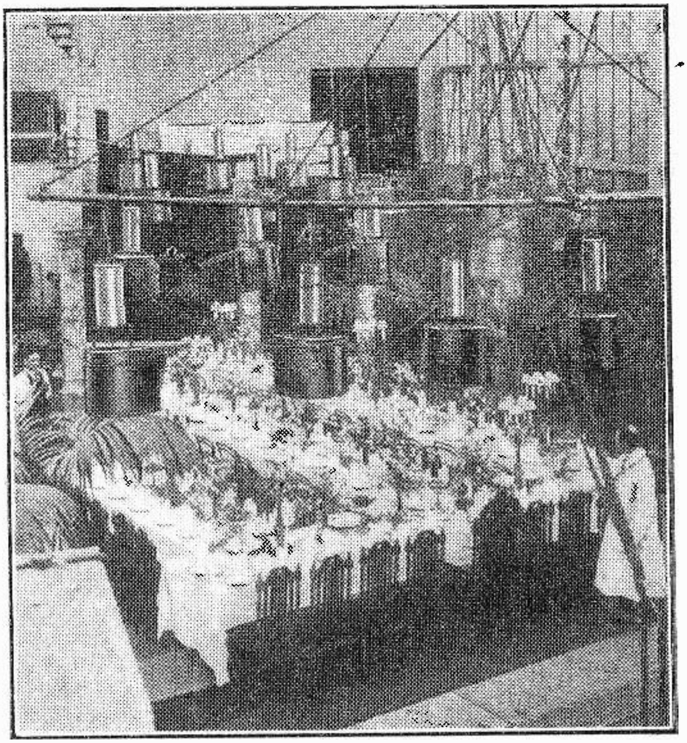
FAREWELL A.P.

THE Alexandra Palace is an ugly highly inconvenient structure which has had almost as many farewell performances as the proverbial prima donna. Its last use as a TV Studio Centre was celebrated by a nostaligc programme reviewing highlights of its earliest transmissions. For about 80 years ballad concerts, symphony orchestras, blood-and-thunder melodrama, pantomime, concert parties, fireworks and film studios have taken their turn within and without its walls. Before the BBC established TV studios there, it was the home of the original "Big Ben" Film Company, for whom George Pearson produced a series of highly successful hair-raising spy melodramas. If the option on the TV studios and auxiliary premises is taken up by Norman Collins' "High Definition" Company, filming is likely to return to the Alexandra Palace—but in a modern electronic form. For months, development work has been carried on at High Definition's Highbury studio, where two stages are fitted out for this specialised type of television recording, which has now reached a very high standard. Programme sponsors are already taking a close interest in the possibility of obtaining recorded features, which have the special advantage that they can be exported and used on TV transmissions all over the world.

I don't know whether new viewers found it boring, but as one of the original "two thousand," I found *Thank You, Ally Pally* a most absorbing programme. Many of the excerpts from these early programmes were taken from the special film which was transmitted each morning for the benefit of radio dealers and installation engineers. The Television Party, which ended the programme, was a hilarious affair of unrehearsed incidents which went on for rather a long time. But it was worth waiting for to see Arthur Askey, Renee Houston, Petula Clark, Boyer and Ravel, Larry Adler and *all* the TV announcers, including Leslie Mitchell.

STUDIOS—THEN AND NOW!

THE original studios at the Alexandra Palace were at the Muswell Hill end of the building and were adapted for film production in 1913 by a young ex-schoolmaster, George Pearson, whose film enterprises seem to have indirectly forestalled television in several ways. Many highly successful silent film thrillers were made here under the trade mark of "Big Ben" until Mr. Pearson moved to Lime Grove, Shepherd's Bush, in 1915, where a large new "glasshouse" type studio had been erected by the Gaumont Company. Here he made films of an even more hair-raising type, including *Ultus—the Man From the Dead*, a super-sensational character of the modern Robin Hood type; who might well be resuscitated for TV at the same stable—Lime Grove. When talkies arrived he produced the film version of *Journey's End*, later one of the earliest TV play successes, repeated in *Thank You, Ally Pally*. Mr. Pearson, now a leading executive at the Colonial Film Unit, can look back at the changing shapes of the original studios at Lime Grove, to the enlargements of silent stages in 1927/28 and the building of further additional stages, this time sound-proofed for talkies, in the early thirties. Part of the original glasshouse premises are incorporated in the present BBC building at Lime Grove. The piecemeal addition of stages, workshops and offices over so many years accounts for the rabbit-warren aspects of its corridors.



Interior of the original "glasshouse" stage at Lime Grove. Sets were illuminated for filming by daylight reinforced by Westminster-enclosed type arc-lamps suspended from the roof.

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).

THE MISSING LINK ?

SIR,—Your article on coloured television interests me. But why all these phosphors, when the solution of this problem is so very obvious, almost self evident ? On January 19th, 1954, I filed a provisional specification of a very simple device for the solution of the problem : 3D life-like, life size coloured television at home and in the cinema, with my new screen. But there is more to it than that. A revolution in colour photography on ordinary panchromatic film, the rejuvenation and bringing into use of cathode ray tubes that can produce *negative* pictures only, etc.

I know that you will say " But the BBC are not yet attempting to broadcast colour, so what ? " Yes, I know. Leave the BBC alone. To get colour we want nothing more from them. They are actually broadcasting colour without being aware of it. You smile. I need only write one single word in answer and you would gasp and say : " Why on earth didn't we think of it before ? " I have written to the I.C.I. informing them of my patent. But the mentality of boards and committees must prevail, I suppose. I have my complete specification ready. But I refrain from sending it in. I do not want the Americans to get hold of it before it is at least provisionally patented over there and in other countries, nor before the cheap, mass production in England is well under way.

