

# Practical Television '61

APRIL  
1961

AND TELEVISION TIMES



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*Easy to build*

*Inexpensive*

*Building a Cabinet for the - 'OLYMPIC'*

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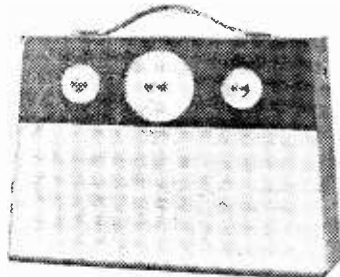
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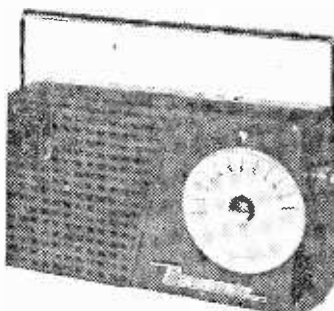
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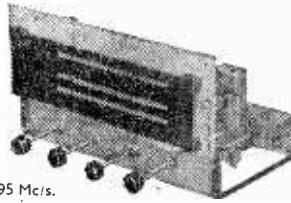
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# Practical Television

AND TELEVISION TIMES

VOL. 11, No. 127, APRIL, 1961

Editorial and Advertisement  
Offices:

**PRACTICAL TELEVISION**

George Newnes, Ltd., Tower House  
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## The Pilkington Committee

THE controversy over the number of lines to be used in future British television and the question of the introduction of colour are not the only problems to be placed before the Pilkington Committee. Actual programme content is now forming the subject of much of the evidence being submitted. A Roman Catholic committee recently criticised the low moral standards in some television plays, variety performances and other programmes. The committee spoke of "a complete lack of restraint and reticence" which can lead to a "serious infringement of both modesty and morality". Further observations included "It is not just a question of immodesty of dress or of bad language, the very themes treated frequently conflict with accepted standards of moral behaviour and... during the past few years there has been a deterioration in the standards observed both by the BBC and the ITA programme companies".

There is also, says the committee, excessive preoccupation with violence and horror, an over-emphasis on the abnormal or even perverted. Repetition creates a climate of opinion which can have disastrous effects, especially on a youth led to believe that infidelity in marriage and recourse to violence are normal. The committee contends that the competition between the BBC and the ITA has been of a destructive rather than creative character, because each has been driven by the desire for large audiences. The establishment of a Classification Board is also recommended, to be appointed in the same way as are members of the Board of Film Censorship.

A Radio and Television Safeguards Committee, representing sixteen trades unions, recommends the establishment of a National Council for Broadcasting to advise Parliament on broadcasting matters and a General Broadcasting Committee to enforce ethical standards. The Council would see that general regulations affecting broadcasting were observed. The Committee would investigate complaints about the standard of programmes.

The Advertising Inquiry Council, in a memorandum to the Pilkington Committee, complains of inadequate checking and controlling of advertising on ITV. The memorandum makes the charge that the present Advertising Advisory Committee contains too many representatives of the advertising industry and that offensive advertisements are sometimes removed only after outside pressure. The proposed new council would contain representatives of social welfare, medical and consumers' organisations. It would have powers to veto whole classes of advertising, and would be financed by revenue from the network's advertising.

Evidence on sound and television broadcasting continues to reach the Pilkington Committee and it seems that much of the criticism contained in it is adverse. Few good words have appeared for the Independent Television Companies and it must now be quite clear that many organisations, which represent many viewers—not small groups or minorities—are of the opinion that very many improvements are possible and certainly necessary.

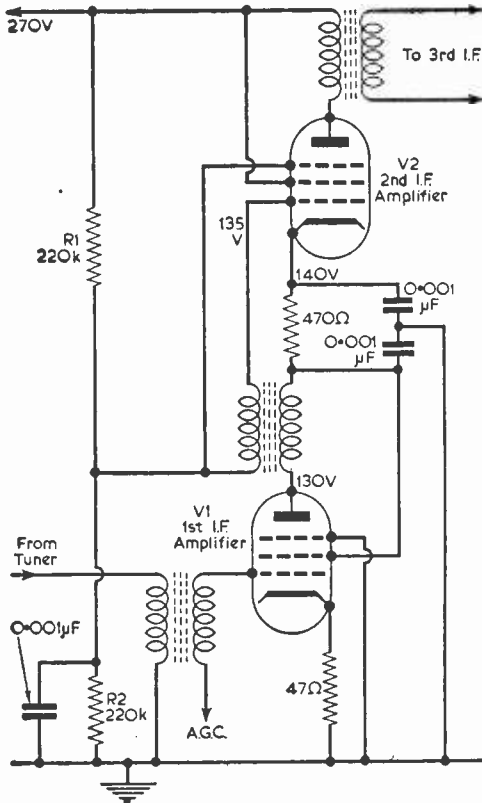
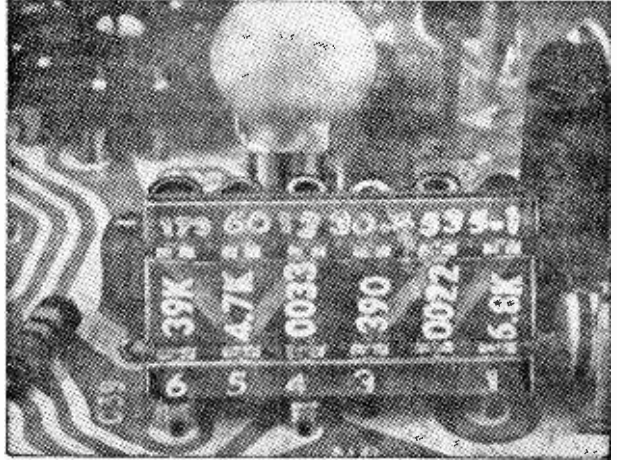
Our next issue, dated May, 1961, will be published on April 21st.

# AMERICAN TV TRENDS

By P. Halliday

WHEN American television receiver practice is considered, emphasis is often given to the various basic circuit differences from British models, resulting from the different transmission standards (E.M. sound, negative picture modulation, etc.). It is however, equally interesting to consider those parts of the set which are common to both American and British systems. It is an open secret that there is a regular two-way traffic between Europe and America in the new television features which are so readily dismissed by the cynics as "sales gimmicks" but which in these days of more gradual receiver changes are often among the more striking technical innovations.

The latest printed circuit boards have component values printed on the reverse side.



## Printed Circuits

Today, only a small minority of British receivers do not contain at least some part of their circuitry in the form of printed wiring panels. Surprisingly, quite a number of American firms still make a strong point of their "conventionally wired chassis"—this is partly because many of the early printed wiring sets proved highly unpopular with service engineers and, through them, with the public. To overcome this dislike of servicing printed circuits, the wiring pattern is also printed on the board with full component reference numbers which is also liberally sprinkled with test points and key circuit identification points; sometimes the foil wiring pattern is also printed on the component side of the panel to facilitate circuit tracing; and the larger multi-connection components have been redesigned to make it easier to replace them should this prove necessary. These various identification techniques, claimed to provide "road maps" for the technician, are of course also found in some recent British models, the Philco "Codenta" (COlour iDENTification Assembly) chassis being a notable example. To overcome any remaining public mistrust of printed wiring, one American manufacturer offers a five-year guarantee for his panels.

There seems to be an increase in sets using high-level contrast-control circuits, i.e. the contrast-control between the video amplifier anode and the cathode (or grid) of the picture tube. High-level contrast control has the advantage that the gain of the video amplifier stage is not

Fig. 1. (left)—Simplified stacked I.F. stages—resistors R1 and R2 set the bias level for V2.



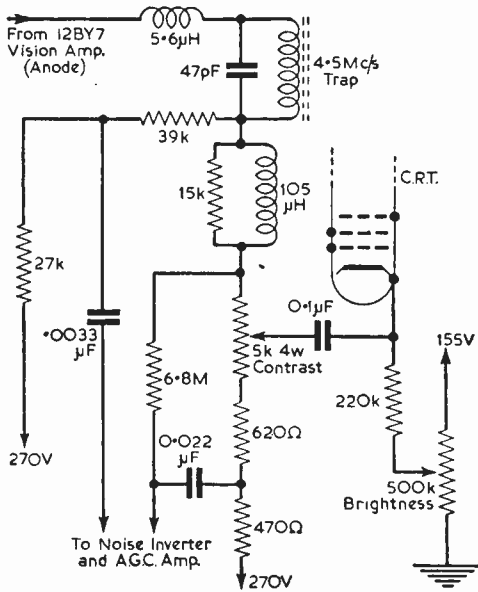
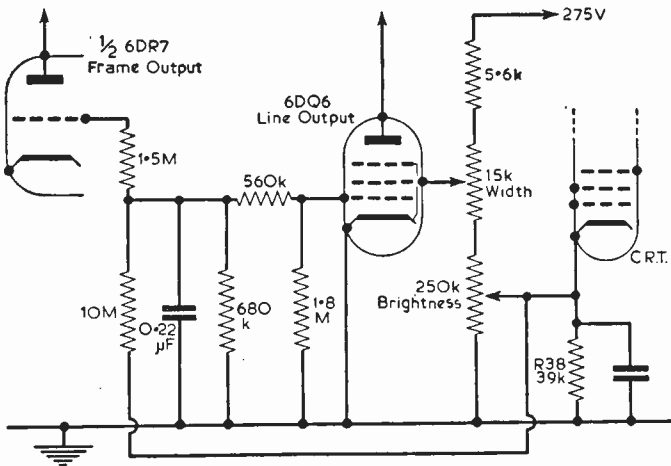


Fig. 2. (above)—High level contrast control used in Du Mont receivers.

Fig. 3. (below)—Brightness and size compensation circuits in Philco sets.



changed and thus the signal level to the sync separators is not affected by the position of the contrast-control. Fig. 2 shows one of the simplest high-level contrast-control circuits as used in Dumont chassis 120601-A.

"Cascade" or stacked I.F. amplifiers are more common in 1961, and some new tubes with higher gain have been introduced for I.F. service. The stacked H.T. has the advantages of less current drain from the H.T. supply and better signal-noise ratio because of the regulation of the first I.F.

plate supply by the second I.F. A simplified diagram of the stacked system is shown in Fig. 1. The voltage division across the valves is maintained, regardless of the respective valve condition, by resistors R1 and R2, which hold the grid voltage of V2 constant. Since the valve currents are in series, it is necessary only to apply AGC to V1.

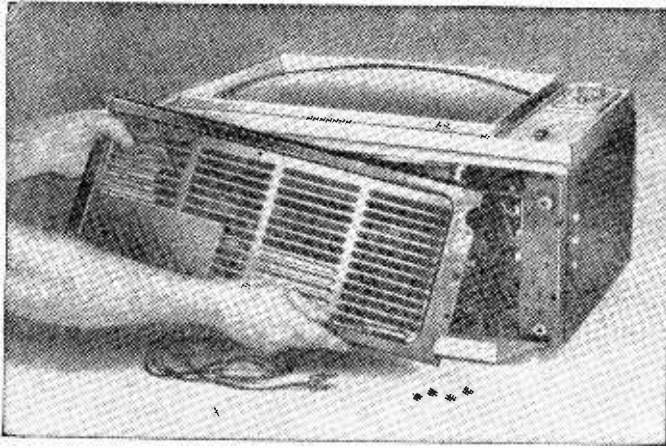
The reasons may not be apparent at first glance for the 10M resistor from the centre arm of the brightness control to the lower end of the grid resistor in the vertical output stage of certain Philco sets (Fig. 3), or why the brightness control is in the earthy lead of the width control. This circuitry makes up a "brightness-size" compensation network. Brightness-size compensation is needed because regulation of a high-voltage system is something less than ideal. When brightness is turned up, the CRT draws more current. This reduces the high voltage, and the raster size will increase slightly because the electron beam is now easier to deflect.

Vertical compensation is achieved by feeding back a positive voltage to cancel out part of the normal negative bias on the frame output valve. (The negative bias is taken from the grid circuit of the line output valve.) As the brightness is increased (brightness-control arm going toward earth), there is less positive voltage. This permits the grid to go more negative and reduces the picture size. The brightness-width compensation would appear to be connected in reverse. As the brightness is increased, there is less shunting action by the 39k resistor (R38). This would seem to increase rather than decrease the width because the screen voltage of the line output valve is increased. However, in practice, the high voltage tends to be increased by this action faster than is the width, and compensation results. The brightness-size compensation tracking is said to be good.

**Power Supplies**

The division between printed- and hand-wiring adherents is also echoed in the power supply arrangements. Here the great gulf is between those makers who favour the inclusion of a double-wound isolating transformer and those who omit this costly component; like a whisper from a now almost forgotten era when British sets were not all "live". But in the United States, despite the 117V mains supply, most of the more expensive sets still fit an isolating transformer. There are several considerations which do

not apply in Britain favouring its retention: conventional half-wave rectification, even with high efficiency silicon rectifiers, produces a maximum H.T. line of only about 130V—this low voltage is used in some A.C./D.C. models. Thus a voltage doubler circuit is needed unless a step-up transformer is fitted—unexpectedly some makers use a 1:1 ratio isolating transformer with voltage doubler, rather than a step-up type. The 60c/s mains frequency means that transformer cores can be slightly smaller than would be required on British 50c/s mains.



Zenith's 19in. portable has a bottom plate which may be removed to facilitate servicing.

### "Zoom Lenses" and "Picture Tube Savers"

Two small dodges which have yet to cross the Atlantic are worth noting. At least one maker still fits a picture enlarger switch, a device which first appeared in the days of small picture tubes. The switch is arranged to increase both line and frame scan power by about 25 per cent: this gives an over-scanned picture, providing an enlarged central portion of the transmitted picture.

Another extremely simple device is the "picture tube saver" on Setchell-Carlson models. This is based on the well-known method of extending the useful life of a low emission picture tube by running it at some 25 to 50 per cent above its heater rating. British service engineers often fit a small transformer to provide the boost voltage when this becomes necessary. The "picture tube saver" simply consists of having the full boost voltage permanently available but wiring a  $3\Omega$  5W resistor in series with the picture tube heater. When emission drops, the user inserts a plug which short-circuits the resistor.

### Transistorised Sets

The American Philco Company marketed the first fully transistorised television receiver in 1959 and since then has been joined by several other firms, though there has been no flood of models. The original Philco set, which cost about £90, weighed with battery 15lb, had 21 transistors and two EHT valve rectifiers in a doubler circuit, and used a small 2in. picture tube with an optical magnification system with beam-splitter and concave mirrors. Larger screen direct-viewing models are now available, including a 19in. portable model by Motorola with 23 transistors and 12 diodes, and weighing 40lb. The  $114^\circ$ -deflection picture tube in this model is designed for operation with 100V on A1 and is driven by a 20V peak-to-peak video signal. The set has a 15kV regulated EHT supply. There is no retail price maintenance in the United States so that prices are only "recommended" by the makers; for the Motorola transistor model this

is just under £100, with an extra £30 for a mains-operated power supply and charger for the 20V silver-cadmium battery which provides some five to six hours portable operation.

Typical of the tuner units fitted in these transistor sets is the 13-channel incremental-switch model by the General Instrument Corp. which has three micro-alloy-diffused transistors (MADT); one as a neutralised grounded-emitter R.F. amplifier, the second as mixer, and the third as a local oscillator. The unit requires only 8.5mA from a 12V supply. Noise figures are given by the makers as 9–12dB on the higher frequency channels and 4.5–7.5dB on the lower frequencies.

### Remote Control Units

The increasing interest of British manufacturers in remote control devices has been much in evidence during recent months; in this respect they are catching up with the United States where many different types of control units have been tried out during the past few years. For example, a very simple pneumatic control was introduced during 1960 by one maker but dropped in his 1961 models, comprising a length of plastic tubing with an air bulb. Squeezing the bulb caused air pressure to operate a micro-switch, either turning the receiver on, or advancing the channel selector. To overcome the problem of control cables, several different media have been used: radio frequency control; light beams with a hand-held torch which was shone towards photo-cells in the receiver (liable to be affected by changes in ambient light); and the currently favoured ultrasonic systems.

Most of the ultrasonic systems now in vogue in the USA have been seen over here. The generators, usually tuned to about 40kc/s, comprise either transistor oscillators or resonant reeds which are "hit" by small hammers. Systems differ in the number of "functions" or control channels provided. These ultrasonic systems have been found to be relatively free from the troubles of mutual or external interference.

### Miscellaneous Features

The squarer 19in. and 23in. picture tubes are now widely featured. These picture tubes often have an integral bonded safety glass as it is claimed that, apart from eliminating dust between the surfaces, reflections are materially reduced.

Valve VHF tuners generally resemble U.K. practice though a recent innovation by R.C.A. is to fit one of their newly developed "Nuvistor" valves as a triode R.F. stage.

Although the Americans are generally regarded as "audio" conscious, this is not reflected to any great extent in the audio stages of the average television set, most of which use a single pentode output valve. However, a few makers fit push-pull output stages, or multi-loudspeaker systems, or both.

# VALVE FAULTS

## RECOGNISING FAULT SYMPTOMS AND ASSOCIATING THEM WITH SPECIFIC COMPONENTS

By G. J. King

IT has been proved that a large number of the many faults which occur in domestic television receivers each year are the direct result of valve faults, and it is of great advantage if the symptoms which these faults produce can be associated with a particular valve with the least amount of trouble. The knowledge that a particular symptom could be caused by a fault in a particular valve, at least, signifies to the technician the first move that can be made in the process of curing the trouble, without the need to delve too deeply into the circuit.

With this in mind, this article sets out to analyse from the practical angle some of the fault symptoms which could be caused by faulty valves, but it must be borne in mind that symptoms similar to those to be described could also be caused by a fault in an associated component or circuit. Nevertheless, in the large majority of cases, it will be found that the suspect valve is, in fact, responsible.

### Valve Microphony

This is a valve fault which only shows up when the valve is used in certain circuits. For example, microphony developing in the frame amplifier valve will invariably cause the symptom of sound interference on vision. Horizontal dark lines will occur across the picture in sympathy with the sound signal. This effect could, of course, be caused by other troubles, but when the frame amplifier is the culprit it will be found to clear by turning the volume control right back.

Further proof that the valve is at fault is available by gently tapping the valve with the handle of a screwdriver while observing the picture. If the picture is similarly disturbed each time the valve is tapped, one can be almost sure that the fault will be cleared when the valve is replaced. It is interesting to note that microphony may not be revealed by checking the valve on an ordinary valve tester.