The title of my patent I can give you and its number, " 1524," a universally adaptable tunable colour television screen. My belief is that what you do put into a box you can take out, except, of course, when the substances you put in destroy themselves. So if I put a cat into a box with a mouse, the chances are that the feline will eat the rodent !

If I put three differently coloured balls into a transparent box, you can easily take out any coloured ball you choose. However, not so readily out of a transparent box of my design ! Transparent though it be !

There is something to brood on, which may give you a clue to the one word that solves the riddle.—" PATENTEE " (Name and address supplied).

RADIO AND TV INTERFERENCE AND ELECTRIC STORM PRECAUTIONS

SIR,—I would very much like to see regulations regarding the installation and suppression of radio and television apparatus. I feel that much could be done in this direction if certain rules and conditions were applied to reduce the percentage of interference caused by this apparatus. We suppress our cars, motors (electric), etc., but it is high time we suppressed this apparatus itself in an efficient manner. If interference is to be abolished, it must be suppressed at the source.

I would like also to see out-of-doors erections of aerials and masts so connected and efficiently earthed to reduce damage to apparatus, etc., during an electric storm. In this direction the practical method and not the technical method would be required to be applied to the connection of the aerial feeder. This would be opposite to the general trend of present day practice. —J. H. ROBINSON (Fife).

INCREASING PICTURE SIZE ON A 6in. TUBE

SIR,—Re Mr. E. G. Warder's letter in the March issue of PRACTICAL TELEVISION, I would like to say that I agree in every respect with Mr. Warder, and at the moment I am using the Argus timebases which, with the VCR97, are definitely not capable of scanning even to the 5in. width. The frame timebase is capable of very large scan, but the linearity is not so good. However, a little juggling with the component values does give fair results. In experiments with the line timebase, however, I found it impossible fully to scan the tube without raising the supply to 650 volts, which is quite out of the question for any length of time ; furthermore, resistors have to be increased in wattage (some to 5 watts) and condenser voltage ratings increased. There are two other alternatives : values of condensers in the line oscillator sync feed to suppressor grid circuit can be increased to 200 pF with slight line foldover, or the line amp removed and a 6SN7 wired in its place, giving push-pull deflection. This latter is the best idea of the lot. The tube can, of course, be rotated 90 deg. and line and frame deflection plate connections changed over, but I found trouble in getting enough frame scan. No, the VCR97 is not, in my opinion, a tube aptly suitable for a critical enthusiast. The better tube is the white and blue VCR517C, which is a medium-persistence tube and does show signs of trace on rapid pan shots and 100 per cent. white on black, but you soon get used to this and after the tube has been used for two or three months this effect practically disappears altogether. I would point out that with this tube fitted to an " Argus " I built about two years ago I have had perfect pictures, and being a television engineer you will realise I have quite a critical mind due to handling all makes and sizes of TV receivers. A few modifications are necessary to the timebases, as the VCR517C is not a direct replacement for the VCR97 (except in base connections), as some firms state in their advertisements.—D. E. CONDUIT (Stirling).

SIR,— I have been a regular reader of PRACTICAL TELEVISION for a little over two years, and I always turn to the readers' correspondence first when each month's copy comes to hand.

In the March number you publish a letter from Mr. E. G. Warder (Darlington), who seems to have the same trouble as myself. He may therefore be interested in my own ideas, which have enabled me considerably to increase the width of my picture.

About 12 months ago I made up the " Argus " timebase in the form of a separate unit, making use of a 182 Ind. unit and VCR97 tube. First test produced a picture about 3in. wide. I tried the tube with the key to the right and this gave me a picture about 4¾in. wide, and because I was busy at the time had to leave well alone.

Several months ago I fitted a 517C tube in place of the other one and without alteration to the controls switched on. Result a tall, narrow picture. I had to insert a resistance in the height circuit, which made the picture 5¼in. high. I had a look through back numbers of PRACTICAL TELEVISION, which produced several ways of overcoming the width problem.

I therefore proceeded as follows to modify the circuit. Anode load resistors in line R42 and R47 reduced to 47 K ; screen resistors R43 and R48 reduced to 27 K ; R71 in bleeder network removed and connected between anode of E.T.H. rectifier and

C63. Another .1 2.5 kV condenser was connected between anode of E.H.T. rectifier and earth. The resistance next to the bottom end of the bleeder network was now connected to earth R70. This effected some improvement in width.

You also advised variation in condenser values to improve width. Why not make them variable? I said to myself. I removed C52 50 pF and fitted a 50 pF Philips' concentric trimmer. Reducing the capacity of this condenser made the picture wider. The limit is reached when the picture becomes distorted. Across C56 I wired another 50 pF condenser. Increasing the capacity in this case made the picture wider. Each adjustment will need a fresh setting of the linehold and R41 may have to be increased to enable a single picture to be resolved, or a 1½ megohm resistor wired in series with the linehold. I then replaced C57 with a 100 pF ceramic trimmer. Adjusting this had the same effect as the linehold. At one setting my picture jumped from side to side when the linehold was adjusted. At another setting adjusting the linehold brought the picture smartly into place and locked steady.

The net result of these alterations is a picture 5¼in. high and width in proportion. The use of trimmers in the timebase proved most interesting and showed me how important it is to have the values of the condensers just right. A slight adjustment of C52 made a difference of nearly an inch in width. With condensers rated at plus and minus 20 per cent. it is easy to see how results can vary.

To take full advantage of the very much larger picture I have removed the front metal panel of the Ind. unit and remounted my tube. This leaves the full face of the tube in sight. To the front of my timebase cabinet I have fitted a 9½in. by 8½in. plate-glass screen. The plate glass is held in place with an escutcheon. This latter and the plate glass were intended for a 9in. tube. I discarded the rubber mask and fitted a cardboard surround with an opening 7½in. by 6in. I have also mounted all my controls on a small panel, which enables me to alter the size of the picture to suit the programme.

When I again tried the 97 tube in the unit I found the picture was too wide.

I am using a home-made indoor dipole aerial made at small cost. For vision a 1355 receiver unit with I.F.s staggered, R.F.26 head.—S. E. INGLEFIELD (Northampton).

TV IN EIRE

SIR,—The article by Mr. L. B. Moore on TV reception in Eire in your February edition was of especial interest to many of us, who refusing to be daunted by the adverse conditions with which we have of necessity to contend, strive to obtain reception in an area which is far beyond the accepted definition of ultra-fringe. It is questionable whether anything but very sporadic reception is obtainable from cross-channel stations anywhere in Eire, except along the eastern seaboard and even there it is largely by way of multi-path and, therefore, very prone to be affected by troposphere conditions.

I have myself frequently obtained excellent reception from the Holme Moss transmitter, despite that a range of hills—the highest rising to 2,400 feet—interposed themselves, but such reception was characterised by very extreme fading usually. I live at an elevation of 600 feet and about 100 miles from Belfast; but the topography of the surrounding country is such that very little land going to any greater height is met with this side of the Mourne Mountains, and being 15 miles west of Dublin I will escape the highest of these so far as radio signals are concerned.

I therefore concluded that reception from the temporary transmitter at Glencairn might be possible and having erected a horizontal aerial I tuned to the Glencairn sound channel. To my surprise sound came at quite remarkable strength and with remarkable consistency. I therefore built a double Yagi array, each section comprising two directors, folded dipole and a reflector and elevated it to about 55 feet. A masthead pre-amplifier was fitted, this being of two grounded stages followed by a pentode stage, and it feeds separate sound and vision receivers. The strength and quality of the sound are excellent, but the picture is weak, though almost always viewable I am confident that when the present temporary transmitter is replaced by a medium powered one I can look forward to good reception.

From my experience of reception under adverse conditions, I am satisfied that separate sound and vision receivers are almost indispensable, and a masthead pre-amplifier with the first stages grounded grid or neutralised triode virtually so, if the picture is not to be obscured by snow.—J. A. LOGAN (Co. Kildare).

THE RADIO TRADES EXAMINATION BOARD

(*Continued from page* 564)

with satisfactorily by most candidates, but answers to the second part were generally very poor. It is important to understand the position of coils and/or magnets in relation to the tube electrodes.

Question 4. Nearly all candidates were able to describe the symptoms of (*a*) (*b*) and (*c*), but a number failed on (*d*) and (*e*). Methods of reducing the interference were not dealt with very well.

Question 5. Most of the candidates obtained pass marks for this question, but answers were not at all good and lacking in detail.

Question 6. Many candidates gave very poor answers to sections (*a*) and (*b*), but were able to draw the circuit and describe its operation correctly. This again points to lack of understanding of the basic principles.

Second Paper

Question 1. A surprising number of candidates were unable to determine whether the circuit was of a T.R.F. or superheterodyne receiver.

Question 2. Most of the controls were correctly named, although a few candidates confused frame linearity and height.

The second part of the question was answered with insufficient detail in most cases.

Question 3. Satisfactory answers by most candidates.

Question 4. Although candidates seemed to understand the circuit, most answers contained very little detail.

Question 5. Satisfactory answers by most candidates. Sections (*d*) and (*e*) gave most trouble.

Question 6. Although some candidates answered this question quite well, a large number seemed to have little idea which components were most likely to be responsible for the various troubles.

YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 583 must be attached to all Queries, and if a post reply is required a stamped and addressed envelope must be enclosed.

" METROSILS "

I wonder if you could give me the information I would like to know concerning " Metrosils "—who they are made by, what they really are (condenser or rectifier), and functions or characteristics? I have a Pye Television F.V.1 and there appear to be two in the set. I have been a reader of your journals PRACTICAL TELEVISION and " Practical Wireless " since they both came out and I must congratulate you on them both as they have given me considerable knowledge. I have been all through your books since 1950 to this year, but can see no firm who advertises, or anything about them in your books.—L. A. Stoten (Enfield).

Metrosil is actually a trade name for a non-linear resistive element. It provides, in addition to other applications, an easy means of producing a boost voltage, and this method is now widely used. The Metrosil obeys a current/voltage relationship of I equals KVa, where a is a constant. Standard Telephones and Cables, Ltd., should be able to assist you further in this respect.

LACK OF SYNC

Would you kindly help me with the following?

(1) No sync on line or frame.

(2) 1in. white band across screen quarter distance down screen.

(3) ½in. white band across screen three-quarter distance down screen.

The frame bands travel slowly down, getting thinner as they approach these lines. The picture, although travelling at varying speeds across screen, can be identified at times, but only on the tube area in between the white lines mentioned, the remainder being a criss-cross formation of lines, fly-back lines are also visible.

With aerial disconnected.—Raster lines not evenly spaced and no raster visible on white lines. I have had the following tested :

All diodes ; thyratrons replaced ; sync valve 6F14 ; all electrolytics, including high voltage condenser.—P. M. Kane (Yeovil).

For lack of sync check the following : V14 and associated components, paying particular attention to C27, C25, R34 and R35.

For effects (2) and (3) in the frame timebase check : C37, R56, C38, T2, and the frame deflecting coils for short-circuit turns.