Microphony in the sound output valve will produce a ringing sound superimposed on the sound signal from the loudspeaker. The effect is often aggravated when the sound volume is turned up fairly high and when high-frequency notes are reproduced. Again, a check is possible by turning down the volume control and tapping the suspect valve with the handle of a screwdriver. The valve should be replaced if ringing occurs in the loudspeaker each time the valve is tapped.

Similar microphony effects may occur in the tuner valves, notably the frequency changer, but the test

for these valves and for any prior to the detector (sound or vision) must be made with the aerial removed from the set and the volume and contrast controls fully advanced. Some form of microphony can only be detected when the set is responding to an unmodulated carrier. The valve responsible in this case can be located either by running the set when an unmodulated sound or vision carrier (or both) is being radiated by the transmitter, or by feeding in an unmodulated signal from a signal generator tuned to the sound or vision carrier as required.

### Microphonic Line Timebase Valves

Microphony in the line timebase oscillator valve often causes the picture to judder sideways whenever the receiver is subjected to vibration. This can happen in sympathy with the sound from the loudspeaker when the volume is turned up to a fairly high level. In some cases the line hold may be destroyed intermittently with loud passages of sound or when the cabinet or the faulty valve is tapped.

Similar trouble in the line output valve can give rise to a vertical ripple effect on the picture, as shown in Fig. 1. This, of course, will only happen when the valve is subjected to vibration. In sets using flywheel sync circuits, such as the Ferguson 991T, microphony in the line oscillator also produces a symptom similar to that shown in Fig. 1.

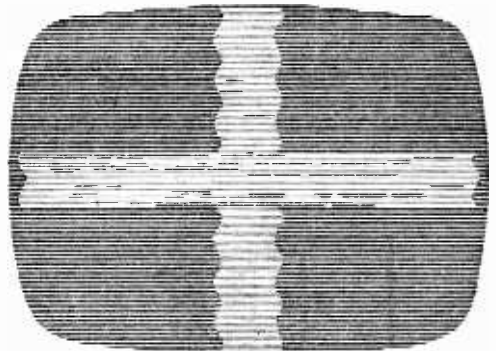


Fig. 1.—The symptom of microphony in the line amplifier valve, on valves associated with flywheel sync.

However, if the reactance valve or discriminator diode suffers from microphony, the whole picture tends to oscillate sideways within the raster whenever the impaired valve is tapped or caused to vibrate.

### Loose Electrodes

A common fault with certain valves is that the electrodes become insecure from their mountings and that poor connections develop within the valve. This trouble can eventually lead to inter-electrode shorts, but the first stage of the trouble may not be as severe as this. With timebase oscillator valves it is often found that either the vertical or horizontal lock is completely destroyed by tapping the faulty valve with the handle of a screwdriver, and that the lock can be restored by a further sharp tap.

In the sound channel, disconcerting cracklings are produced from the loudspeaker each time the faulty valve is tapped or when the volume is turned up too high. It should be noted, however, that similar effects are also caused by bad connections between the valve pins and the valveholder sockets, but this trouble can easily be proved by rocking the valve in its holder. If this action causes the effect, then the valve pins should be cleaned with fine-grade emery cloth and the valveholder sockets tightened or the valveholder replaced.

#### Frame Valve

If the trouble exists in the frame amplifier valve, dark, horizontal, lines will appear across the picture when the valve is tapped, and in severe cases the whole frame may collapse to a bright, horizontal line. In some cases, the linearity is affected as the valve is subjected to vibration, and, when the valve becomes highly sensitive to this fault condition, the frame linearity may alter with sound from the loudspeaker.

In the line output valve, the picture width often varies when this fault exists, and in some cases a change in the note of the line timebase whistle is observed. This may well be accompanied by flashing in the valve, since large pulse voltages exist in it and flashing occurs around the loose electrodes. Once a line output valve deteriorates to this condition, it is as well to replace the valve immediately as it is likely to ruin the line output transformer if it is left in a shorting condition for even a short while.

Loose electrodes in the frequency changer or oscillator valve invariably cause random changes in oscillator frequency. Such changes may swing the sound and vision tuning point outside the range of the fine tuning control, or they may alter the

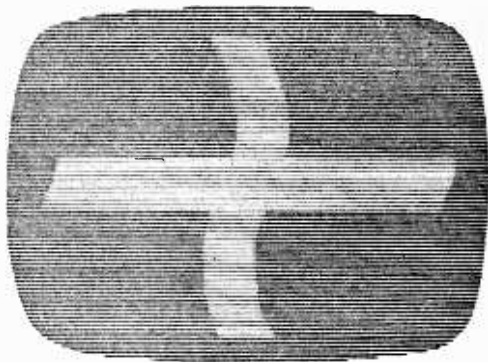


Fig. 3.—The fault of hum in the line timebase caused by poor heater-to-cathode insulation.

#### R.F. Section

In the R.F. amplifier valve, picture and sound "noise" may come and go in a random manner when this trouble exists. This is because the very small movement of the loose electrodes causes random detuning of the R.F. circuits. The same effect may well be observed if the fault exists in one of the I.F. amplifier valves, but usually in these stages, the sensitivity of either the sound or vision channel is affected intermittently, as can be proved by tapping each valve in turn until the one responsible is brought to light.

Loose electrodes in the video amplifier valve generally cause intermittent alteration in the black and white ratio of the picture. The effect is that the picture is perfectly normal at one instant, and then suddenly the picture will be far too under-contrasty, or it may suddenly become far too black and white and continue varying in this manner as the faulty valve is subjected to vibration.

#### Low Emission Valves

Low emission shows its effect more vividly in the timebase circuits than in the signal carrying stages. Nevertheless, low emission of the tuner valves, particularly the R.F. cascode double-triode, will produce an excessive amount of picture grain, especially on the Band III channels, and this is likely to be accompanied by a high level background hiss on sound.

Low emission of the I.F. amplifier valves should be suspected if the sound and vision sensitivity appears to be considerably impaired. If both sound and vision are low, the I.F. valve common to both signals should be checked for emission, and replaced if necessary. If it is the vision channel which is affected, and at full contrast the picture only just locks and is very weak, the vision I.F. amplifier valves should be checked. The same applies to the sound I.F. valves if the vision is normal and the sound is weak, even at full volume. In this latter case, however, a check should also be made of the sound A.F. and output valves. An indication that the emission of an I.F. or A.F. valve is below normal is when the voltage measured between the valve cathode and chassis is below that given in the service sheet, in spite of

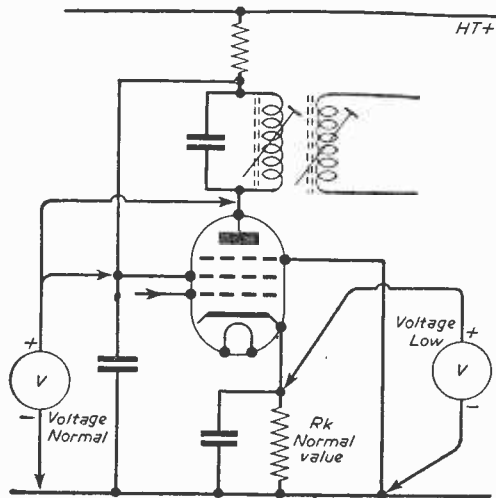


Fig. 2.—Testing for low emission in a valve.

tuned frequency by only a small amount, thereby necessitating frequent resetting of the fine tuning control in order to maintain optimum picture and sound, consistent with minimum sound interference on vision.

the correct voltages being present on the other electrodes and the cathode resistor being of correct value. This check is shown in Fig. 2.

### Confusion With Tube Fault

When the video amplifier valve is low in emission, the effect can be very much like a worn CRT. The white parts of a picture tend to flatten out when the contrast is turned up, and in some cases the picture may even go negative. There is also the possibility that the sync pulses may become distorted, resulting in the vertical and horizontal holds becoming somewhat critical in operation.

Low emission of the line output valve is usually revealed by insufficient picture width, even at full setting of the width control or inductor. This produces a black margin down each side of the picture, and may sometimes affect the picture height as well, depending on whether the frame

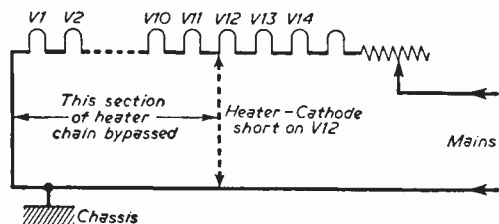


Fig. 4.—A heater-to-cathode short in V12.

timebase draws power via the efficiency diode circuit. In certain cases, the left-hand side of the picture may not be affected as much as the right-hand side, and the right-hand side may be bordered by a fairly bright vertical line, producing slight foldover. The EHT voltage is also likely to be reduced, which will result in poor focusing or prevent optimum focusing from being achieved, even with the focusing lever adjusted hard against one of its stops.

Trouble of a like nature is possible when the efficiency diode (the PY81 type of valve) is low, but here the left-hand side of the picture (when viewing from the front of the screen) is mainly affected. The horizontal linearity towards the left of the picture may well be disturbed, and the half of the picture towards the left of the screen may be less bright than the remainder. Again, the frame amplitude may be below normal, and this may not be corrected by adjustment of the height control. Vertical non-linearity may also be apparent.

In the frame circuits, insufficient height will be the main symptom, but if the frame output valve is the culprit there is likely to be foldover and severe cramping at the bottom of the picture. General frame non-linearity is an accompanying effect, and this may or may not be corrected by the frame linearity control. In any event, the height control will have to be set at very near maximum in order fully to scan the screen.

### Grid Current Effects

A valve passing grid current can cause very odd symptoms, depending on the circuit in which the valve is employed. For example, grid current in

the output valve will tend to cancel out the standing bias and cause very bad distortion. Certain triode-pentode valves are prone to this trouble, especially if the heater current is above the correct value. The trouble may not exist when the set is first switched on, but may take some time to develop, and in the example given the sound would progressively become more distorted as the temperature of the valve increases.

In the frame circuits, such valve trouble causes severe non-linearity, often stretching at the top of the picture and cramping at the bottom, as the valve warms up. If the oscillator valve is faulty in this way, it may be necessary to correct the frame hold from time to time during a viewing period to prevent the picture from rolling. Progressive drift of the line hold may be apparent when the fault is in the line oscillator valve, calling for similar correction of the line hold during a viewing period.

Grid current in valves connected to the A.G.C. line can upset the A.G.C. action and even render the contrast control partially inoperative. This is because a positive potential is reflected back into the A.G.C. line, and this tends to cancel the A.G.C. bias to some degree. Valves taking grid current often operate at a temperature far in excess of normal.

### Heater-to-Cathode Leakage

Developed across the cathode resistor of a valve which has poor heater-to-cathode insulation is an A.C. voltage which is reflected into subsequent stages. In most cases, this produces mains ripple symptoms. For example, poor heater-to-cathode insulation in the A.F. amplifier valve injects an A.C. voltage to the control grid of the output valve, and thus causes a hum on the sound.

Such trouble in the frame timebase valves, or even in the sync separator, gives the symptom of opening and cramping of the frame scan, and may also cause intermittent frame locking and picture jumping.

In the signal-carrying stages, modulation hum is likely to occur, i.e., hum will only be present, either on the sound or vision (e.g., ripple on picture), when the set is receiving a signal. The hum voltage will, in fact, modulate the carrier of the sound or vision signal passing through the faulty valve.

Hum injection into the line timebase will give a horizontal displacement of the picture, often in a completely sinusoidal fashion, as shown in Fig. 3. In all normal cases, as with 50c/s ripple on the H.T. line, owing to faulty smoothing, the hum effect will be locked to the picture and therefore will not move because the frame timebase sync pulses transmitted are locked to the mains frequency.

If a dead short occurs between the heater and cathode in a valve in which the cathode is connected direct to chassis, and the set is of the A.C./D.C. type, then a section of the heater chain will be short-circuited. The effect will be that the section of the heater chain which is shorted will not light up, but the heaters of the valves of the section remaining in circuit will light up brighter than normal. This is a dangerous condition because the valves lighting up brightly are being

(Continued on page 365)

# Telenews

## Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of January, 1961, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	Total
London Postal .. ..	1,892,739
Home Counties .. ..	1,338,456
Midland .. ..	1,878,691
North Eastern .. ..	1,896,356
North Western .. ..	1,462,933
South Western .. ..	944,034
Wales and Border Counties .. ..	672,771
<b>Total England and Wales .. ..</b>	<b>9,985,979</b>
Scotland .. ..	993,283
Northern Ireland .. ..	159,196
<b>Grand Total .. ..</b>	<b>11,148,463</b>

## Outside Broadcast Vehicles for Switzerland

TWO television outside broadcast vehicles have recently been exported to Switzerland for use by the Swiss Broadcasting Corporation to the Tessin area. The vehicles were equipped by Marconi's Wireless Telegraph Co. Ltd.

One vehicle houses the main body of the technical equipment, and the other the vision and sound mixers and the commentators. Three languages can be handled simultaneously on the sound side—German, French and Italian—and a Eurovision control panel has been incorporated.

## TV Station for Dover

THE BBC's new low-power television station near Swin-gate, which shares the site of the Air Ministry radio station on the cliff some 400ft above Dover, was brought into operation on 1st February. It replaces the temporary station which has been serving the Dover area since April 1958.

The new station is equipped with two 500W vision and two 125W sound transmitters manufactured by Standard Telephones

and Cables Ltd. One set of equipment is a reserve for use in the event of a fault in the other. The power is the maximum that can be used if interference with other BBC and Continental television stations, with which Dover must share a frequency channel in Band 1, is kept to acceptable limits.

Like the temporary station, the new station will transmit on Channel 2 (vision 51.75Mc/s offset by -6.75kc/s, sound 48.25Mc/s offset by +31.5kc/s). The transmissions will be vertically polarised.

An improved directional aerial, mounted on a 38ft cantilever extension of one of the disused 350ft Air Ministry towers, gives minimum radiation towards the Continent and maximum radiation in a northerly direction, so that places like Deal, Ramsgate, Broadstairs and Margate will

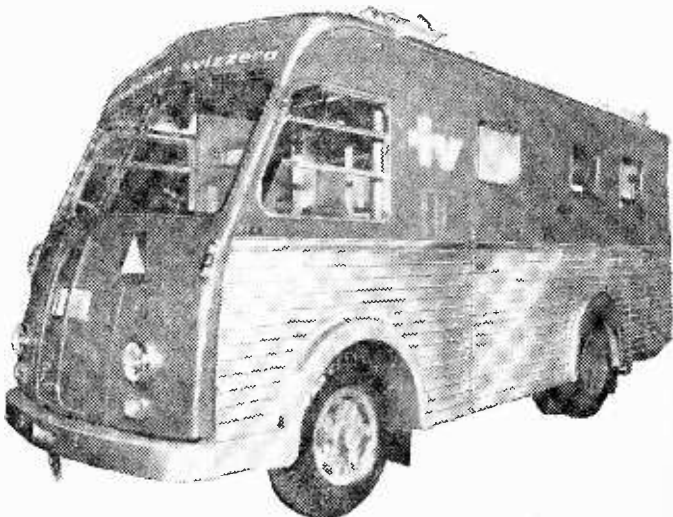
receive a stronger signal than they did from the temporary station.

## New Method of Checking Floor Flatness

A QUICK and accurate method of measuring the flatness of floors has been evolved by the Taylor, Taylor and Hobson Division of Rank Precision Industries Ltd.

This new method, using the Sweep Optical Square, has been used by the Company at the BBC Television Centre at the White City to check flatness of studio floors, an essential requirement for the operation of TV cameras to prevent any shaking when they are moved.

Modern scientific progress in operating theatre and film studio equipment has resulted in a far greater demand for this type of measurement.



One of the outside broadcast vehicles which have recently been delivered to the Swiss Broadcasting Corporation.

The Sweep Optical Square provides a flat plane which is independent of gravity and is adjusted to pass through three known height points on the surface being checked. A travelling target enables the height of all other parts of the surface to be measured relative to this plane. The instrument is used in conjunction with the 'Micro' Alignment Telescope which is widely employed in industry to check alignment and squareness.

The reference plane is obtained by mounting a pentagonal prism beneath the telescope and rotating it about an axis concentric with that of the telescope. This provides a reference plane true to within 1 second of arc in angle, plus 0.0005in. in displacement. An optical micrometer is built into the prism box for the purpose of measuring errors of flatness to the reference plane. Readings are taken in units of 0.001in. with a total measuring range  $\pm 0.05$ in.

#### Equipment on Exhibition Train

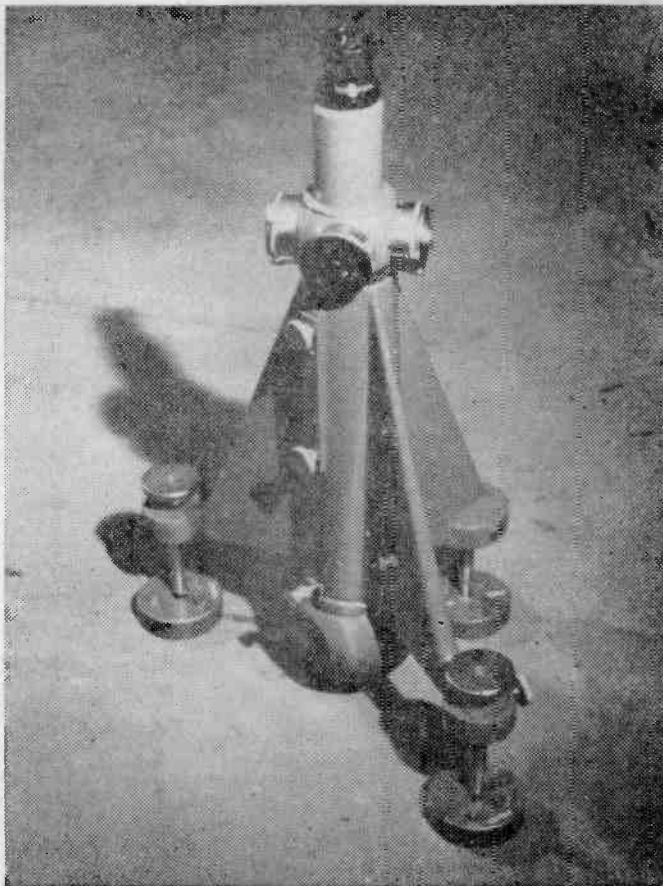
**T**HE exhibition train which completed a 36-day tour of the West Country advertising Westward Television's new commercial service — which begins transmission on April 29th—contained a fully operational TV studio equipped by Marconi's Wireless Telegraph Co. Ltd. During its tour the train visited 23 towns in the programme contractor's area. The tour opened on February 13th after the train had been on view at Olympia Station, London, for two days.