PICTURE FAULT

Could you please tell me what is wrong with my Ferguson TV set? I cannot get a picture. I have checked everything, and I find if I increase the 2-watt resistance feeding the EF80 valve on the output of the vision side, which also decreases the voltage on the TV tube cathode, I get a picture then, but this does not seem a permanent cure.—L. H. Barnell (Northampton).

You should first make certain that the video anode load resistor is up to the stipulated value of 12,000 ohms. Next check the emission of the valve itself, for if this is low the potential at the tube cathode will rise and back-bias the tube. Check the video valve biasing circuit, and the 68,000 ohm resistor connected from the tube cathode circuit to chassis. Suspect the 470,000 ohm resistor connected from one side of the brightness control to the H.T. line for an increase in value.

TIME CONSTANT

I am using a TV sound unit—home-built. TV sound comes through at good quality loudspeaker strength when fed into 3½ watt A.C. amplifier. Dial is marked 0 to 180. TV picture is 10 on dial sound 25, from 0 to 35 reaction is smooth with about 80 volt H.T. ; beyond 35 deg. all reaction ceases, with higher voltage on H.T. threshold howl ruins reaction. I have tried different sized reaction coils but the trouble is still there. Could you advise a cure as I would like to get 10 m. amateur bands?

All wiring is short with component wires cut to minimum. Also could you give me a rough practical sketch for cathode controlled regeneration? Hoping not to have caused you too much trouble.—F. Hall (Rotherham).

This effect may be alleviated by altering the time-constant components (capacitor and resistor) in the grid circuit of the valve. Try reducing C to 50 picofarads and R to 150,000 ohms. We regret that we are unable to provide diagrams in connection with our query service.

POOR LINEARITY

I have a Marconiphone Television V.R.C. 77DA, which has one or two faults that I should like to correct. Fault 1 : Frame jumps or quivers but remains locked. Fault 2 : Left-hand of test card larger than that on the right. Will a new line transformer cure this?

Some time ago I had a white line 2in. from left of screen, so I replaced B36, KT36 and U35. After this I didn't get sufficient width, but leaving the old B36 and replacing KT36, U35 I managed to obtain full scan, with the width control at its full travel, and the hold at its critical point. With the old B36 and KT36 I can obtain more than full scan. May be a low H.T. line?

This may help. A few weeks after we had the set the screen went blank, and I took no notice till I smelled something burning, looked in the back, and KT36 was glowing all the colours of the rainbow. Replaced KT36 and the set was working again. Any advice will be gratefully received. I have the circuit of this set.—J. Buxton (Long Eaton).

The defect in the KT36 probably caused the cathode resistor to over-heat considerably, and alter in value. Such a defect would provoke poor horizontal linearity and insufficient picture width. You should, therefore, check the value of the resistors concerned (sometimes the value—94 ohms—is made up by two 47 ohm resistors connected in series), and also the associated decoupling capacitor. Check the mains rectifier, for low H.T. line voltage would aggravate the symptom. Frame bounce is often caused by a defect in the B36, or by an alteration in the value of a component feeding the sync pulses to the frame generator.

TUBE REPLACEMENTS

The old tube of my T.101 " Invicta " (television) set was a 9in. Mullard MW22/7 with a B8B base, but the dealer tells me that this tube is now obsolete, the current one being MW22/16 with a B12A base. What alteration will have to made to the set and C.R.T. base for this tube to be used ?

Regarding my old tube, which lights up with a white light on switching "on" the brightness control, having no effect.

In recent advertisements I have seen transformers for sale enabling tubes with " heater cathode " shorts to be used again. Do you think this could be the matter with mine ?—G. O. Ware (Enfield).

Your dealer is correct in informing you that the MW22/7 tube is obsolete, and that the MW22/16 is a substitute type. It is necessary only to change the tube base for a B12A type. The connections on the MW22/16 are as follows : pin 1 heater ; pin 2 grid ; pin 10 anode 1 ; pin 11 cathode ; and pin 12 heater.

An intermittent heater to cathode short within the picture-tube would provoke uncontrollable brilliance on your receiver. If you can prove this, a low-loss heater isolating transformer could be used to provide the tube with a further lease of life—see " Operating With a Heater to Cathode Short," PRACTICAL TELEVISION, May, 1953.

AERIAL DATA

I constructed my " Viewmaster " a little over a year ago and have operated it from a single dipole aerial about 12ft. from the ground level with surprisingly good results. Recently I bought a second-hand Belling-Lee " H " array made for Sutton Coldfield, which I propose to convert to Holme Moss. Could you please give me the correct lengths of the elements as each lot of data that I have seen appears different. In PRACTICAL TELEVISION, June, 1952, you gave the dimensions : channel 2 (a) 4ft. 6in., (b) 9ft. 3in., (c) 4ft. 6in., whereas further figures give (a) 4ft. 6in., (b) 9ft. 7in., (c) 2ft. 10½in. Are the differences between the dipole and reflector set at a quarter and an eighth wavelength ?

As I am only a beginner I would be obliged if you could explain the differences to me. I might add that my friend operates his " Viewmaster " from a commercial-made single dipole and the elements in his case are 4 ft. 9in. long.—J. Hardy (Nantwich).

The differences in dimensions of aerials mentioned in your letter are due to quarter wave and eighth wave spacing. Very little difference in performance will result in making these changes but the smaller spacing between aerial and reflector will give a sturdier construction but will be more likely to cause " flutter " of the picture in the event of a heavy breeze.

INSUFFICIENT FRAME AMPLITUDE

Many thanks for your prompt reply to my query after fitting a frame oscillating transformer to my Pye D16T console television.

You will recall that the frame return lines were closer than previously, and the frame was slipping badly.

I find on an unmodulated raster that the lines are evenly spaced and the short ones directly under each other, which seems to point to good interlace. The picture is perfect.

I have managed to check the frame slip ; my trouble now is insufficient frame scan, with vision sensitivity, sound sensitivity and frame amplitude ; at maximum I am about ½in. short each end, and this increases by the end of an evening's viewing.

I am replacing a noisy volume control shortly and also have a new frame oscillating transformer, which although the resistance readings are higher, I have been assured by the supplier that the inductance has been altered to match ; the original transformers are not now being made, and this is a specially made substitute.

I would like your opinion on the short scan so that I can fit the new transformer if needed, from the Service Sheet. I see that R41 in series with V9A anode was reduced from 68,000 to 560,000 ohms to increase the scan (serial number of change unspecified) ; my serial number is 9705.—D. McCallam (Merstham).

Insufficient frame amplitude here may be caused by low emission V9, an increase in the value of R40 and/or R41, or a reduction in the value of C30. This latter cause also gives rise to poor vertical linearity. It may be advisable to try the modification specified, i.e., reducing the value of R41 to 560,000 ohms.

INTERMITTENT FAULT

Would you kindly offer me your advice as to the location of a fault of an intermittent nature that has appeared in a television receiver of mine ?

The set is an EKCO model TA201 (pre-war).

Since the war almost all the valves and electrolytics also the tube have been replaced.

The fault appears at first sight to be loss of gain and is intermittent, sometimes being satisfactory all the evening, other times varying several times in one evening.

The symptoms are : Upon switching on we may get a perfect picture with the brilliance just on and the contrast only partly round. After an interval the picture almost disappears and upon turning the brilliance to full, also the contrast, we get a very flat picture ; after a while this will flash back to full brilliant picture, and upon reverting controls the picture is perfect. A peculiar feature is the fact that the fault, when present, can often be cured simply by manipulating a lighting switch in the room or switching the sound on and off. I have tried substitution of the valves, but to no avail.

I possess a multi-range meter and have another set same model, to fall back on for any spares (less tube and E.H.T. transformer).

Your help and advice as to the most likely place to look for this fault will be greatly appreciated.—H. G. Hersey (S.E.9).

This kind of symptom is generally caused by an intermittently defective capacitor associated with the vision R.F. stages. The capacitor defect can often be corrected temporarily by subjecting it to a transient pulse, such as created in the set by actuating a light switch, or by switching the receiver off and then on again quickly. It generally proves a tedious process to establish the component responsible, and substituting each capacitor in turn for one known to be well up to standard represents about the only practical way of tackling the problem. In particular suspect coupling and decoupling components. Check for poor soldered connection.

TELEVISION: Simplex, Argus, Coil-sets, **21/-**; ⅜in. sq. canned Formers, **2/3**; .007, 150v, W99, miniature RF decoup. Cond., per doz. **6/-**; Junction Transistors, Mullard, **52/6**; HiFi V.H.F. Wrotham Tuners, FM: Kits, **£7/5/-**, complete **£15**, with p/supply; the last word in AF perfection, range 40 mls., 5v set, stove enamel chassis finish. BEL, Marlborough Yard, N.19. (ARC. 5078.)

WE SPECIALISE in Radio and Television Cabinets. May we quote you for your individual requirements? Estimates free. Write, phone or call. STANLEY J. REEVES, 21, Mitcham Lane, Streatham, S.W.16. (Phone: STR. 0618.)

ALL YOUR T/V COMPONENTS, Valves, Books and Transformer Re-winds can now be obtained from one source. Send **9d.** stamps for new "Replacement and Rewind Manual." "DIRECT T/V REPLACEMENTS," 134-136, Lewisham Way, New Cross, S.E.14. (Tideway 3696, 2330.)

VIEWMASTER A/P, 12in., 9K E.H.T., double-door mhgy. Console. Offers. Box No. 168, c/o PRACTICAL TELEVISION.

VIEWMASTER, London, 12in. Console, perfect working order, **£35**, o.n.o. 39, Percy Road, N.12.

R3170A., brand new, with all valves, **75/-** (carr. 7/6); Responser 3118, 160/220mcs, with power pack, **75/-** (carr. 10/-); IFTs, 10/13mcs., canned, new, **1/3**; 7mcs (R1355), **1/6**; Indicators, T233, with VCR97, 3/VR65, 3/VR54, 2/VR92, new, **50/-** (carr. 7/6); RF Units, type 24 **15/-**, 25 **17/6**, 26 **45/-**, 27 **40/-**, 26 or 27 with broken dialplate, **35/-** (carr. 2/-); Metal Rectifiers, HW, 600v, 30ma. or 270v, 80ma. **6/-**; Tested Valves, VR91, VR53, 955, VR116, RK34, MH41, 6C4, 9001 at **4/-**; VR65, VR66, VR65A, VU120, CV54, VU111, VR135, 7193, VR21, 991, 12SH7 at **3/-**; original box, VR91, VR136, EL91, 6AM6, 6B8M, 6N7M, TT11 at **8/6**. Terms: Cash with order. S.A.E. for list/enquiries. Postage extra. W. A. BENSON, 308, Rathbone Road, Liverpool, 13.

THE CHEAPEST Blank Ali. Chassis, made in bright 18g. ali., with sides and narrow end turned in and down ½in. for maximum strength and rigidity.