Marconi's supplied the television cameras and teletext equipment for the train.

Marconi's also provided five Mark IV television cameras, a vidicon camera and associated equipment for the control rooms of Westward Television's new studios at Plymouth.

#### One To Do the Job of Many

**T**HE Grange Estate at Letchworth, Hertfordshire, will in future have no more aerials for television fitted above its many roofs, for after experimenting in one part of the estate with a "master" aerial system, the Council have found that such a system provides for excellent viewing and also rids the roof tops of an unsightly forest of individual aerials. The new



*This instrument is used for checking the flatness of TV studio floors.*

"master" system will cost each household just ninepence per week.

#### Trade Test Transmissions

**T**HE Independent Television Authority announces that full-power trade test transmissions began from its Caradon Hill transmitter, near Liskeard in Cornwall, on 1st February 1961. The transmissions consist primarily of Test Card "C" and begin at 10.0a.m. daily except on Sundays.

The transmitter radiates in Channel 12 and the signal is vertically polarised. The actual carrier frequencies are vision 209.74325Mc/s, sound 206.23Mc/s.

The station is equipped with a pair of vision transmitters each having a maximum power output

of 5kW (peak white) and a pair of sound transmitters each having a maximum power output of 1.25kW (carrier).

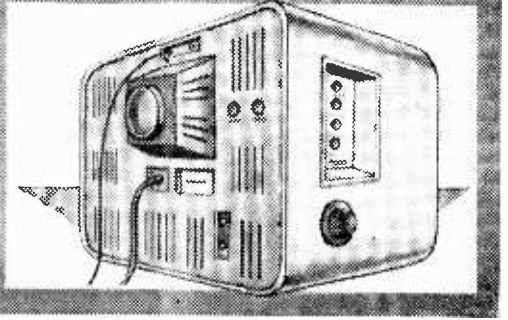
The station has an effective radiated power (vision) of 200kW to the South-West, 25kW to the South and South-East and 10kW to the North-West and North-East.

Caradon Hill is some 10 miles north-west of Liskeard and the station is 1,215ft above sea level.

The Caradon Hill station, together with its sister station at Stockland Hill, near Axminster in Devonshire, radiates the programmes provided to the ITA by Westward Television Ltd., whose studios are in Plymouth.

It is hoped that programme transmissions will begin about the end of April.

# Servicing Television Receivers



No. 66—THE DECCA DM45

By L. Lawry-Johns

THE Decca DM45 is a 17in. receiver with VHF radio and the DM55 is the 21in. version of it. These notes may be used in conjunction with the DM35 (17in.) and DM56 (21in.) models, but as these have no VHF radio the circuit differs inasmuch that V14 is not fitted, and the associated circuitry as well as the TV/VHF switching is omitted.

### Cleaning Screen

Place the receiver on its side and remove the curved wooden strip and rubber packing strip. The viewing window may then be slid through the slot at the bottom of the cabinet. When replacing, ensure the packing strips are in position at the top as well as at the bottom of the window. The window and tube face are best cleaned with an anti-static polish, but ordinary window cleaner may be used if desired.

### Chassis Removal

Remove the rear cover by slackening the screws and sliding them inwards. Pull off the top

control knobs. There are two screws in the control panel which must be removed. A further two screws secure the lower flange of the chassis. When these are removed the chassis may be swung outwards and upwards on its hinges. It may be removed completely by disconnecting the tube base socket, EHT clip, loudspeaker and scanning coils plugs. The chassis is then lifted from its top hinges.

### Fault Conditions

The symptoms of no vision, no sound, should first direct attention to the fuse which, if blown, will cut off the supply to the valve heaters and surge limiting sections of the mains dropper. If the fuse has failed, fit another and carefully note the valve heaters. If, after a few seconds, the PY82 valve heaters light up brightly, immediately switch off and remove the PY83 valve from the line output section. This may well have a heater-cathode short. Have the valve tested for heater-cathode insulation or, better still, try another valve. If the valve

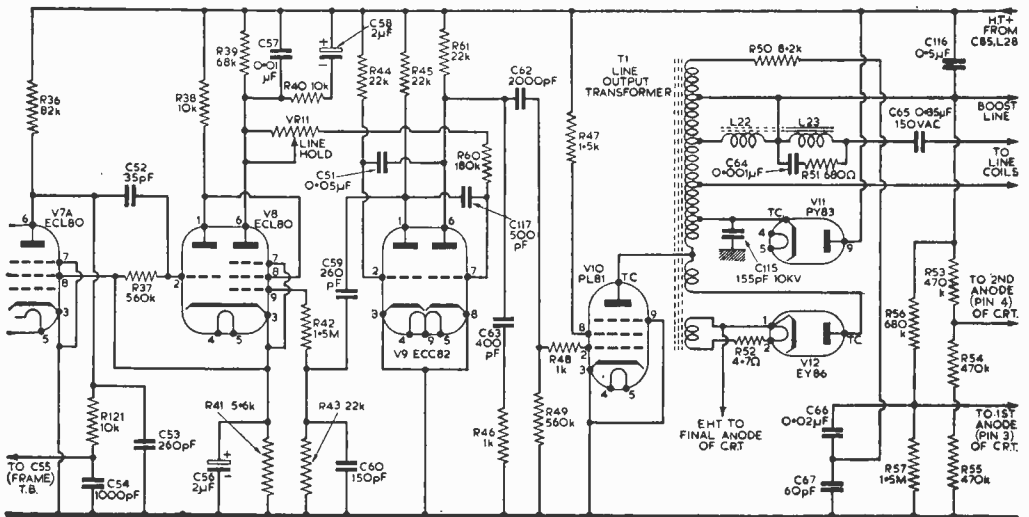


Fig. 1.—The line output and oscillator circuits.



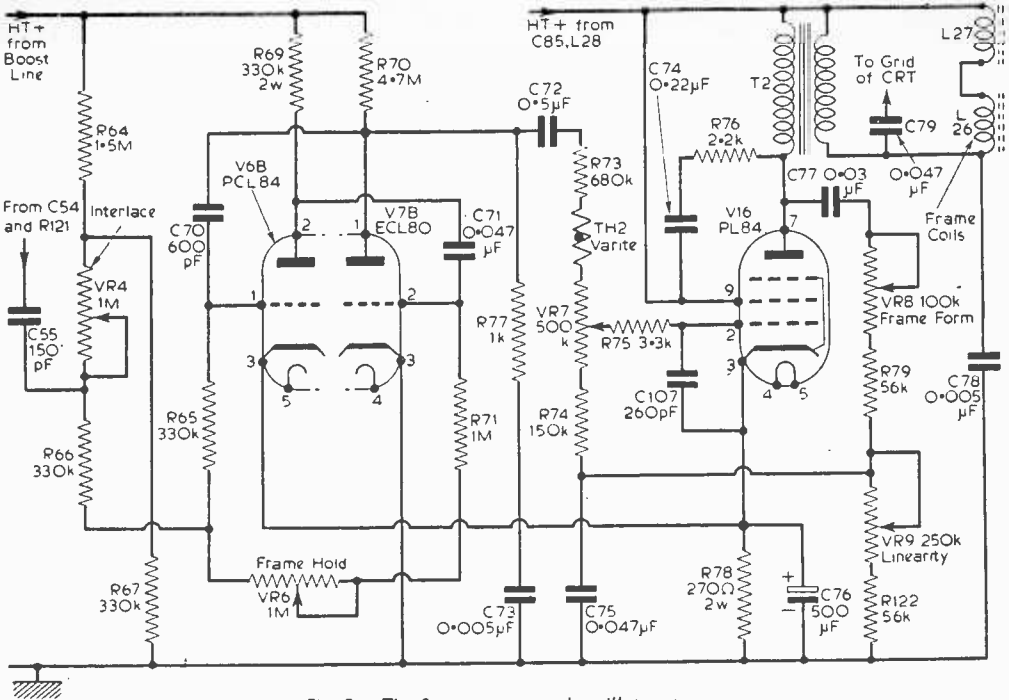


Fig. 2.—The frame output and oscillator stages

heaters now warm up normally, closely observe the PY83 valve, which may overheat (at this stage ignore the PL81). If the PY83 anode becomes overheated, switch off and test C115, which may be a 175pF or 155pF capacitor rated at 10kV.

This may be found shorted, and its replacement should cure the particular fault outlined above. There are, however, some variations on this theme which can be confusing.

The capacitor C115 may or may not be respon-

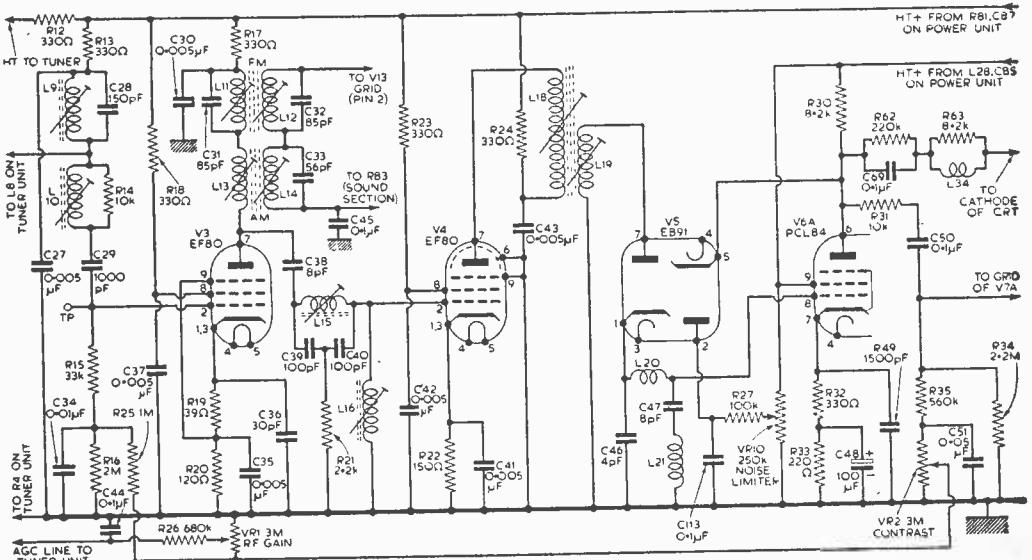


Fig. 3.—Final common I.F. stage, vision detector and vision output circuits. (Resistors R28, R29—3.9k and 2.2k respectively—are connected in series from pin 8 of V6A to chassis, the junction of the two being a test point).

VOLTAGE TABLE

VALVE	ANODE (V)			SCREEN (V)			CATHODE (V)		
	Pin No.	TV	VHF	Pin No.	TV	VHF	Pin No.	TV	VHF
V3 EF80... ..	7	145	195	8	150	260	3	4.5	5.0
V4 EF80... ..	7	180		8	190		3	5.0	
V5A } EB91 ... ..	7						1	0.9	
V5B }	2	*0/140					5	135	
V6 PCL84 ... { A	6	140		9	195		7	10.5	
{ B	2	95					3	15.0	
V7 ECL80 ... { A	6	140		8	35				
{ B	1	70							
V8 ECL80 ... { A	1	130							
{ B	6	120		8	132		3	35	
V9 ECC82 ... { A	1	80							
{ B	6	130							
V10 PL81 ... ..	TC	No test		8	160				
V11 PY83 ... ..	9	200					TC	No test	
V12 EY86 ... ..	CRT Anode 14.5 to 16.5kV								
V13 EF80... ..	7	150	195	8	100	135	3	1.0	1.5
V15 PCL82 ... { A	8	75	80						
{ B	6	170	220	7	170	220	2	10.0	
V16 PL84 ... ..	7	180		9	190		3	15.0	
V17 ... ..							3	210	250
V18 ... ..							3	210	250
CRT ... ..				3	420				

BOOST VOLTAGE: JUNCTION C116/R56 620

\* Varies with setting of limiter. Contrast and R.F. gain set to maximum, minimum signal input to lock timebases; all other controls set for normal picture. Readings taken with 20k/V meter except EHT.

sible for a heater-cathode short in the PY83, but it is quite likely that such a condition could cause the preceding valves, PL81 and both PY82 to fail, or also develop heater-cathode shorts, fortunately not all at once (although the writer has known this), but any one of them. Therefore it is prudent to proceed with caution when tackling a fault of this nature. An added complication occurs when the mains dropper fails (R107-R108). This can fail without a valve fault causing it, but the above-mentioned condition may "blow" it owing to excess current flow. Therefore, if the fuse has blown, but

a replacement fails to produce any results, check the continuity of the R107-R108 sections of the mains dropper before proceeding to check the heater chain. It should be noted that the thermistor T.H.I. (VA1015) may be fitted between the PY82 valve heaters and not as shown in the diagram.

**No picture—sound in order**

Advance the brilliance. If there is no illumination on the screen, listen for the line timebase whistle. If this cannot be heard check the PL81 and PY83 valves in the line timebase section. The PL81 may

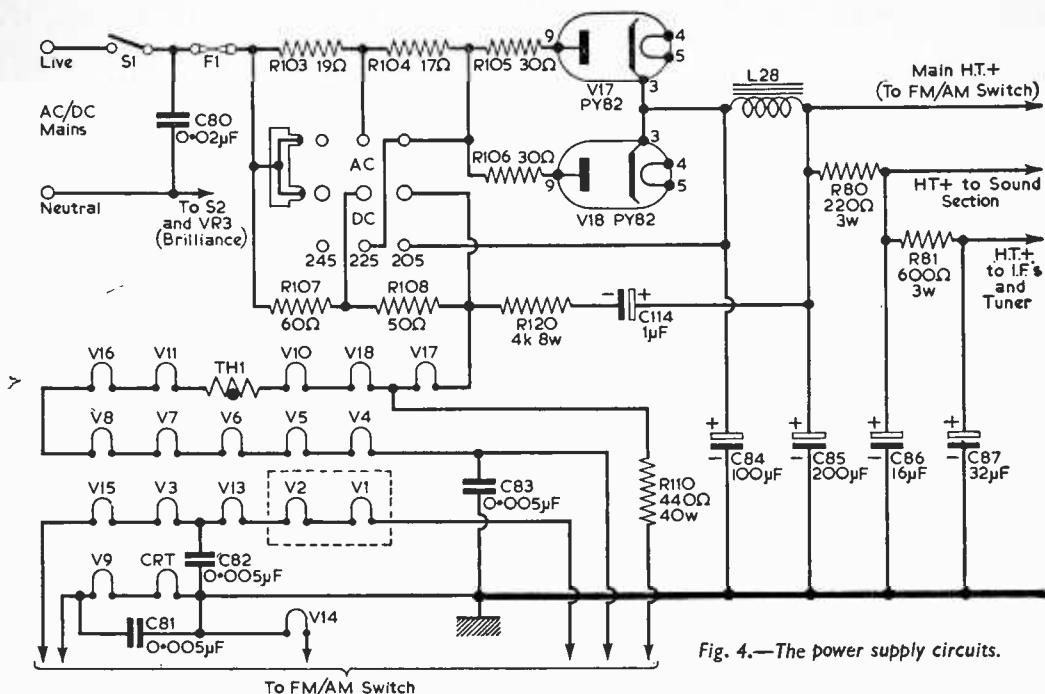


Fig. 4.—The power supply circuits.

well be at fault and a replacement will restore normal conditions, but the fact that it is overheated is not necessarily an indication that it is defective.

A faulty ECC82 (V9) will cause the PL81 to overheat owing to lack of line drive. In every case, replacement is the best possible test.

If the line whistle is audible, check for spark or glow at the EY86 top cap. Although the top cap may be covered, bringing a screwdriver blade into contact with the cover will cause a visible blue glow if the EHT is applied. If this is present, but the EY86 does not light, replace it as it probably has an o.c. heater.

**No picture, but uncontrollable brilliance**

If the screen is fully illuminated and the brilliance

**507ft TOWER FOR LONDON**

For some time now the Post Office has been faced with the risk of obstruction to television links and public telephone services from the high buildings already built in London.

These services are going to depend more and more on microwave radio links, which require a clear line of sight from point to point, and high buildings on this line can break the link. To overcome the problem the Post Office plans to build a 507ft tower at the Museum exchange in Howland Street, London, W.1, to replace the radio mast on the existing building. At Museum exchange is located the switching centre for the interconnection of outlets from London to the existing national radio and television network in the London area and the BBC and ITA transmitters and from numerous television studios in the London area. It is also the London

control has no effect, check C79, the 0.047µF frame flyback capacitor at the top of the chassis reverse side which may well be shorted, thus causing the CRT grid to be held at H.T. potential. A defect in the tube could cause similar symptoms, and a meter check should be made if there is any doubt, noting the voltage at pin 6, which should vary with the setting of the brilliance control. If the reading does not vary at pin 6 but remains high, short pins 1 and 8 (heater) and remove the base socket. If the reading now follows the variation of the control, the tube is at fault. If it remains at about H.T. potential, C79 is most likely to be at fault, but C68 (0.5µF) must be checked also, as this also connects to the H.T. line.

(To be continued)

focal point for microwave radio links over which more and more trunk telephone traffic is being carried instead of by underground cables.

**TELEVISION IN SOUTH-WEST ENGLAND**

The Independent Television Authority announces that programme transmissions in South-West England are planned to commence on April 29th, 1961.

Independent Television programmes will be provided by Westward Television Limited, whose studios are at Derry's Cross, Plymouth, and will be broadcast from the Authority's transmitters at Caradon Hill in Cornwall and Stockland Hill in Devon. These two stations will cover a population of over 1½ million living in Devon, Cornwall, and parts of Dorset and Somerset.

# Using Tuner Units

By K. Jones

## COUPLING MULTI-CHANNEL TUNERS TO SINGLE-CHANNEL RECEIVERS

Now that at least two new commercial television transmitters are about to go on the air (in Devon and Cornwall), many viewers will be considering the possibility of connecting multi-channel tuners to their existing Band I-only receivers. Such tuners are often obtained through advertisements in the technical press, and most experimenters realise that the output of the tuner must match the I.F. of the receiver. However, the relationship between the sound and vision I.F.s sometimes causes a little bewilderment, because some sets have a sound I.F. "above" the vision I.F., while other sets have a sound I.F. "below" the vision I.F.

tuner producing signals which are acceptable by the receiver's I.F. stages. How can these signals be connected to the set with the least amount of disturbance?

A simple arrangement is to connect the tuner signals to the cathode of the receiver's common I.F. amplifying valve, as shown in Fig. 1. There should be no alteration to the screen and anode circuits, but the cathode bypass capacitor should be disconnected and possibly the value of the cathode resistor altered. In effect, the stage is changed into an earthed grid amplifier, and this is accomplished by disconnecting all the original components from the control grid circuit and then connecting the grid to chassis, as the diagram shows.

The input impedance at the cathode is almost equal to the reciprocal of the valve's mutual conductance (e.g.  $Z_{in} = 1/g_m$ ). The mutual conductance of such a valve is in the region of 7.5mA/volt, which means that the cathode input resistance would be around  $130\Omega$ . This in parallel with the cathode resistor, say,  $160\Omega$ , looks something like  $70\Omega$  to the tuner signal output coaxial, which itself is about  $70/75\Omega$ . Thus, a good impedance match is secured with very little trouble.

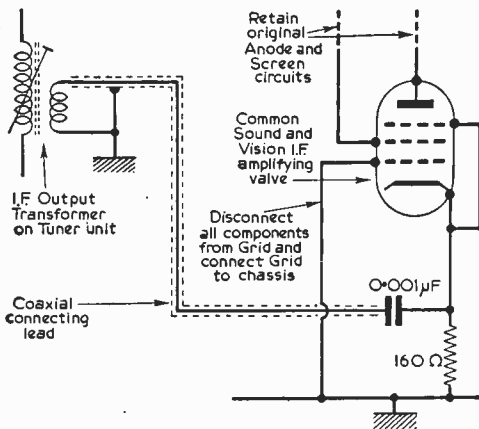


Fig. 1.—A simple method of cathode injection.

Most of the five-channel Band I-only sets have sound above the vision, which means that the receiver's local oscillator is adjusted to work above the signal-frequency, while the converse follows with the earlier single-channel sets, in which the local oscillator is adjusted to work below the signal-frequency. Even though the I.F.s may be correct, therefore, it is essential to ensure that the tuner's sound and vision relationship corresponds to the receiver, for it is no simple matter to modify a tuner to change round the I.F.s.

Most experimenters are also conversant with H.T. and L.T. connections on the tuner, and previous articles have dealt with this matter in some detail. There is still much debate, however, concerning the best method of injecting the signals from the tuner into the receiver's I.F. stages.

### I.F. Injection

Basically, the exercise is a very simple one. On the one hand we have a superhet television receiver with the original R.F. and frequency changer stages disconnected, and on the other hand a multi-channel

### I.F. Injection at Band III only

If the tuner is of the type which converts the Band III-only signals to intermediate-frequency signals, and the set is expected to work normally on Band I, some form of switching is essential since

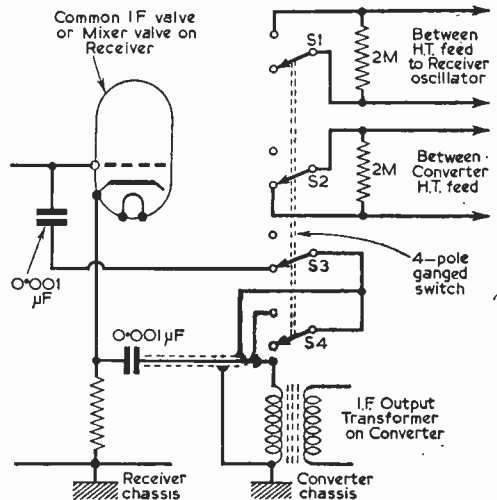


Fig. 2.—A method often required where the converter is for Band III only, and the existing R.F. and oscillator stages are used for Band I.

Switch section S3 would not be required where the tuned circuits connected to the valve grid are adjusted to Band I.

the converter or tuner cannot remain connected when receiving Band I signals. There are certain Ferguson tuners available under this category on the surplus market, so it will be instructive to consider the fitting of this type to an ordinary receiver, or receiver other than a Ferguson model.

common I.F. amplifying valve, as shown in Fig. 3(a). The anode, screen and cathode circuits should not be altered, but all the components should be disconnected from the control grid circuit, and this grid loaded to chassis by a 100Ω resistor. This represents a reasonable match to the tuner output impedance, as does the cathode circuit of an earthed grid stage.

A useful increase in gain is possible by coupling the tuner signals to the common I.F. stage through a matching transformer, as shown in Fig. 3(b). The transformer should be wound on a standard ¼ in. former, preferably with a screening can, and the grid winding should comprise 50 turns of 36 s.w.g. enamelled covered wire for I.F.s between 9 and 15Mc/s, 40 turns for I.F.s between 15 and 20Mc/s and 15 turns for I.F.s between 34 and 40Mc/s. The coupling coil should consist of two or three turns of larger-diameter PVC-covered wire wound round the earthy end of the grid winding. The coil former should contain an adjustable dust-iron slug, which should be tuned for optimum sound and vision.

A signal step-up of some 10 times (20dB) is possible by this method, and this is very useful where extra gain is required in fringe areas.

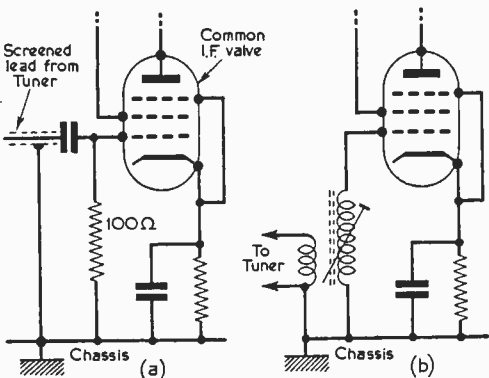


Fig. 3.—(a) A method of injecting the signals from multi-channel Tuners.

(b) For additional gain, the tuner signals can be coupled via a step-up matching transformer, winding details of which are given in the text.

**Additional Gain**

A further increase in gain is possible by retaining the existing frequency changer or mixer valve and altering the wiring of this so that the stage corresponds to a common I.F. amplifier. This is easily possible in those receivers using a pentode frequency changer or pentode mixer. The oscillator in the receiver should be completely disconnected and the associated coil and components removed from the chassis. The valve's cathode circuit can remain as in the original design and so, in most cases, can the anode circuit. The screen grid should be connected via a 1k resistor to the H.T. line and decoupled by an 0.001μF capacitor.

The tuner signals can then be coupled in at the control grid, across a 100Ω resistor, as in Fig. 3(a) or, if even greater gain is required, via a step-up transformer, as in Fig. 3(b).

In receivers which use a triode as the mixer and a triode as the oscillator, the oscillator triode should be completely disconnected and the associated components removed from the chassis, and the tuner signals should be injected at the cathode, as shown in Fig. 1.

In most cases it is desirable to use the existing mixer valve for signal injection, as this procedure facilitates the control of contrast, and avoids excessive alteration to the contrast control circuits.

The signal, again, may be injected at the cathode of the common I.F. amplifying valve, but for Band III reception a switch must be incorporated to do four things: To switch H.T. to the tuner; to switch off the Band I local oscillator; to switch a capacitor between the control grid of the common I.F. stage and chassis; to switch a capacitor between the cathode circuit and the tuner output lead. When the switch is in the "Band I" position, then it will switch off the H.T. to the tuner; switch on the Band I local oscillator; switch out the capacitor in the grid circuit; switch the coupling capacitor across the cathode resistor.

The idea is shown in Fig. 2. The various leads should be as short as possible, and this applies in particular to those in the signal carrying circuits.

It is often possible to use the existing mixer section of the Band I frequency changer valve as an I.F. amplifier on Band III, and inject the tuner signals into the cathode circuit as before. The arrangement in Fig. 2 is suitable for this, but only three switch sections will be required, as the control grid need not have a capacitor switched between it and chassis. This is because the grid circuit of this valve will be loaded with a Band I tuned circuit, and for I.F. signals this can in any case be considered as a short-circuit.

**Tuners covering Bands I and III**

With the ordinary multi-channel tuner, such as the turret or incremental type, complicated switching is not necessary. The original R.F. and frequency changer stages can be removed from the set and the tuner signals injected at the grid of the

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# Flywheel Synchronisation

## Part 1

### EFFECTS OF NOISE

By R. Talks

**T**HE whole aim of synchronisation is to control the receiver timebase so that the picture appears in the correct place on the raster in every line. The transmitter provides sync pulses accurately placed relative to the picture information. In practice, these sync pulses control the moment at which receiver flyback starts. Flyback should start at the same moment relative to the sync pulse in every line, for changes in the moment of triggering produce changes in the position of the picture on the raster. Small changes from line to line produce the well-known "raggedness" of vertical edges in the picture. To obtain some idea of the magnitudes involved, we can say that  $1\mu\text{sec}$  displacement of picture information along a line represents roughly 4mm (0.16in.) shift on a 17in. tube. This order of raggedness is intolerable. Generally some four to eight times less is necessary.

With direct sync, the leading edge of each sync pulse triggers flyback. We simply require that all sync pulses shall be identical. Two things prevent this being achieved—noise and interference. Noise is fundamental and is always superimposed on the signal. It is only of importance, however, when the signal level is low and noise and signal become of comparable magnitude. Noise adds a random fluctuation to the signal. Fig. 1a shows a sync pulse without noise and Fig. 1b shows a typical pulse when noise is present. The vital point is the random nature of the noise and no two pulses are alike; thus the moment at which the signal passes the triggering level varies in a random manner. Fig. 1c shows a magnified view of 1b close to the triggering level. The effect of noise is kept down considerably by reducing the bandwidth of the sync separator. In British receivers it is of the order of 0.5Mc/s or even less. Even so, there must be a signal level at which noise produces excessive raggedness. Roughly speaking, this is  $100\mu\text{V/m}$  for Band I.

#### Modulation Systems

There are several kinds of interference to consider.

From the sync point of view the British 405-line system with its positive modulation is fairly immune to impulse interference. Very strong spurious sync signals are impossible, for the interference can do no more than cancel the carrier. In practice, too, any below-black spurious signals are impossible, for it is inconceivable that impulse interference (car ignition, hair-dryers, etc.) can give rise to an R.F. carrier almost equal in amplitude to that of the television signal—accurately equal in frequency but antiphased. The worst effect of impulse interference is to lose a sync pulse.

Just the existence of interference during the sync period does this. A heavy burst outside the sync period can also cause a sync pulse to be lost by producing blocking in a poorly designed I.F. chain.

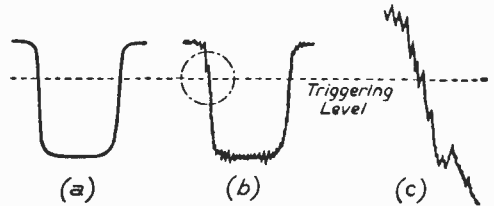


Fig. 1a.—Waveform of a typical sync pulse.

Fig. 1b.—A sync pulse degraded by noise.

Fig. 1c.—A magnified version of Fig. 1b close to the triggering level.

When a sync pulse is absent, the timebase reverts to its free-running frequency and may take several lines to pull into sync again. This produces a band across the picture of something worse than mere raggedness — in fact, a completely unintelligible strip. Negative modulation systems, such as the Continental 625-line system put forward as a candidate for the VHF Bands IV and V in this country, are in very serious difficulties. Any interference worthy of the name provides very strong sync pulses. These can trigger flyback at almost any point of the forward stroke. Although Continental receivers seem to bristle with "anti-interference" devices, the use of a flywheel is universal in all of them.

The only other form of interference we shall consider is that due to reflections, especially from moving objects such as aircraft. The longer path travelled by the reflected signal produces two effects. First, the picture and sync information are delayed with respect to the direct signal (modulation delay). A path difference of 300m represents  $1\mu\text{sec}$  time delay. Secondly, the R.F. carrier of the reflected signal has a phase difference with respect to that of the direct signal. At 50Mc/s, 3m path difference—a half wavelength—gives phase reversal; at 200Mc/s, 75cm gives phase reversal. So it is obvious that the R.F. carriers can be in antiphase

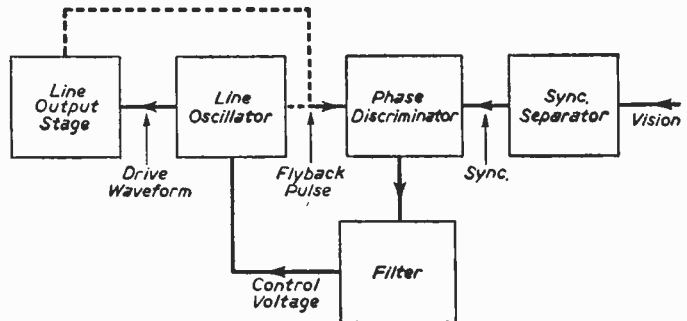


Fig. 2.—Block diagram of a flywheel timebase.

whilst the modulation delay is very small. Under these circumstances the resultant signal strength falls; in fact it disappears if direct and reflected signals are of equal strength. Similarly, in-phase carriers increase the signal strength. On the other hand, it is easy to obtain large path differences where the modulation delay is considerable. For instance, an aircraft one mile high overhead must give a path difference in excess of one mile and a time delay of at least 5.3 μsec. With such a large path difference, a small movement of the aircraft will cause the relative carrier phase to reverse and at quite ordinary speeds it can make the path difference change by a few wavelengths within a frame period. This gives rapid fading which the AGC cannot follow and the effect is by no means confined to fringe areas—readers who live under a runway approach path to an airport know this very well!

during the preceding few frames. Now the detector output is fixed by the amplitude of the carrier applied to it and this output is direct-coupled to the video stage. Any fall in signal level beyond a certain point will therefore be indistinguishable from a sync signal. Similarly, a rise in signal strength can prevent the output falling to the critical level at all, except where the two sync pulses overlap. In this case, the sync separator only works on receipt of the reflected signal's sync pulse and the timebase can lock to the delayed signal. Later it may revert to sync on the direct signal giving the well-known horizontal jumping of the picture.

As regards modulation delay, this causes overlapping of picture signals into the front porch or into the sync pulse itself. The effective position of the sync pulse leading edge is therefore variable and with more than 10 μsec delay the sync pulse can be completely obscured. Also with carriers in antiphase, the two signals can cancel near a transition, giving a spurious sync pulse. This is also the cause of "negative" pictures often seen during aircraft flutter. All of these remarks refer to positive modulation, but there is no fundamental difference with negative modulation.

**Summary of Requirements**

To summarise the properties required of a flywheel timebase we can say that it should not be affected by noise superimposed on the sync pulses; it should not be affected by the absence of a few sync pulses; it should not be affected by a few spurious sync pulses nor by a few misshaped ones. Obviously, no device can withstand the continued absence of correct sync signals, but even with heavy interference the timebase should settle down again quickly once the sync disturbance is over. In other words, the out-of-sync behaviour and the change to the synchronised condition are important aspects of performance.

**Flywheel Sync**

The whole point of flywheel sync is that the timebase is not affected much by a single sync pulse. (The name is derived from the analogy of a heavy flywheel kept rotating by a gentle knock once per revolution. A few knocks missing or out of place will have very little effect on the rev/min.) It is only the average effect of several sync pulses that controls the timebase. Thus a few pulses missing, etc., are hardly noticed, and noise, being a random phenomenon, tends to have its effect cancelled out. The exact effect of interference depends upon the circuit used and each circuit must be studied individually in this respect.

Fig. 2 shows the basic arrangement of a flywheel timebase in block diagram form. Since the whole aim is to control the position of the picture on the raster, we must have some electrical device which examines the picture position. Putting this in other words, we must compare the relative phase of sync pulse and timebase. This is done in the phase discriminator, whose job it is to deliver a voltage which is dependent upon this relative phase. A line flyback pulse is normally used for comparison, derived either from the oscillator or the output stage. The discriminator output is in pulse

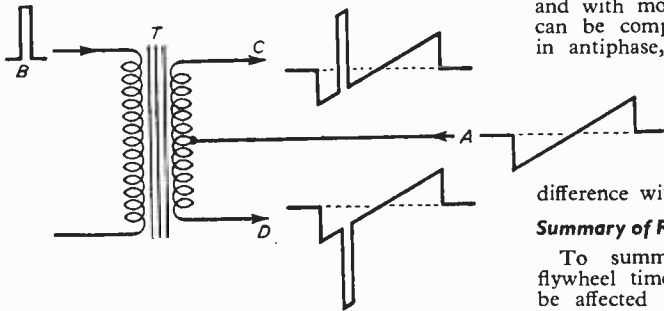
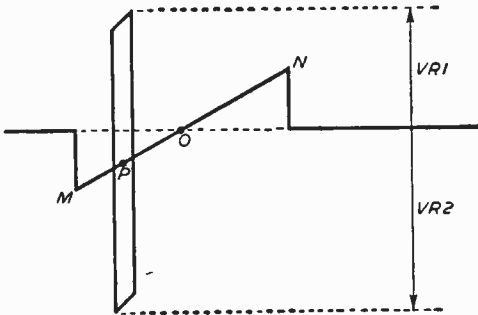


Fig. 3 (above).—Operating waveforms in a discriminator.

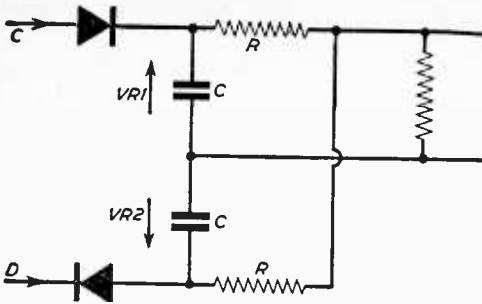
Fig. 4 (below).—The output voltage of the discriminator is zero only when the sync pulses are centred on O: at all other positions VR1 and VR2 are not equal. The discriminator circuit is thus a source of a phase-dependent voltage which is suitable for control of the timebase oscillator.



Another source of rapid fading occurs where the direct signal is weak, as, say, when the receiving aerial is in the shadow of hills. The reflected signal here can exceed the "direct" (a signal diffracted over the hills) in strength, but it is very variable owing to changes in position of the aircraft, which is acting something like a mirror.

**Fading**

We can now see some of the effects on sync caused by reflected signals. Let us first consider the fading aspect. The receiver gain and sync separator bias will have been set by the signal



form and has to be filtered to produce a steady voltage. The filter is basically a simple R/C filter, but it is an important part of the flywheel. The time constant of this filter determines, in effect, the number of sync pulses which are averaged and so determines very largely the performance of the flywheel. The filtered output of the discriminator is used to control the line oscillator. This must be a circuit whose frequency can be varied easily by means of one of its supply voltages. A sine-wave oscillator with reactance valve is most common, but a multivibrator has been used. The oscillator must also have a manual frequency control which is the "line-hold control". The grid drive waveform for the line output valve must also be obtained from the oscillator.

#### An Idealised Discriminator

From the above, we see that the discriminator is the heart of a flywheel. It is much easier to understand the behaviour of a flywheel if we take a "concrete" example. So we first describe the action of an idealised discriminator—its practical form will appear later.