7 x 4 x 2,	**3/4**	9 x 5 x 2½,	**4/-**
10 x 6 x 2½,	**4/6**	10 x 8 x 2½,	**5/-**
12 x 8 x 2½,	**5/6**	12 x 9 x 2½,	**6/-**
14 x 9 x 2½,	**6/6**	15 x 9 x 2½,	**6/9**
16 x 8 x 2½,	**6/9**	16 x 10 x 2½,	**7/3**
17 x 9 x 2½,	**7/3**	17 x 12 x 2½,	**8/6**

Other sizes made to specification. Any length up to 17in., any width up to 12in., any depth up to 3in.. Cost 1d. per sq. in. of the top surface only, ignoring depth, e.g., 10 x 7 x 2½ = 10 x 7 = 70 sq. in. = 70d. = 5/10. SERVIO RADIO, 156/8, Merton Rd., Wimbledon, S.W.19. (LIBerty 6525.)

FRESH STOCK: Condensers, 0.01, 0.04, 0.001, 0.002, 0.005, all at **2/6** doz.; Hunts, 0.1-350v **6/-** doz., 500v **8/-** doz., 001-1K **5/6** doz.; Dubilier, 8mfd/500v **2/6**, 8 x 8-500v, **3/6**, 16 x 16-500v **4/3**, 32mfd-500v **4/3**, 32 x 32-500v **6/-**, 25mfd 25v **1/6**, 50/50 **1/8**; Valves, SP61, SP41, **4/6** each. Free lists. WINWOOD, 12, Carnarvon Road, London, E.10. Mail only.

James H. Martin & Co. for

"VIEWMASTER," "TELEKING," "SOUNDMASTER," "TRUVOX TAPE DESKS," Components, Valves, Cabinets, etc.

Mail Order ONLY, Easy Terms available.

FINSTHWAITE, NEWBY BRIDGE, ULVERSTON, LANCS.

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

"VIEWMASTER" Valves, exact to specification, guaranteed new and boxed, set of 12 **£5/15/-**, post free; "Tele-King" 17in. Receiver, complete set of 17 valves exact to specification, **£8/19/6**, post free; 6AM6, EF91, 6F12, Z77, 8D3, W77, EF92, EB91, 6AL5, any 8 for **50/-**, post 1/6; 1.4v. miniatures, 1S5, 1R5, 1T4, 3V4, 3S4, 1S4, DK92, 3A4, any 4 for **27/6**, post 1/-; all valves guaranteed new and boxed. For individual prices and other types see displayed advert., page 584. READERS RADIO, 24, Colberg Place, Stamford Hill, London, N.16. (STA. 4587.)

TV WITHOUT MAINS.—Absolutely first-class picture, plus DC circuit for lighting; as supplied to the B.B.C. Special AC/DC "Chorehorse" Generators, self-starting, compact, and complete, AC 220/250 volts, 50/60 cycles, 250/350 watts AVC. Will run radios, vacuum cleaners, small tools, etc., **£47/10/-**, plus 10/- delivery. Below:—

STORAGE BATTERIES, 12v, 75 AH, heavy duty, 19 plates, separate cells, in hardwood cases, finest possible specification, **£7/17/6**, delivery 9/6. 12v, 22 AH, almost similar specification, surprisingly powerful, **£3/14/-**, delivery 5/6. 6v, 90 AH, 15 plates, hard rubber cells, also suitable for cars, tractors, lorries, etc., **£3/7/6**, delivery 7/6. 6v, 150 AH, extra heavy duty, 25 plates, separate cells in hardwood crates, **£6/17/6**, delivery 8/6. TEDDINGTON ENGINEERING CO., LTD., Dept. "C." High St., Teddington, Middx. (KINgston 1193-4.)

"RADIO UNLIMITED" offer brand new Valves and Components. V/master Set, 12 valves, as specified, **£5/17/6**; V/master Coils Set, incl. choke, **17/6**; C.R.T. isolation, 25% boost, 2v, 4v, 6v, all at **7/6** each; Fil/trans., 210/250v-6.3v, at 1.5a, **5/9**; L/spkrs., Goodmans 5in, **15/6**, R. & A. 8in, **17/6**; Valves 6AM6, 6AL5, EF92, **7/6**, 6 any type **42/-**; 6V6GT, 6X5GT, 6F6, 6K7M, all at **6/6** each; 1T4, 1S4, 1S5, 1R5, **7/6** each; 3S4, 3V4, **8/6** each; ECL80, EF80, PY80, PY82, 10F1, 6K8, 12K8, **9/6** each; 5Z4, 5U4, U50, 5Y3, 25Z4, 25Z6, **9/-** each; over 13,000 valves in stock; keen quotation by return; Co-axial Cable, special offer, **7/6** doz. yds.; W.W. Cntrls., Viewmaster set of 6, **19/6**; 3-4 watt types, 5K, 100K, 50K, 500 ohms, 750 ohms, **3/9** each; Carbon Cntrls., all values, long spindles **2/9**, SP/sw **3/9**. RADIO UNLIMITED, Elm Road, London, E.17. (KEY. 4813.) Free lists.

ALUMINIUM, LIGHT ALLOYS, BRASS, COPPER, BRONZE,

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

3000 STANDARD STOCK SIZES

H. ROLLET & CO., LTD.

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

SLOane 3463

Works:

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

Branches at Liverpool, Manchester, Birmingham, Leeds.