The timebase waveform at A (Fig. 3) has sync pulses added to it via phase-splitting transformer T. The pulse outputs shown at C and D are now peak rectified. From Fig. 4, we see that these rectified voltages are only equal when the sync pulses are centred on O, or outside the region MON. At all other positions (P for example), VR1 and VR2 are not equal. So when they are subtracted (as in, say, the circuit of Fig. 5) there is some resultant voltage, and it changes sign as the phase of the sync pulses passes through point O.

This, then, is our phase dependent voltage required for control of the oscillator. In practice, the capacitors C form the flywheel filter, too. The current through each diode is limited by the source impedance of the circuits supplying A and B Fig. 3. Also the conduction period of the diodes is limited to the duration of the sync pulse. Consequently, each capacitor C takes several cycles to charge up and so performs the averaging required.

#### In-sync Behaviour

As long as the timebase remains synchronised, then movement of the line hold control does not change the oscillator frequency. This sounds obvious, but it is vital to appreciate the point. The control voltage changes and exactly compensates for the line hold control movement. The control voltage change can only be brought about by the timebase phase changing relative to the sync pulses which in

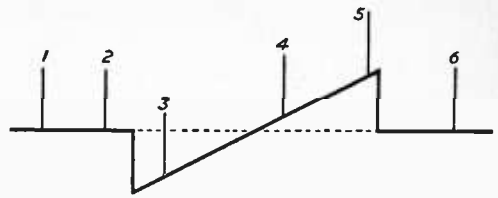


Fig. 5 (left).—When the voltages developed in the discriminator—VR1 and VR2—are subtracted, there is some resultant voltage which changes sign as the phase of the sync pulse rises through point O in Fig. 4.

Fig. 6 (above).—The "hold range" with six successive sync pulses marked: here "pull-in" is not achieved.

turn makes the discriminator output change. The visible result is that the picture moves across the tube face. A limit is set to this process when some part of the circuit reaches the "end" of its characteristic—usually the discriminator reaches a condition where it can give no further change of control voltage in the required direction. This happens at, say, M in Fig. 4. Any further movement of sync pulses to the left produces zero output—a change in the wrong direction to maintain sync. Thus the oscillator falls out of sync, and we have reached one end of the "hold range".

The above remarks imply that the discriminator and reactance valve characteristics must be suitably matched. For suppose the line hold control is moved in the direction that would give, in absence of sync pulses, a higher oscillator frequency. Now the control voltage cannot change instantaneously, so the oscillator frequency does in fact rise initially. Thus the timebase waveform begins to move to the left with respect to the sync pulses. Therefore, VR1 begins to rise and VR2 to fall. The resulting change in control voltage must reduce the oscillator frequency again and so restore the oscillator to its original synchronised frequency. If the reverse were to apply, the oscillator frequency would rise still further and fall out of sync. In fact, such a system, has no stable sync condition—but it can provide a half-hour of good tax-free entertainment.

#### Pull-In Behaviour

In what follows, it is essential to keep three things in mind:

1—Once the line hold control has been set at some point, then the oscillator frequency is entirely controlled by the control voltage.

2—We shall consider the discriminator and filter to be separate for convenience. The peak rectifiers are assumed to change output instantaneously. Their output (the discriminator output) depends only upon the relative phase of sync and timebase.

3—When out of sync, the direction and rate of movement of sync pulses with respect to timebase are fixed entirely by the frequency difference between them. Timebase fast gives sync pulses moving to the right relative to the timebase waveform.

When the timebase is out of sync, then successive sync pulses fall at different parts of the timebase waveform. Eventually one must fall at a point which gives the correct polarity control voltage to bring the oscillator frequency closer to that of the sync pulses. However, the flywheel filter is essentially



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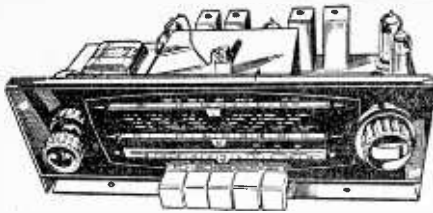
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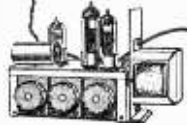


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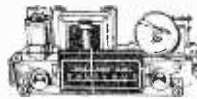
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an R/C filter and the control voltage does not change appreciably owing to the one sync pulse. What change there is, however, is in the right direction. What happens now depends upon the frequency difference between the sync pulses and the free-running timebase. If this difference is large, then the following sync pulse falls in a position that gives the wrong polarity control voltage or, at least, no increase of correct polarity, and sync is not achieved. When the initial frequency difference is smaller, however, several succeeding pulses can occur in the appropriate region of the timebase waveform. In this respect they are self-aiding, for the resultant control voltage changes the oscillator frequency in the right direction to reduce the frequency difference. Hence the pulses tend to "dwell" in the correct region but hurry through the incorrect one. It must be realised that, even if the timebase is not pulled into sync the oscillator frequency is being varied by the control voltage. At a sufficiently small frequency difference, the pulses dwell for enough cycles to let the control voltage build up sufficiently to bring the oscillator frequency to that of the sync pulses. The oscillator has now become synchronised and we are at one end of the "pull-in range".

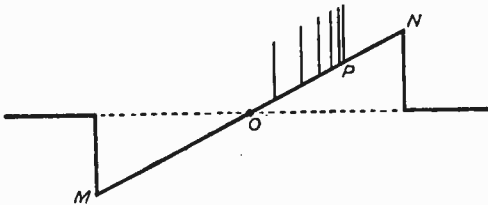


Fig. 7.—A case where "pull-in" does occur—The frequency difference is less and each successive sync pulse brings the timebase frequency nearer and nearer to the correct value.

### Performance Figures

Pull-in range and hold range are quoted in c/s and measured as follows. The line hold control is set to one end of the range in question. The sync pulses are now removed either by shorting or removal of the signal and the frequency of the now free-running timebase is measured. This is repeated at the other end of the range. The difference of the two measured frequencies is the required figure.

The pull-in range is directly connected with the number of sync pulses averaged by the flywheel. The larger the time constant of the filter the more slowly does the control voltage build up. This means that more pulses are required to build up the correct voltage. The oscillator frequency must therefore be brought nearer to that of the sync pulses before pull-in occurs. That is to say, the pull-in range is smaller. The normal sort of figure for pull-in range in British receivers is around 250c/s. This is always less than the hold range because pull-in can never occur at M or N (Fig. 4), for the oscillator at the end of its hold range can only be kept in sync by pulses falling continuously at, say, M. Once out of sync, the oscillator can only be pulled in by the process described above. Now, no matter how many pulses occur between O and M, they can never give an output from the filter equal to that due to continuous occurrence at M. So even if a pulse actually reaches M, the

output corresponds to some lower portion which is not enough to keep the oscillator at sync frequency.

Figs. 6 and 7 show the process of pulling in. For the sake of convenience, the sync pulses are shown as lines only. Again we assume that the timebase frequency starts off higher than sync frequency. Fig. 6 shows the case where pull-in is not achieved. The sync pulses appear to move to the right. Pulses 1 and 2 produce no output and so have no effect on frequency. Pulse 3 gives output which increases frequency and gives a wider gap between 3 and 4 than that between 1—2 and 2—3. Pulses 4 and 5 do reduce the frequency again but not sufficiently to pull-in, and 6 is again at a zero output position.

Fig. 7 shows a case where pull-in does occur. Again pulses before M have no effect, and those between M and O increase frequency, so "hurrying" through this region. Eventually though, pulses fall between O and N. (They are closer now owing to the lower frequency difference.) Now each pulse lowers the frequency, making successive pulses come closer together. But, each successive pulse gives a bigger and better output, so lowering the frequency more and more. This in turn makes the pulses crowd together more and more closely, which gives the filter output more time to build up. So we reach a position, P, where the output is just right to keep the sync pulses permanently in that position—which is only another way of saying that the timebase is now synchronised.

(To be continued)

## VALVE FAULTS

(Continued from page 351)

overrun, and if left operating in this condition will quickly be ruined.

The effect is illustrated in Fig. 4. Here, a heater-to-cathode short exists in V12 which, in this case, shorts out valves V1 to V11. Thus, valves V12 (which is the faulty one) to V15 will have a higher voltage across them than is normal. If the short occurred across the other side of V12's heater, then that valve's heater would also not be lit. It follows, therefore, that the valve which should first be suspected is either the first one in the heater chain which is alight or the last one in the chain which is not alight.

### Interface Resistance

Certain valves which are operated with very small mean cathode currents sometimes develop an interface resistance between the cathode material and its support. This tends to form a degenerative resistance in series with the cathode, thereby lowering the valve's mutual conductance.

This happens in particular in the A.G.C. amplifier valve (EF80) used in the Ferguson Model 203T series, and the effect is failure of operation of the manual contrast control. The valve should be changed with one of similar type in another part of the set, for when it is put in a position where it can handle a greater current, the fault will clear and the valve will operate normally. In order to retard the effect in the substituted valve, a 270Ω ½W resistor should be connected across the heater tags of the A.G.C. amplifier's valveholder.

# New Frame Output Valve

MORE POWER FOR BEAM DEFLECTION

(Extract from "Mullard Outlook"—February, 1961 issue)

THE screen size of television picture tubes has steadily increased from the early 9in. tube to the present day 21in. tube, and the angle through which the electron beam has to be deflected has increased from  $65^\circ$  to  $110^\circ$ . The power required to deflect the beam has therefore increased and new valves have had to be developed to meet these requirements; the latest of these embody the frame grid principle (see the January 1960 issue). The Mullard PCL85, a triode-pentode, has been specially developed for use in the frame timebase of television receivers using  $110^\circ$  deflection picture tubes.

## Pentode Section

The pentode section of the PCL85 is designed as a frame output valve. An important requirement of such a valve is that it should provide a high peak anode current at a low anode voltage. With an anode voltage of 50 and a screen grid voltage of 170 the anode current of the PCL85 is 200mA. Under similar conditions the PCL82, the previously recommended valve for frame timebases, has an anode current of 135mA.

The increase in anode current means that more unwanted heat is developed at the anode and the new valve has therefore been designed for an anode dissipation of 7W. The screen grid dissipation can also limit the peak anode current available from the frame output valve because, as the drive is increased, the screen grid current rises. A resistor is usually incorporated in the screen grid circuit to limit the dissipation, but this resistor produces a drop in the screen grid potential and so limits the peak anode current. To avoid this the screen grid of the PCL85 is optically aligned so that the wires of the screen grid are in the shadow of the control grid wires when viewed from the cathode. This reduces the screen grid current considerably and hence the dissipation. To illustrate this, in the PCL85 the anode current above the knee is 15 times the screen grid current whereas in the PCL82 the corresponding anode current is only 4.5 times the screen grid current. The new construction allows the valve to be used without a limiting resistor up to a screen grid potential of 230V before the dissipation exceeds the limit of 2W.

## Triode Section

The triode section of the valve has been designed for use as a blocking oscillator or as a feedback amplifier. The first application requires a valve with a medium value of amplification factor,  $\mu$ , a high value of mutual conductance, gm, and a high anode current in the positive grid voltage region. The second application requires a moderately high value of  $\mu$ . The triode section of the PCL85 has therefore been designed to have an amplification factor of 50, a mutual conductance of 5.5mA/V and an anode current of 10mA with zero grid voltage and an anode voltage of 100V.

The triode section is shorter than the pentode section and is supported by a "balcony mica". The shorter structure is more rigid than one having the length of the pentode section, and the valve is less likely to suffer from microphony and fluctuations resulting from cathode distortion.

## Heater Voltage

It is important that the heater voltage of any new television valve for use in 300mA heater chains

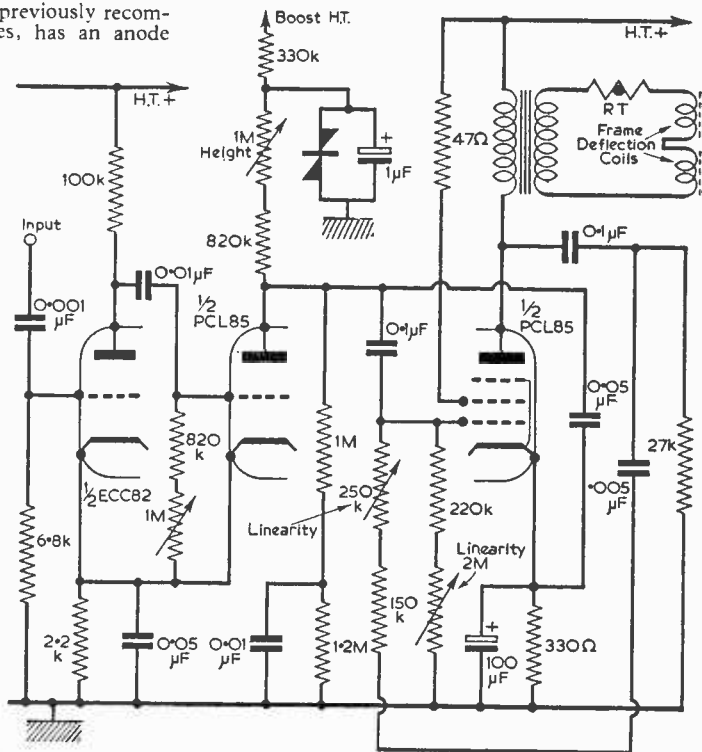


Fig. 1.—Typical frame timebase circuit with PCL85 valve

should be kept as low as possible since these chains are nearly full already. The heater power of the pentode section has had to be increased to approximately 30 per cent above that of the PCL82 to cater for the increased anode current, but the shorter triode structure has enabled the heater power of that section to be decreased. This has resulted in a heater voltage of 18V, which is only 2V above that of the PCL82.

#### Applications

The circuit of a frame timebase is shown in Fig. 1 as an example of an application of the PCL85. The frame oscillator is a cathode-coupled multivibrator made up of the triode section of the PCL85 and a triode section of an ECC82. The oscillator frequency can be adjusted by the variable resistor in the grid circuit of the PCL85 triode section. The output is taken from the anode of this section and fed into the grid circuit of the frame output valve, the pentode section of the PCL85. A Blumlein negative feedback network is used to ensure linearity of the output waveform.

A thermistor is connected in series with the deflection coils to compensate for any change in resistance in the coils, caused by temperature changes. As the temperature of the coils rises so will their resistance increase. The resistance of the thermistor decreases with a rise in temperature to compensate for this. The timebase is stabilised against variations of mains potential by the voltage-dependent resistor across the decoupling capacitor in the multivibrator anode circuit.

This circuit is intended as an example only and does not show the frame timebase of a particular receiver. The value of the various components will depend on the operating conditions of the receiver concerned. Although it is possible to design frame timebases for 110° picture tubes using the PCL82 the output transformer has to be large because of the extra power required. The transformer design is particularly difficult with stabilised timebases (as in this example) where there is a larger standing current through the transformer. The introduction of the PCL85 with its improved anode current characteristic will allow smaller transformers to be used, with a consequent reduction in cost.

## TRADE TESTS FROM THE STOCKLAND HILL TRANSMITTER

The Independent Television Authority announced that trade test transmissions commenced from its Stockland Hill transmitter on March 1st, 1961. Initially the radiated power was very slightly less than the full-power condition, but full-power was reached by about mid-March.

Stockland Hill is 4½ miles North-West of Axminster and it will serve Devonshire and parts of Dorset and Somerset.

Initially trade tests, consisting largely of Test Card C, are broadcast from 10 a.m. to 5 p.m. daily, except on Sundays. Towards the end of March it may be possible to extend the hours of transmission.

The station is broadcasting on channel 9 and the signal is vertically polarised. The transmitting aerial has directional characteristics and it radiates its maximum power of 100kW to the North-West and South-West.

The power to the South-East will be 20kW and to the North-East 10kW.

## ANOTHER STUDIO IN SERVICE

The second of the large studios (Studio 4) is now in operation at the new BBC London Television Centre which was opened in June last year. Two further studios will be brought into service at the Centre later this year, and three more already constructed are to be equipped in a later stage.

Studio 4 will be used chiefly for light entertainment, music and children's programmes. It is 44ft high and has a floor area of 8,000sq.ft.—the same as Studio 3 which is already in service. It is equipped with cameras manufactured by E.M.I. Electronics Ltd which like those of Studio 3 manufactured by Marconi's Wireless Telegraph Co. Ltd., are fitted

with the English Electric 4½in. Image Orthicon tube. This tube with its high sensitivity, good stability and improved signal-to-noise ratio gives pictures of a very high standard. Studio 4 is provided with four camera channels and two further cameras can be added from a central apparatus pool if required. The cameras are fitted with turret-mounted fixed focus lenses giving viewing angles of 9°, 16°, 24° and 35°, supplemented by zoom lenses which have been newly developed for studio use. These latter enable a wide range of camera shots, continuously variable from close-ups to long shots to be obtained with a single camera without the need to switch from one camera to another while lens turrets are rotated, as is necessary with fixed focus lenses. Camera mountings include cranes, motor-driven dollies and pedestals.

The Control Room Suite, containing the vision, lighting and sound control positions and also the main control desk—from which the producer directs the cameramen, sound crew and artists—looks over the whole studio through double glazed plate glass windows at first-floor-level. The sound control desk provides control of forty-three sound sources of which up to five may be external to the Television Centre.

The extensive studio lighting system is of the most modern type specially designed for television. It includes some 330 illuminators which can be raised and lowered by electric hoists. The comprehensive control system operated from the console in the Control Room Suite enables the illuminators to be switched or dimmed singly or in groups. The console embodies 20 memory combinations by means of which the lighting supervisor can make the majority of lighting changes during transmission at the touch of a single control. A mimic diagram suspended above the console shows the state of dim of every lighting control channel. The total lighting power consumption is 200kW.

Studio 4, like Studio 3, has been designed so as to provide for the introduction of colour television later.

**T**HE cabinet to house the completed set is constructed in as simple a manner as possible without the use of complicated cabinet joints, and provided some care is taken, will amply repay all the effort expended.

The whole case is covered in wood-grained plastic sheet, such as Formica or Perstorp, in contrasting

colour. The original is finished in walnut, with the panels and the frame over the tube face in birds-eye maple.