"No Quantity too Small"

SIMPLEX. Red Sylvania EF50, **7/6**; Resistors, ⅛w or ¼w, 20%, **3½d.**; silv. mica Conds., 5pf, 15, 25, 50, 100pf, **3d.** ea., 500pf **5d.** ea.; Pots., less sw., **2/-** ea., with sw. **3/-** ea.; ⅜in. Formers and Cores, **9d.** ea.; 32-32mfd, 450v, TCC, **6/-**, 25mfd, 25v, **1/-**; Tub. Conds., 350v or above, .001mfd, .005mfd, .01mfd, .1mfd, **5d.** ea.; Pye plug and socket, **6d.**; plain knobs, **9d.** ea.; transformer, **35/-**; full price list on receipt of s.a.e. Armour-plated Glass, 13in. x 10½in. x ¼in., **3/6**; 9in. Mask, **5/-**; .002mfd, 18kV TCC Visconol, **7/-**; Perspex dark screen, 13½in. x 10½in. x ⅛in., **5/-**; 3-element folded Dipole Aerial, **70/-**; mounting bracket for 2in. pole, **8/6**; co-axial Cable, 75-80 ohm, **8d.** yd.; high tensile alum. alloy Poles, 2in. dia., 10ft., **32/6**, 20ft. **65/-**; carr. on poles or aerials 5/-, or both 7/6. Pre-amplifiers, 1-valve with power pack, **60/-**, without power pack **30/-**; R.F. Chassis by famous manufacturer, 3-valve type (less valves), over 30 components, **7/6**, post pd., 7-valve type (less valves), over 60 components and 4 bank Yaxley sw., coils, etc., **17/6**, post pd.; wiring diagram included in each case. All goods new and guaranteed. GLADSTONE RADIO, Gladstone Place, Newton Abbot, Devon.

AMERICAN MAGAZINES.—One-year "Audio Engineering," **28/6**, specimen copy, **3/-**; "High Fidelity," **50/-**, specimen copy, **4/6**; "Popular Science," **28/6**. Free booklet quoting others. WILLEN LTD. (Dept. 23), 101, Fleet Street, London, E.C.4.

50 SECONDHAND Televisions always for sale; famous makes. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

BOOKLETS: "How to use ex-Gov. Lenses and Prisms." Nos. 1 and 2, price **2/6**. Ex-Gov. Optical lists free for s.a.e. H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

WANTED

NEW VALVES WANTED, small or large quantities, 3Q4, 6V6, 5Z4, ECL80, EF80, EY51, PL81, PY82, KT61, 6L6N, VR150/30, 5R4, 80, etc., etc. Prompt cash. WM. CARVIS, 103, North Street, Leeds, 7.

EDUCATIONAL

I.P.R.E. Data for constructing TV Aerial-strength Meter, **7/6**; 5,500 Alignment Peaks for superhets, **5/9**; sample copy "Practical Radio Engineer," **2/-**, Membership-examination particulars, **1/-**, Syllabus of seven postal courses free and post free. SECRETARY, I.P.R.E., 20, Fairfield Road, London, N.8.

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the hobby enthusiast, or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other professional examinations. Train with the college operated by Britain's largest electronic organisation; moderate fees. Write to E.M.I. INSTITUTES, Postal Division, Dept. PT28, 43, Grove Park Road, London, W.4. (Associated with H.M.V.)

BENTLEY ACOUSTIC CORP. LTD.

38, Chalcot Road, N.W.1. *PRImrose* 9090

6BA6	7/-	6SN7	8/6	12BE6	7/-
6BE6	7/-	6V6	7/-	EB91	5/6
6BJ6	7/-	7C5	7/-	ECC33	10/-
6BW6	7/-	7C6	7/-	ECC35	9/-
6J5G	5/-	7S7	7/-	ECC81	8/-
6K7G	5/-	763	5/6	EF39	6/-
6K8	8/-	807	7/6	UBL21	13/-
6L7	6/-	12AT7	7/-	UCH21	13/-
6N7	7/-	12AU7	10/-	VR91	2/-
6SL7	7/6	12AX7	7/-	VR136	5/6

Post extra. 24 hr. C.O.D. Service. Refund Guarantee. S.A.E. Free List.

News from the Trade

MULLARD HYDROGEN THYRATRONS FOR RADAR

THE Communications and Industrial Valve Department of Mullard, Ltd., announce the availability of two hydrogen thyratrons, types XH8-090/4C35 and XH16-200/5C22. These are ideally suited to airborne, ground and navigational radar installations employing high peak short duration pulse powers where maximum economy of space and weight is essential, while their ability to handle heavy peak currents at high pulse repetition frequencies makes them of use in many general pulse applications. The XH8-090/4C35 and XH16-200/5C22 are plug-in replacements for American types 4C35 and 5C22, and are, therefore, of interest to manufacturers of export equipment. They are also used in Services equipment under the designations CV1787 and CV2520.

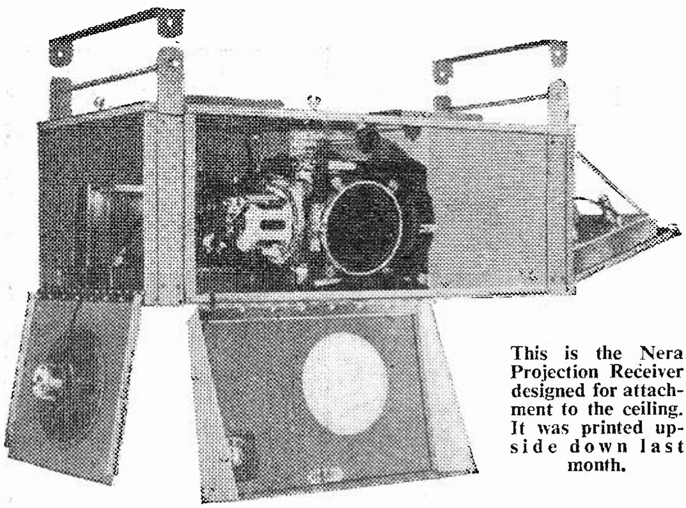
Both valves operate with a heater voltage of 6.3v. The XH8-090/4C35 has peak anode voltage and cathode current ratings of 8 kV. and 90 A., while the corresponding values for the XH16-200/5C22 are 16 kV. and 325 A. Operating temperature range is wide (−50 deg. C. to +90 deg. C.), and there is no restriction on mounting position. The inclusion of a new type of replenisher ensures a long life and a high degree of reliability.—Mullard, Ltd., Century House, Shaftesbury Avenue, W.C.2.

"NURAY" HEATER BOOSTER

THE "Nuray" is the second of a series of servicing aids to be introduced by Direct TV Replacements.

This unit is a heater booster for low emission C.R.T.s in paralleled circuits. Its main advantage over the normal booster transformer is that it can be fitted in, about three minutes, without any drilling or soldering. A clamp on the Nuray is designed to fit into the ventilation holes or slots on the back of the cabinet, then it just plugs in. The stages of boost are marked low, medium and high. Engineers with this unit are able to show the customer the effects of boosting a low-emission picture tube, without involving labour for which it may be difficult to obtain payment, if no improvement is apparent.

When the customer does require a new tube, an allowance can be made and the Nuray removed for use in another set. The price of the Nuray is 27s. 6d. retail, less 33⅓% trade discount. Available for 2-volt C.R.T.s (other types to order).—Direct TV Replacements, 134-136, Lewisham Way, S.E.14.



This is the Nera Projection Receiver designed for attachment to the ceiling. It was printed upside down last month.

BRIMAR VALVES FOR BAND III TV TUNERS

WITH the performance criteria of a good signal-noise ratio, low oscillator drift and radiation, minimum cross-modulation and I.F. break-through, Brimar have introduced the following valves for use in tuners in Band III TV receivers.

PCC84/7AN7

This double triode with separate cathodes and internal shielding between units has the high slope of 6 mA/V at the low anode voltage of 90 volts which is required to obtain optimum performance from the D.C. cascode R.F. amplifier used to achieve adequate signal-noise ratio. The use of cathode bias for the grounded cathode triode not only minimises variation of the input impedance with AGC but also extends the cut-off. This permits cross-modulation to be kept to a negligible level without resorting to a remote cut-off valve.

With a 0.3 amp heater, this valve may be used in A.C./D.C. equipment.

PCF82/9U3

This triode-pentode with separate cathodes and a 0.3 amp. heater, for use in A.C./D.C. equipment, has a number of advantages over other mixer-oscillator valves designed for similar applications.

The high slope (8.5 mA/V) of the triode section permits the required oscillator voltage to be obtained with the minimum generation of oscillator harmonics and a low value of oscillator grid current.

Although it is necessary to have a high conversion conductance available for Band III reception, this parameter is not so important as at low frequencies. One of the other factors which is of importance is the input impedance and its variation with frequency.

Full details of operating conditions for these two valves may be obtained from the Brimar Valve Application Department, Footscray, Sidcup, Kent.

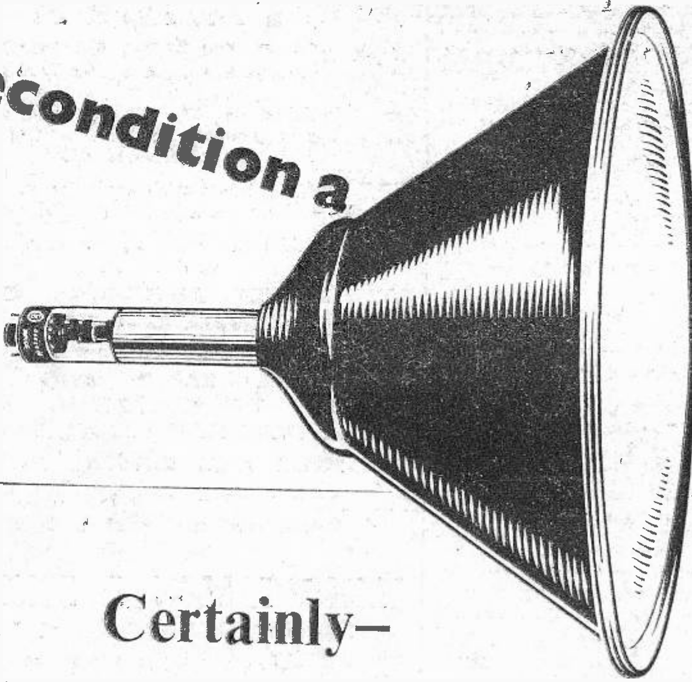
QUERIES COUPON

This Coupon is available until May 21st, 1954, and must accompany all Queries.

PRACTICAL TELEVISION, May, 1954.

Published on the 22nd of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland and Abroad 13s. 6d. (Canada 13s.). Registered at the General Post Office for the Canadian Magazine Post.

Recondition a C.R.T.?



Certainly–

if it's an 'English Electric' T.901A

Every home constructor will appreciate English Electric's unique C.R. Tube Reconditioning Service. It means that when your C.R.T. ceases to work, you can, if it's an 'English Electric' metal tube in physically sound condition, take it to your dealer and exchange it for a good as new and guaranteed one—for £12. A nice little saving of £10 for you.

Write to 'English Electric' for a complete specification of the T.901A the finest tube that any constructor can buy, and you have started saving money right away.

**The tube specified by the designers of the 'Tele-King', 'Magnaview' and 'Super-Visor' circuits and 'Viewmaster' conversion circuit.*

'ENGLISH ELECTRIC' T.901A

THE BRITISH MADE LONG-LIFE RECONDITIONABLE TUBE

If you have any difficulty in obtaining supplies write to:

The ENGLISH ELECTRIC Company Limited, Television Department, Queens House, Kingsway, London, W.C.2