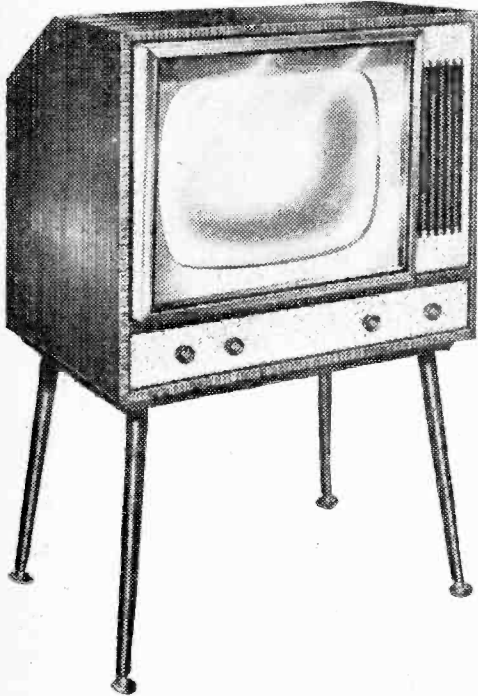
#### Preparing Sections

Half-inch ply-wood is used for the body. Cut out the bottom, sides, front and two top pieces as shown in Figs. 1, 2, 7 and 4 respectively, taking care to plane edges square and true. The two sides should be nailed together temporarily and planed to size all round; this will ensure accuracy. The ends of the tops and bottom are rebated  $\frac{1}{4}$  in. x  $\frac{1}{4}$  in. deep. Drill and countersink holes to take  $1\frac{1}{4}$  in. x No. 6 counter-sunk wood screws. Cut out the large inspection hole in the bottom.

#### Assembling

Screw up the carcass without gluing, which will then allow for any adjustments to be made for squareness.

Fit the sides to the base. It is advisable to drill  $\frac{1}{16}$  in. holes to assist the screws to enter the edge of the ply. Now offer on the top pieces and bevel the meeting edges to fit. A strip of wood suitably



BUILDING A  
CABINET  
FOR THE

# OLYMPIC

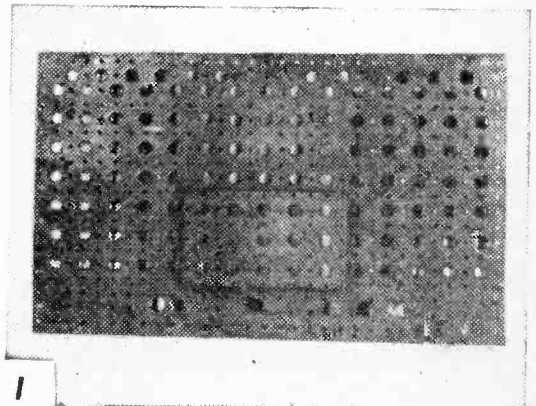
By R. Edwards

1.—The ventilated back-panel of the receiver.

2.—The Perspex safety panel in its "picture frame" mounting.

3.—The cathode ray tube support cradle.

4.—The safety panel being mounted on to its locating pins.



shaped is glued and screwed to the underside of this joint to strengthen it. A bar, shaped as shown in Fig. 7, is mortised each end into the sides to divide the front panel.

**Front Panels**

Cut the two front panels from  $\frac{1}{2}$  in. ply and plane to a neat fit. This will ensure that the carcass is true and square when finally put together. If all proves satisfactory, gluing can now begin. Glue and pin a  $\frac{1}{8}$  in. square fillet  $\frac{1}{8}$  in. in from the front edge to take the panels and  $\frac{1}{8}$  in. in from back to hold the peg-board.

The removable shield over the face of the tube is constructed from wood  $\frac{1}{2}$  in. thick, shaped as shown in Fig. 5 and joined together with rebated corners, pinned and glued.

**Tube Support Frame**

Mark out the front panel and cut a hole for the tube face and speaker opening (see Figs. 6 and 7). Now prepare the inside frame to hold the tube, Fig. 6. This is constructed of  $\frac{1}{2}$  in. wood with rebated, glued, and pinned corners, and is

fastened to the panel with countersunk screws entering from the front. This must be fixed into position before applying the plastic veneer.

Cut out seven pieces of wood to form vertical slats in front of the loudspeaker opening, Fig. 7. These together with necessary lengths of  $\frac{1}{4}$  in. x  $\frac{1}{8}$  in. rounded-edge beading for fastening in panels, should be ebonised and polished ready for final fixing.

**Plastic Sheet**

When cutting the plastic sheet, allowance should be made for the grain to run the height and length of the case with the edges cross banded and corners mitred.

Follow the manufacturer's instructions when applying plastic. On new wood a priming coat of adhesive is recommended; it is allowed to dry thoroughly for some hours.

Begin by covering the two sides, allowing an overhang to be trimmed off flush all round. Next apply the top, shaping the meeting edges to butt

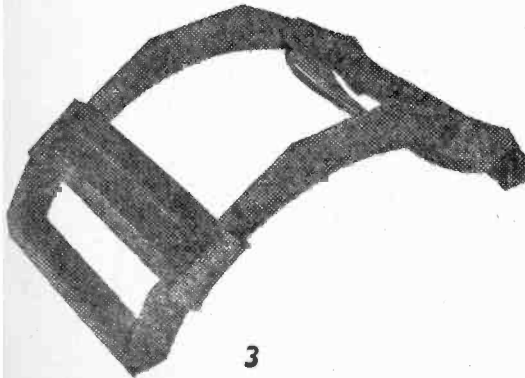
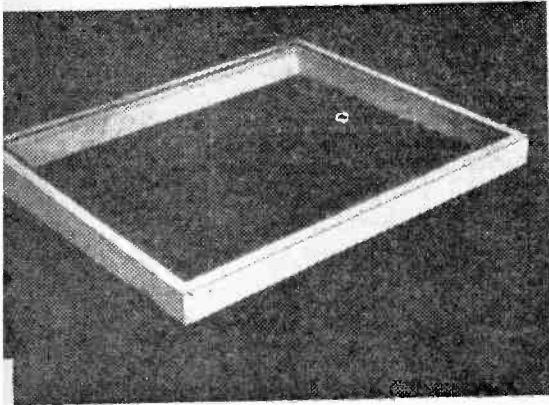
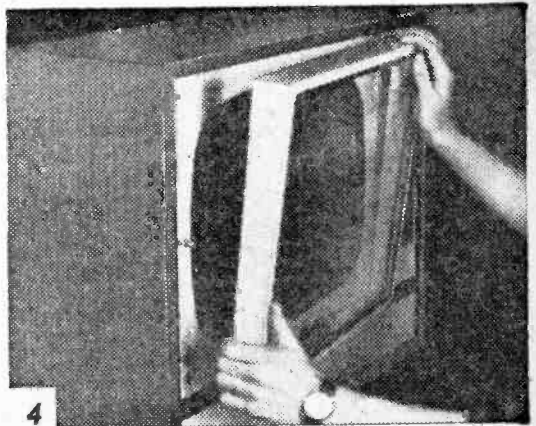
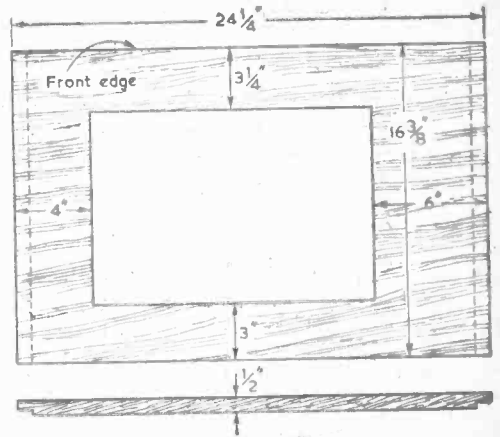


Fig. 1.—The bottom panel of the cabinet.



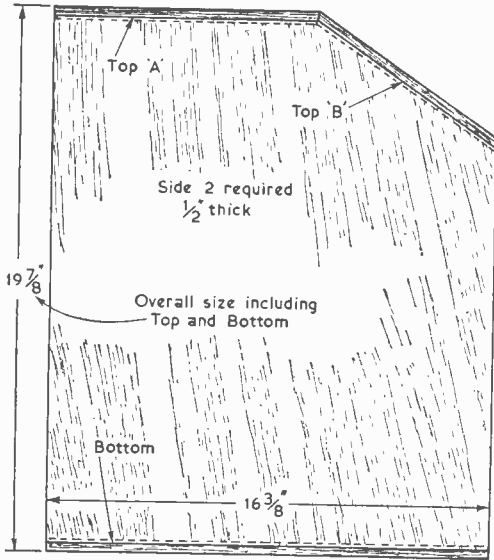


Fig. 2.—The sides of the cabinet.

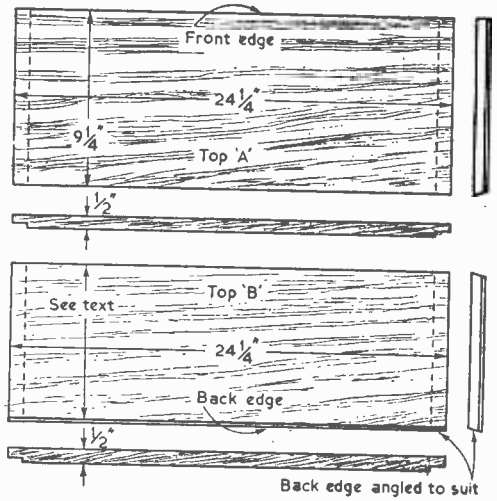
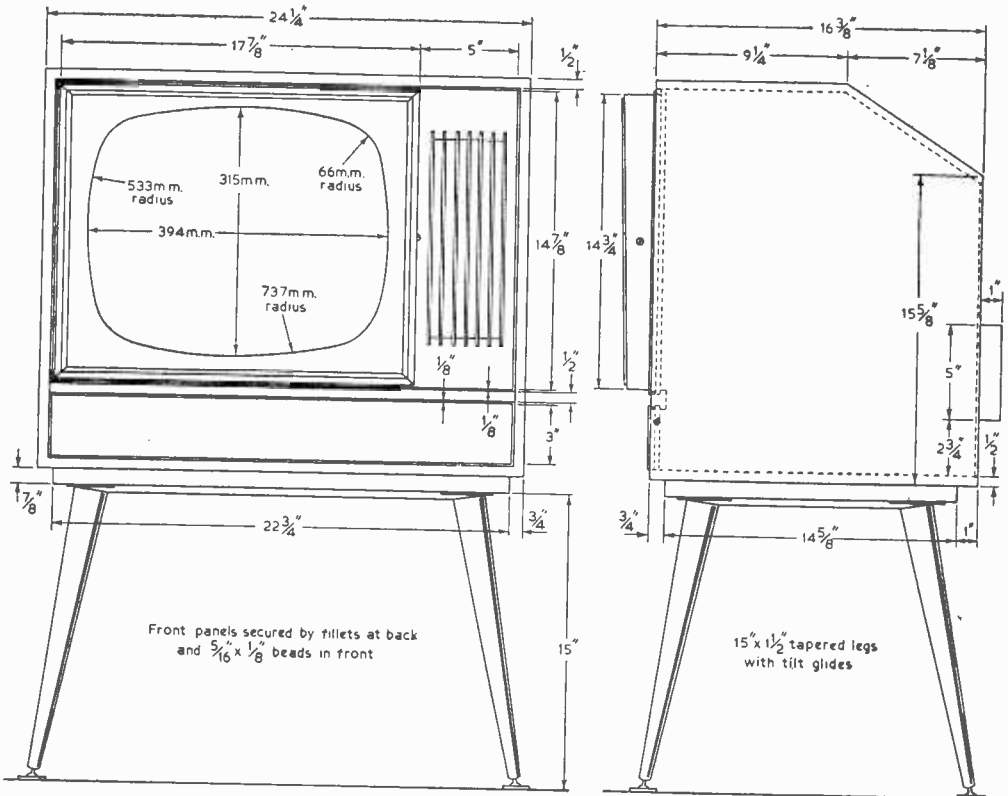


Fig. 4.—The two "top" panels of the cabinet.

Fig. 3 (below).—Front and side elevations of the cabinet with the main dimensions.





together. Plane and file off the surplus material at the edges. Cut strips to face the front edges and apply them.

Note that when covering the edges of the cabinet, the bottom edge will have to be increased in thickness by  $\frac{1}{8}$  in. owing to the fact that no veneer is applied as on the top and sides. This can best be accomplished by fastening a  $\frac{3}{8}$  in. wide strip of plastic to the underside of the front edge.

The front panels can now receive attention, and the necessary holes be cut after the veneer has been applied.

Veneer the tube shield frame (Fig. 5) inside and out, leaving the front edge to be applied last. The corners should be mitred.

**Front Shield**

To complete the shield (Fig. 5) after veneering, a brass tee strip

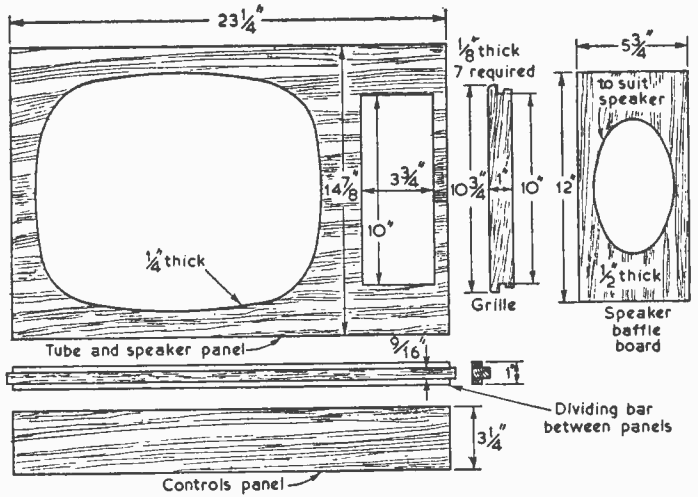


Fig. 7 (above).—The front panels and loudspeaker panel.

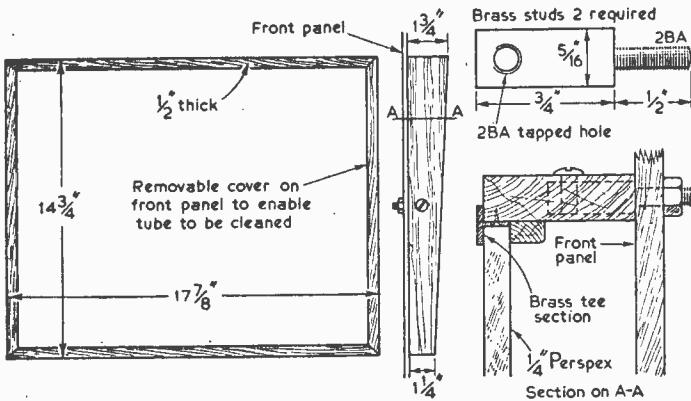


Fig. 5 (left).—The "picture frame" mounting of the Perspex safety window.

is screwed to the inside front edge, the corners mitred, forming a rebate to hold the "Perspex", see the section in Fig. 5. The brass used was cut from a length of curtain rail. After fitting, polish and lacquer.

Cut the "Perspex" to size, and hold in position by a small wooden bead.

Two brass studs, Fig. 5, are fastened to the panel and fit into holes drilled into the edge of frame. Two screws in the side secure the shield to the studs as shown.

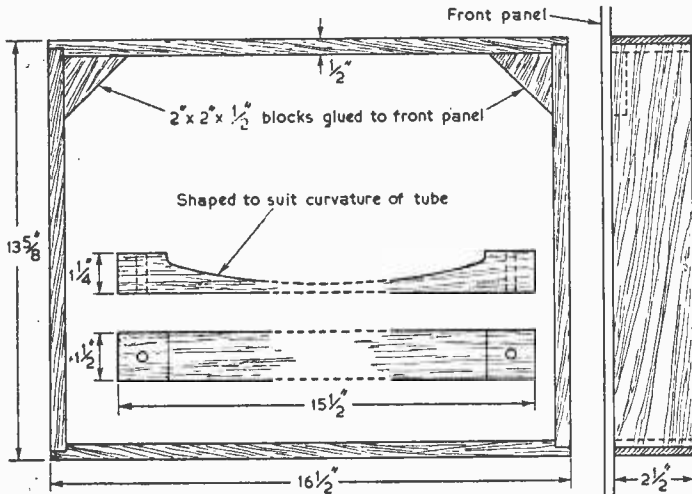
**Loudspeaker Baffle**

This is cut from  $\frac{1}{4}$  in. ply with a hole to suit the loudspeaker and screwed to two fillets, one on the side of the tube frame and one on the side of the case (Fig. 7).

**Base**

Screw the tapered legs to each corner of the stool frame and fasten to the cabinet. The whole should set back  $\frac{1}{4}$  in. from sides and front and 1 in. from the back.

Fig. 6 (left).—The supporting frame for the C.R.T.—also see Fig. 7 above.



(Continued on page 380)

# Letters to the Editor

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

**SPECIAL NOTE:** Will readers please note that we are unable to supply Service Sheets or Circuits of ex-Government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

## A STRANGE FAULT

**SIR,**—D. K. L. in the December issue experiences surges on the frame side of his receiver. He should, however, not be misled into thinking that it must be only in the frame circuits that the trouble arises. I had something of a similar nature in a set I was repairing for a customer and the trouble was traced to a faulty electrolytic condenser. The set had a double unit (100-60 $\mu$ F) and there was apparently a leak between the two sections. Replacing either of these sections by a single condenser cured the trouble on the bench and eventually I fitted a replacement for the double condenser and everything is now satisfactory.—R. RINGE (Eastbourne).

## SYNC SEPARATOR

**SIR,**—In the article on Vision AGC in the September issue, a circuit of a typical sync separator is shown. I wonder if the contributor could let us have a detailed article on this apparently insignificant but all-important stage. One is accustomed to think of this as just a pentode working at the bottom of its anode-current curve, but from many sets which I have serviced, this appears to be far from the fact. Some makers have the valve with maximum H.T. but minimum screen voltage, whilst others reverse the arrangement. Some use a high value grid leak, whilst others have the usual value paralleled by the contrast control which reduces the effective grid leak.

Another point is that some makers take both line and frame output from the anode, whilst others split these, using a split anode load, and at least one maker takes one output from the anode and the other from the cathode. Perhaps your contributor could explain the merits and demerits of the various cases.—H. D. SLINGEN (Barking).

## CHOOSING YOUR AERIAL

**SIR,**—I read with interest the article under the above title in your October issue, but there were two types not mentioned. Both of these have enjoyed great popularity in the United States, and I wonder if they have been omitted because they are not suitable for our conditions. One of these is known as a "Bow Tie" aerial and the other a "Rhombic". I believe some time ago the latter was described in these pages, but I am sure there are many viewers who for one reason or another would like to try out some alternative type of aerial. This

is especially so in some areas where more than two stations can be received, and would avoid the erection of multiple arrays which in addition to looking unsightly also present many problems in view of the overall weight.—R. PEDERSEN (Rugby).

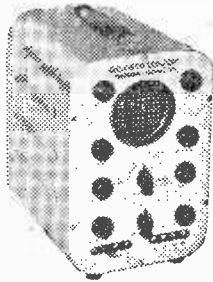
## MATCHING STUBS

**SIR,**—Some time ago you gave an article on a small unit built around a diplexer, to enable one to adjust the levels of the two local stations so that the sensitivity control could be left untouched when changing over. I think an alternative to this device could be constructed in other ways, and if so, it would enable one to carry out remote change-over by a simple single-pole change-over switch. The arrangement described used a resistor in the strong station feed from the diplexer, to reduce it to the level of the weaker, and I would think that a similar and simpler scheme would be to use matching stubs in the leads from the aerials. These could be adjusted on an actual station to provide the necessary loss on the stronger station, and perhaps it may even be possible to construct a simple network of resistors (they need be only  $\frac{1}{4}W$ ) to give a similar effect. I have not sufficient technical knowledge to suggest values or a circuit, but this will no doubt give some readers a line of experiment upon which they can embark if they have the time and maybe they will let others share in their success—if they have any!—G. ROBERTS (Herne Hill).

## ACCOMMODATING SOUND

**SIR,**—I have noted the controversy which has been raging about the line definition, and I know that America and the Continent use F.M. for sound. I believe that this helps to reduce the overall bandwidth needed for our double A.M. system. Is there not some method (I believe it is called sub-carrier) by means of which the sound could be used to modulate some part of the carrier not used for the transmission of intelligence on vision? I must confess to some ignorance of the complete technique of television broadcasting, and only have the knowledge I have gained from your pages. I believe the picture actually only occupies a part of the complete scan (a part is suppressed at the top of the frame and can be seen by reducing the height and turning up the brilliance), and I would have thought the technicians could have found some way of getting the sound into the vision waveform so that it remained intelligible and avoided the necessity for the wide bandwidth which is called for today. Could it not be at ultra-sonic or even sub-sonic frequencies and afterwards brought to its normal range?—F. E. RIDOUT (Glasgow).

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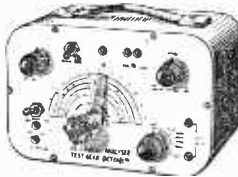
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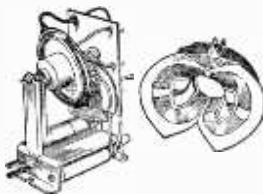


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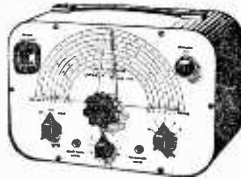
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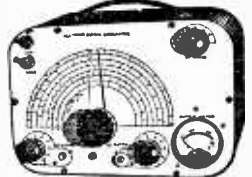


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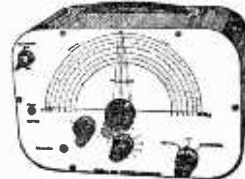
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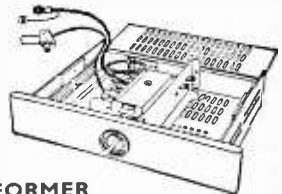
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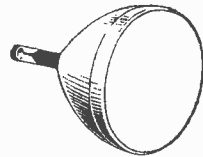
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# Trade News

## NEW PRODUCTS AND DEVELOPMENTS

### High Gain Image Intensifier

A HIGH gain image intensifier tube made by the English Electric Valve Company Limited comprises an input photo-cathode, five secondary emitting dynodes and an output fluorescent screen, and is operated in conjunction with its focusing solenoid, input and output optical systems and power supplies.

The image to be intensified is focused on the photocathode at one end of the tube, and the photoelectrons are accelerated and focused on to the first thin film dynode. Secondary electrons, five or six to each primary, are emitted from the other side of the dynode and these are in turn accelerated and focused on to the second dynode.

### 23in., 110° TV Receiver

A NEW 23in., 110° television receiver, the "Prince Regent", model L.1000A, has been announced by Pam (Radio and Television) Limited.

The printed circuit, 16-valve chassis, has a transistorised stage (an OC45 transistor is used in the sync separator stage) and features press button wavechange.

A remote control unit, capable of adjusting brightness and volume with wavechange, is included with each receiver.

The "Prince Regent" receiver is made by Pam (Radio and Television) Ltd., 295 Regent Street, London, W.1.

### 6,000 Mc/s Travelling Wave Tube

THE M-O Valve Co. Ltd., Hammersmith, a subsidiary of G.E.C., has started production on a new addition to its range of periodically focused travelling wave tubes.

It is known as the G.E.C. TWC5, a travelling wave tube power amplifier, capable of delivering 15W in the 5,925—6,425Mc/s band.

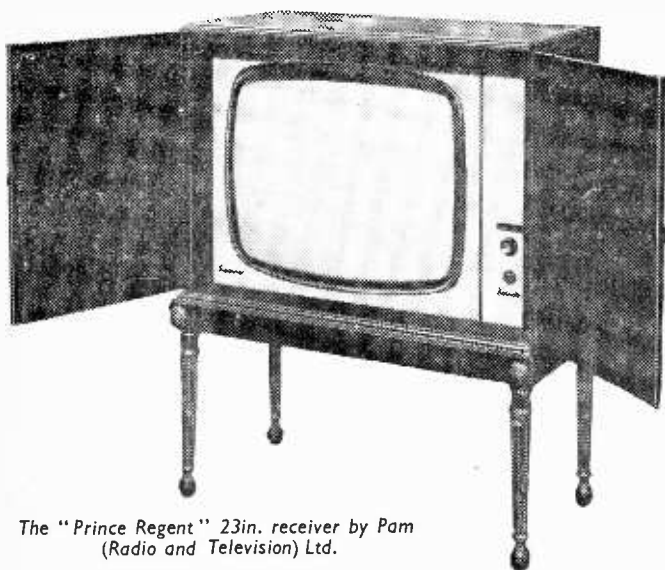
The G.E.C. TWC5 has been specially developed for multi-channel telecommunications systems operating in this range of carrier frequencies, although the permissible bandwidth coverage can be considerably greater. A key feature is that it is easy to replace in a periodic magnetic circuit—a notable advance over comparable valve types. By strict production control of metal and glass mechanical components, and of elaborate pumping schedules, the tube promises a long life and a high degree of reliability, and will meet the most stringent requirements of communication systems.

Already in current demand, this new device is going into repeater stations linking Carlisle to Kirk o' Shotts, and in both-way radio channels between Dundee and Harrogate.

Equipment for both these projects was supplied and installed by The General Electric Co. Ltd., and forms the first stage in a new national broad band microwave network designed for the British Post Office. The travelling wave tube is produced by the General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2.

### Transistorised TV Camera

THE Morhan Exporting Corp., of New York, is now exporting a compact, completely transistorised TV camera, the Model TTVC, made by Blonder-Tongue Laboratories, Inc., of Newark, New Jersey, U.S.A. The camera is extremely versatile, featuring fully automatic operation and



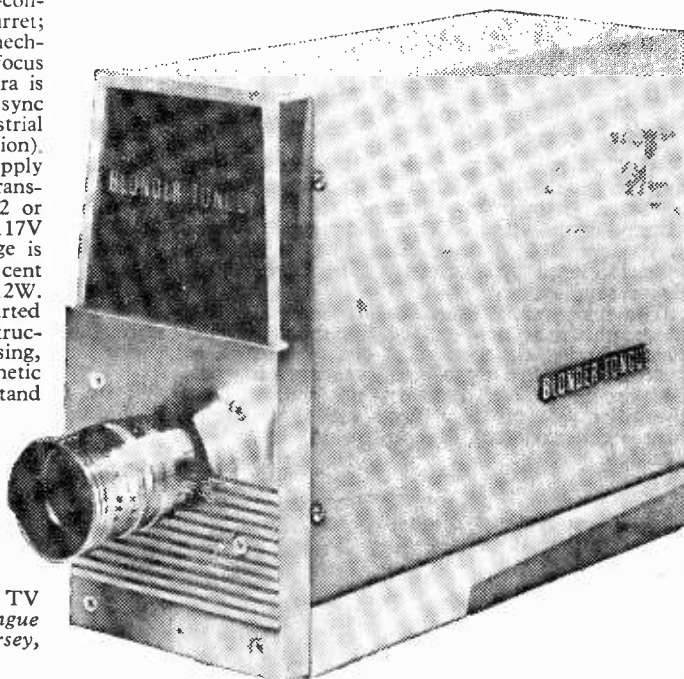
The "Prince Regent" 23in. receiver by Pam (Radio and Television) Ltd.

This process is repeated at each dynode, and the secondaries emitted from the final dynode are accelerated on to a fluorescent screen to produce an intensified replica of the original weak light image.

Tubes have been made giving a photon gain of 100,000 to 200,000, a gain of 7,000 being provided by the five stages of secondary electron multiplication and the remainder arising from the bombardment of the output fluorescent screen.

The usable diameter of the thin film dynodes is one inch. If desired, the picture may be reduced in size between the photocathode and the first dynode, so that the diameter of the input picture need not be limited to one inch. Similarly a larger picture may be formed on the screen if required. This image intensifier is made by the English Electric Valve Co. Ltd., Chelmsford.

accessory provisions for: remotely-controlled or manual lens; lens turret; remotely-controlled pan-and-tilt mechanism; remotely-controlled optical focus and clip-on view finder. The camera is adaptable to a number of optical sync systems: random interlace; industrial sync; EIA sync (studio net operation). The TTVC also features power supply versatility: owing to the use of transistors, a power supply of either 12 or 24V A.C./D.C. may be used, or 117V A.C. 50-400c/s. The supply voltage is regulated to plus or minus 15per cent and the unit draws an average of 12W. Augmenting the ruggedness imparted by using transistors, is modular construction and a heavy duty steel housing, which also ensures maximum magnetic shielding. The unit is sealed to withstand an ambient temperature of up to 55°C (131°F). Channels 2 to 6 incorporate a crystal controlled R.F. modulator, and maximum output is 50mV. The video output level is 1.4V, and the picture resolution is 600 lines. It weighs only 14½lb., and its dimensions are 10½in. length, 8½in. height and 4½in. width. The TTVC TV camera is made by *Blonder-Tongue Laboratories Inc., Newark, New Jersey, U.S.A.*



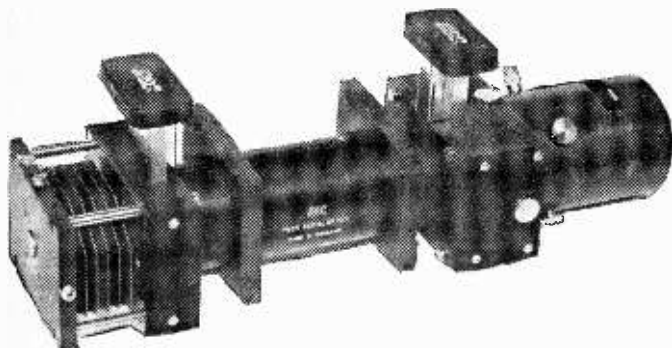
The transistorised Blonder-Tongue TV Camera.

#### The Million Dollar Camera

SINCE its introduction into the USA just over a year ago, the Marconi Mark IV television camera channel has brought over one million dollars' worth of export business to Britain. Sole distributors of the Mark IV camera in America are the Ampex Corporation of Redwood City, California, who cover nation wide sales and service for all Marconi television equipment.

A total of 70 cameras have already been sold to the USA, while world sales to date are well over 200.

The camera is extremely stable, has a short warm-up period, and is lightweight. The picture quality is provided by the English Electric Valve Company's 4½in. image orthicon pick-up tube.



The G.E.C. travelling wave tube (see page 375).

#### Hungary to Build Three New TV Relay Stations

HUNGARY is to build three new television relay stations under her second five-year plan, which began this year. This will bring the number of relay stations in the country to eight.

Most powerful of the three will be sited in the Tokaj wine region, to give full cover to Hungary's eastern counties. The 20kW transmitter will replace the present 1kW transmitter, which will be kept as a reserve.

A 1kW transmitter at Pécs is to be replaced by a 10kW transmitter, to give better cover and stronger reception in Transdanubia, particularly in the Mecsek mining area.

The third station will be erected near Ajka, at Kap Hill on the northern shore of Lake Balaton. It will serve the north, west and southern parts of Transdanubia.

All three stations are expected to begin relaying transmissions in 1963.

At the beginning of this year a new 4kW station came into operation on the 3,300ft Kékes (Bluish) Peak of the Mátra mountains, to give cover to the north of Hungary.

Building of the microwave link between Hungary and Soviet television has begun, and by the end of this year Hungary should be in a position to relay Moscow programmes.



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# Television Trimmers

By L. E. Higgs

**Q**UITE rightly, severe warnings about the trouble that can be caused by tampering with trimmers in tuned circuits of TV receivers are given in most servicing information aimed at both experts and enthusiasts. Certainly slugs and trimmers are best left well alone when a set is in good order and should never be altered in setting when a failure suddenly occurs in the set. There is a great temptation to try twisting this one or that one to "see if it makes it better" when an abrupt change in the performance of a receiver indicates clearly that a breakdown in a component has taken place.

There are however a number of actions that can safely be made to check a receiver exhibiting certain permanent effects that may be attributed to tuning.

## Sound-on-vision

This effect is the shaking and wobbling of the picture during loud sound passages; sometimes the effect is so severe that the vision synchronisation fails completely for short periods. First make sure that this effect is not due to overloading from too strong an input. If it happens only on the strongest station, then reducing the sensitivity may clear the trouble and if the weaker station is now too weak, an attenuator in the strong station aerial lead will put this right. Some sound-on-vision is due to microphonic valves and disappears when the volume is turned down—a tap on the silent cabinet brings rolling waves across the picture showing a microphonic valve is at fault. The most common reason, however, is misadjustment of the local oscillator particularly if the trouble is on one channel only. On thirteen channel receivers, removing the channel selector and turning the coarse tuning slug is often sufficient and, if the core is at the full extent of its travel, remove the coil biscuit and see if the core is cracked or crumbled — if so replace it. If not, tune in the station and with the turret open squeeze up the turns of the coil or open them out slightly with a non-metallic probe until the adjustment is midway. If the sound-on-vision is not attributable to any of the above reasons and you have reason to believe that the I.F. tuned circuits are untouched and the trouble is equal on both channels, try adjusting the turret output I.F. coil (Fig. 1). This may be located on the top of the turret, in the turret, or on the main chassis usually with a screened cable from the turret connected to it. Providing that you make a note of how many turns you alter it (not more than three) and the direction in which you turn it, using a wedge-ended knitting needle and that you replace it exactly before touching any other adjustments, the ratio of sound to vision will be corrected and the sound disturbance will die away as the correct

## A SIMPLE GUIDE TO TUNING TV RECEIVERS

point is reached. Tune during loud musical passages and stop when the correct point is reached or the picture which brightens slightly during this operation will become slightly "smudgy"—a sign of narrow bandwidth (Fig. 2).

## Vision-on-Sound

This is the reverse to the effects described above and can be recognised as a rasping buzz heard on the sound which varies slightly with picture content. Check for overloading, local oscillator tuning and the turret output check described above. If the picture is clear with sharp edges on the 2.5Mc/s grating (Fig. 2), in the centre of the tuning signal then leave the tuning set for this clear result and

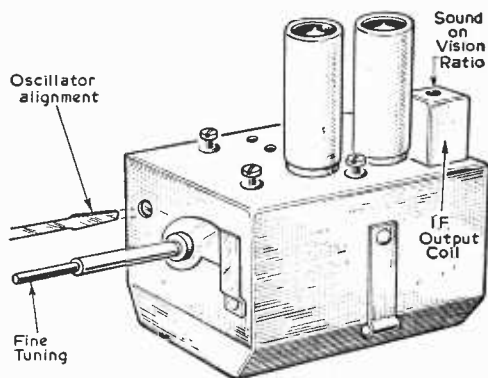
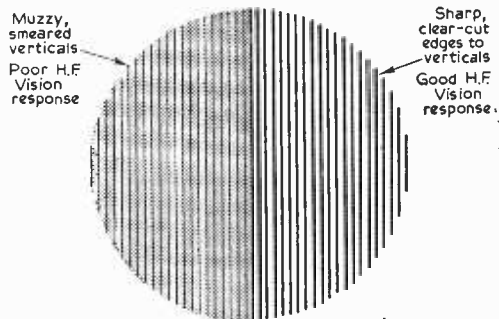


Fig. 1 (above).—A turret-tuner adjustment points.

Fig. 2 (below).—On the test card, poor H.F. vision response is indicated by indistinct vertical gratings.



trim the sound I.F. coils slightly for increased sound output with reduced buzz. Make a note of each adjustment and restore it to the original position before touching another. The sound I.F.s can be located by working back from the sound detector—touching the grid of the sound I.F. valve causes a noise; if a vision valve grid is touched in error this will produce a flash on the screen.

**White-after-black**

This common defect can be caused by many things. If on one channel only, it may be due to a negative ghost picked up on that section of the aerial. Try variations in the aerial position first. Some tubes with reduced emission give an astigmatic halo effect on one side that might be mistaken for this effect. Altering the brightness will cause this white strip to fade out or increase if the trouble stems from the tube. Ringing deliberately introduced in some sets to raise the H.F. end of the vision response, can be offset by adjusting the vision detector output winding core a little. This core is located in the can that is closest to the vision detector and near the video output valve. There may be one or two cores so try each separately, not more than two turns, observing the picture at the right-hand side of a deep black upright. Leave whichever one makes the best improvement and always restore the other back to its original position.

**Identification of cans**

The guide given here is intended to aid the owner of a TV with no service information at hand. If you are in possession of a service manual for the set, even if it is now in good working order, identify the tuning cores and their purpose from the service sheet and mark each with its function in pencil on the can side in the following way, it can save you a lot of trouble in the future, e.g.: L7 sound I.F. 38.15Mc/s; or L9 vision output 35Mc/s.

**Flywheel Synchronisation**

In a number of receivers employing flywheel synchronisation there may be found separate from the other R.F. cans a screened coil assembly in the region of the line timebase. Usually on this can are two slug or pressure trimmers accessible through holes in the can. These are line phasing and frequency controls. The symptoms that indicate adjustment is needed can be:

- (a) horizontal lock is at the extreme end of its range with occasional uncontrolled line slip.

- (b) picture pushed over to one side of the screen with some fold-over at the edge and the shift control at its limit.

For symptom (a), providing the defect is due to adjustment and not a faulty valve, set the horizontal hold to midway and adjust the control that exercises most effect on the synchronising until a locked picture is obtained. Do not adjust both at once.

For symptom (b), the control that has least or no effect on the line hold when adjusted is the phasing control and if the circuit is in order and

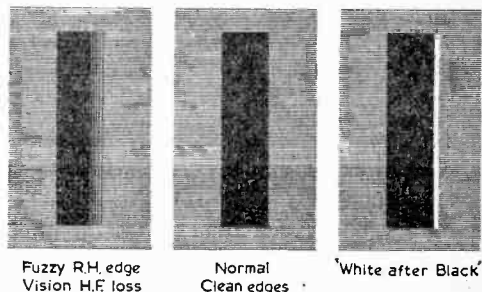


Fig. 3.—Tuning indications from test card blocks.

only out of adjustment then the picture can be pulled across the screen to normal, unrolling the vertical fold-over and centered properly with the picture shift. It is advisable to check the ion trap magnet after this as they are often deliberately adjusted not for maximum brilliance when this fault is present but to centre the picture.

Remember in all of the above mentioned adjustments that provided there is a logical reason for adjusting trimmers, that only one at a time is adjusted and that they are replaced exactly if the expected result is not obtained, there is no need to regard TV trimmers with awe.

**The "Olympic" Cabinet**

(Continued from page 371)

The stool base is made up as in Fig. 9 and is of 3/4 in. wood. The frame is cut away to coincide with the major part of the hole in the bottom of the cabinet.

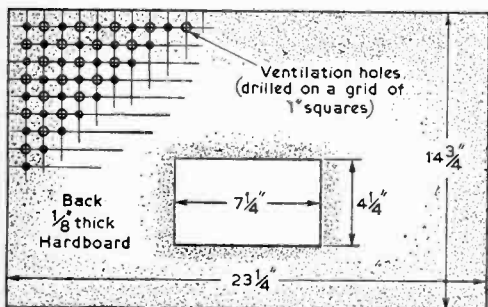


Fig. 8.—The ventilated back.

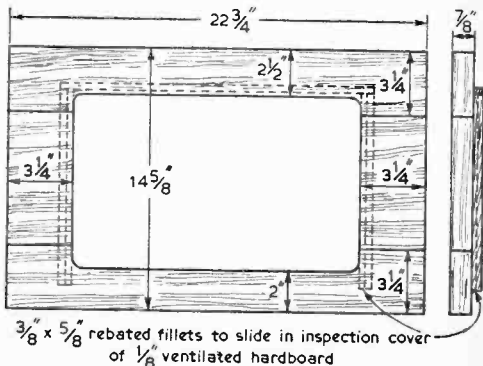


Fig. 9.—The stool base.

Rebate 3/8 in. x 1/2 in. strips to form runners to hold the inspection cover, and pin and glue them to the base, as shown by the dotted lines in Fig. 9.

(To be continued)

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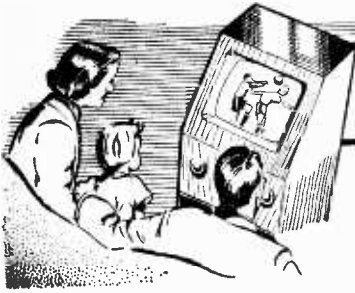
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## UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

FOR many years Friday night has been known as the night for letting your hair down and washing it. So far as television viewers are concerned, late Sunday night is the time to pin it up again to face the problems of the coming week. For a long time, both BBC and ITV channels have been competing with serious plays, to bring you down to earth again. Many of these are specially written for television but few of them rise above the tedium created by overlengthy treatment. Dustbin and kitchen-sink dramas have been enjoying a transient success, carrying a "message" in the live theatre in London and now they have spilled over into television, not only to Sunday night but to other days of the week.

When asked if his cinema films carried a "message" Samuel Goldwyn answered that if he wanted to send a message, he would use Western Union Telegraph—his films were for entertainment purposes only. Nevertheless, some of his films have followed the general trend of debunking convention.

### Thursday Plays

One recent Thursday BBC and ITV competed with plays dealing with the reactions of a son to the unexplained marital problems and frictions of his parents. ATV's "The Savages" told a good story well acted and beautifully produced, but hardly calculated to cheer the family circle at home. Hennie Scott gave a most convincing and appealing juvenile performance, though at times he was a little inaudible. Nevertheless this play retained one's interest mainly on account of comedy relief lines from Victor Maddern and Maggie Smith playing far-from-virtuous characters in a light manner. BBC's "The Brink", set in a lower social strata, dealt with the effects of

family strife upon a youth just starting to earn his own living. Both plays were interesting, both overlong and heavy going for one evening.

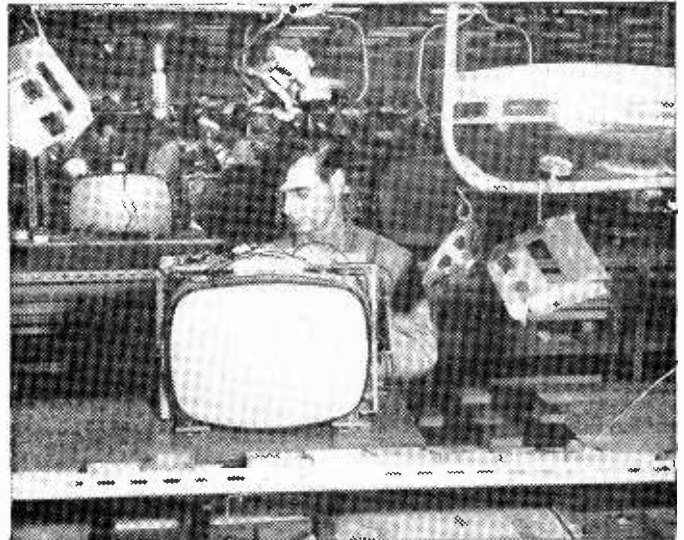
### "The Intervener"

Much better was the BBC's "The Intervener", the last of a series of serious plays especially written for television, in which Alexander Knox starred. Playing the part of a highly respectable and somewhat pompous solicitor, this fine actor compelled attention as a legal drama unfolded. He became the dupe of an attractive woman who, in the days of Melville's melodramas, would be called an adventuress (played by Lana Morris). Indeed, here was a play in which even the dimmest viewer could detect the good

characters from the villains. No hanky panky! and I must say it was rather a relief—especially when a somewhat contrived *dénouement* resulted in a highly satisfactory story ending with the villainess confounded and virtue rewarded. Triumph for the hero and heroine—Philip Bond and Margaret Tyzack! Harold Clayton's production was first-rate aided by excellent atmosphere provided by Roy Oxley's settings.

### Captions

THE days of elaborate captions are over—at least for the time being. Plain, straight type, clear and readable, are the most popular with viewers. Graphic artists at the BBC and ITV programme companies devote more of their time to diagrams, maps



Tubes and speakers, conveyed by chain railway from the stores, hang overhead as this operative completes another stage in the production of an Ultra television set at the company's large factory at Gosport.

and other specialised work, leaving the run-of-the-mill captions to be turned out on a printing press. Some of these presses are expensive variations of the instruments that turn out show-cards for the big stores, in which hot-press methods emboss white lettering on black or grey cards. The introduction in several studios of the new Pye caption machine, which automatically presents any of the forty-eight title cards at the touch of a button, has probably accelerated this trend.

I wonder what would have happened if, as with motion pictures, television had been perfected before sound radio! I suppose we would have had captions for every speech by an actor, as in silent films, and would play our own background music on a gramophone!

#### Mid-day Programmes

**W**HAT goes on at home during the day? I imagine that the majority of readers of this journal have a vague and sketchy idea that the little woman at home, be it wife, mum or landlady, is industriously engaged in a complicated agenda of shopping and household chores. It is only when he is ill in bed that the immensity of their daily task is actually brought home to him, with the vacuum cleaner buzzing in his ears, washing machines ominously rumbling, and the shrill tones of an argument with the milkman, all registering purposeful activity.

About one o'clock there is a lull which would be silent were it not for the sound of the Light programme or a lunch-time television show. For, in these enlightened days, the busy little woman snatches a midday snack of non-starchy food, puts her feet up for a few minutes and relaxes in front of the "telly".

Although the mid-day programme is officially considered to be at an "off-peak" viewing time, its appeal is selective and effective. "Lunch Box" from ATV at Birmingham has been running for years and has a big following, as demonstrated by the fan mail. Tyne Tees and Southern also put out light programmes at this time.

#### Transmitter Range

**C**HANNEL twelve has been rather an unknown quantity for television in this country. The first transmitter to use this chan-

nel is Caradon Hill, one of the ITA stations that will shortly be radiating the Westward programmes. The first reports from dealers and the public when the full-power test transmissions commenced were therefore of unusual interest. They have revealed a surprising freak range in some directions, with good pictures and sound reported from Guernsey, Cork in Eire and in the Swansea district of Wales. Vertically polarised, like the BBC's TV transmissions from North Hessory Tor Station, the ITA test signals from Caradon are being picked up by many viewers within the normal range on their ordinary BBC aerials, without adjustment other than retuning. The same kind of thing happened when Tyne Tees opened in the North-East. There is a risk, however, that though the pictures may be quite strong, the mismatched aerial may restrict the bandwidth of the received signal and the definition of the picture may not be as good as when picked up on the correct type of aerial for channel twelve, pointing in the right direction. Caradon Hill is near Liskeard, Cornwall, and the 750ft mast is on ground already 1,200ft above sea level. So the station has a very good "spring-board" for radiating its 200kW signal to cover Cornwall and West Devon. The second ITA transmitter for this region is at

Stockland Hill, near Axminster, and will operate on channel nine. Both transmitters will receive programmes from the ITA network and local studios, via Plymouth. ITA network programmes will come from London via Bristol, the first part by co-axial cable and the last jump, from Bristol to Plymouth, by five microwave "hops". For a considerable time, it will be one-day only, from Bristol to Plymouth—with no possibility of programmes being sent in the reverse direction. The same situation applied at Anglia, and the programmes that have been nationally networked from that go-ahead ITA programme contractor have, up to now, been recorded in video tape and sent out from London. However, the number of available co-axial and microwave link lines are increasing all the time to meet the expanding requirements of the BBC as well as the ITA companies. There has been a move for some of the smaller regional companies—TWW, Scottish Television, Anglia and Tyne Tees, to exchange programmes with one another, as a variation to relaying the national programmes of the "big four"—ATV, Associated Rediffusion, Granada and ABC TV. But they will have to be really good shows to replace in popular appeal the well-established favourites of the normal ITV network.

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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 UNDER-TAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 391 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

#### FERGUSON 308T

An obscure fault has developed on the above set. There is no sound or vision. The raster and brilliance are in order. H.T. is normal. PCC84 and PCF80 valves in the tuner are also in order, tested by substitution. There is no signal through the tuner, but there are bright flicks when the turret is operated. The aerial is fine and has been tested on another set and is continuous through to the tuner. The click spring on the tuner is all right. Should it be possible to reposition the coils to give adjacent BBC—ITV channels?—H. Myers (Leeds 15).

The local oscillator section of the turret tuner would appear to be in trouble. If you remove the turret from the set and the cylinder from the turret tuner the smaller components will be visible for examination. A small resistor will possibly be seen to be burnt, this being caused by a shorting capacitor associated with it. Replacement of both parts will effect a cure. However, turret tuners are rather specialised pieces of equipment and easily disturbed, so unless you have practical knowledge of servicing we would recommend that you let your dealer solve the problem for you; he, in fact, may have to send the tuner away for repairs. The BBC and ITA coils can be positioned adjacent to each other without trouble.

#### STELLA 1500U

I have purchased a second-hand converter, Cyldon 10, for this model, which the dealer tells me is quite suitable. There is a yellow wire from pin 7 of the plug which has come off, but I am at a loss as to where it goes. Could you give me the best way of wiring to the set?—C. Preston (Sibley).

The white wire connects inside the tuner to pin 8 of the PCC84 via a 100Ω resistor. This is the gain control circuit and in your area should be connected to receiver chassis.

The R.F. valve should be taken from the set, and

across the heater tags of the valveholder should be connected the pink wires. The frequency changer valve of the set should be rearranged to form a low gain I.F. amplifier and the oscillator should be disconnected. To the control grid of this valve should be connected the inner conductor of the tuner signal output lead. The braiding should be connected to receiver chassis, as also should the black lead from the tuner. A 100Ω resistor should be connected between the control grid of the modified stage and receiver chassis. The red lead should be connected to a suitable H.T. point in the set.

#### R.G.D. B2351T

Could you tell me what valves are used in the sound circuit of the above set? The video is quite good but the sound is hardly audible. Will you also let me know the location of the valves?—D. Smith (Dudley).

The sound strip consists of two 6F15 valves followed by a 6D2 feeding the 6P25 sound output valve. Check the H.T. supply to the 6F15 anode and screen at each base, and the alignment of the sound I.F. transformer (between these valves and the resistors associated with the WX6 noise limiter).

#### ALBA T492

What is the best way to boost a Mullard M.W. 31-16 tube on this set?—W. Wightman (Melton Mowbray).

To boost the CRT, use a 6-3V+ boost tapping isolating transformer with mains primary. Remove the existing leads to pins 1 and 12 of the CRT base and short these leads together. Fit the transformer secondary wires to pins 1 and 12, primary to chassis and to the back lead terminal on the mains adjustment.

#### K.B. QUEEN

This set is about 15 months old. Nearly three months ago the H.T. rectifier failed and was replaced. The picture has now shrunk until borders are visible top and bottom about 1in. and the sides about 1½in. I have been able to adjust the height and frame linearity but there is no obvious width control. Where is the control situated on this receiver?—W. Maclaren (Grangemouth).

The width control consists of a sleeve on the tube neck. To increase the width withdraw the sleeve from the deflection coils. Do not rotate the sleeve.

A loss of scan may well indicate a failing metal rectifier (again) or reduced timebase efficiency. Check PL81 valve and PY83 and PCF80 if necessary. The PL81 valve and PY83 are inside the left side screened section, the PCF80 on the right centre of the chassis.

#### H.M.V. 68771

I bought this set second-hand in November, 1958, but I do not know how old it is. It has a channel converter No. 4 but I do not use it as I only have an aerial for BBC. After seven months' use the picture is distorted by wavy lines. On the test card all the white lines are wavy. I replaced two

Z152 valves, which cured the waving, but the picture still shimmers occasionally and there is a loud humming noise. The sound is not very good. If I increase the volume the hum becomes worse. The picture is also dark for about 15 minutes when first switched on.—A. Self (Northampton).

We feel that the receiver is out of alignment and would suggest you retune the clear plastic knob on the rear left side. This should cure the humming and restore picture definition. Should this not clear the condition the receiver should be completely realigned using a signal generator for the I.F. tuning.

#### AMBASSADOR TV4

I cannot cure a rolling on the picture of this set. I have replaced vertical amplitude control and there is also intermittent sound which decreases but soon returns on advancing the sound control. I have renewed this control but it has made no difference.—E. Oates (Barnsley).

We would advise you to replace the 6K25 valve and check the 0.02 $\mu$ F and 0.05 $\mu$ F capacitors associated with the 6D2 and 6P25 sound valves.

#### BUSH TV56

When switching on, the line-hold control has always to be adjusted. It may also have to be adjusted several times when the set is in use. After about an hour a black space appears at the bottom of the screen about  $\frac{3}{4}$ in. in depth. Apart from these faults the picture is perfect.—C. Jones (Burry Port).

You should replace the ECC82 valve (just behind the PY81) on the right side of the chassis. The screening box secured by the P.K. screws and clipped at the side, should be pulled off to gain access. The PCL83 on the front left side of the chassis (behind the vertical form control) also requires replacement.

#### ALBA T717

When the set is first switched on the picture is fine for a time, but after a few minutes the corners at the bottom close in until two or three inches of the screen is black each side. At the top the picture is bent into the centre. The width control is full on and gives just enough width.—F. Embleton (Norfolk).

When the edges of the picture curl in, it is usually a sign of dampness or weak emission of the tube. However, since the width is lacking we would advise you to change the PY32 H.T. rectifier valve.

#### COSSOR 946

When changing from channel 9 to channel 1 I receive the sound programme of the BBC on channels 3 and 4. Also by a little pressure on the channel selector knob a fraction past the position of channel 1 or 9, the picture becomes brighter and the sound much louder. It cannot be held there, and as soon as I release the pressure the switch springs back to its correct position, brightness and sound are then reduced. Since having the turret contacts cleaned with switch cleaner I obtain a

slight grainy effect on ITA only.—J. Upfold (London, S.W.15).

Check that all the fixed contacts are making good connections to the studs on the individual biscuits. This can be easily observed by the amount that they move when passing through an empty channel. Also check the valves, especially the 7AN7 R.F. amplifier and try judiciously retuning the four pre-set trimmers which run down the side of the valves along the turret top. Do this on ITA.

#### EKCO T221

There is no sound or vision on this set. The only valves lighting are 5-10F1's and 10P1's in the sound strip. I am unable to find any breaks in circuits, valves have been checked only with a meter.—L. Pilkington (Stockton-on-Tees).

Replace the 133 $\Omega$  wirewound heater ballast resistor which is in the upper end of the "20" series heater chain. This component is one of two resistors on the top of the chassis behind the voltage selector panel, and is the one pointing towards the EHT compartment, i.e. the right-hand one as you look in the back of the set.

#### COSSOR 927

The sound on this model is working but I cannot obtain a picture. All the valves have been tested and they are in order. The frame output transformer is also working correctly. After switching on there is a blue glow in the SU61 valve; after ten minutes, both fuses blow.—H. Wilson (Hessle).

Check for a short on the EHT line and try replacing the SU61. A simple test is to remove the EHT connector from the tube. If this stops the fuse-blowing suspect a soft CRT.

#### BUSH TV83

Could you please tell me how to fit a replacement tube, regarding removal and re-housing?—D. Webb (Southampton).

The tube is removed as follows: remove the three nuts holding the scanning coil assembly to the wooden cross piece. After removing the ion trap magnet, carefully withdraw the scanning coil assembly to the rear. Undo the two nuts at the top and the two screws at the bottom of the tube-front clamp. The tube may now be withdrawn to the rear complete with its mask. The reverse procedure should be adopted when replacing the tube.

#### VIEWMASTER

This set has a 12in. tube and has been modified as follows: EHT boost circuit (9kV), an auto mains transformer fitted and the frame circuit modified to a P.T. circuit giving increased output.

Are there any tubes available that would fit the above set, larger than 12in. in size which would require none or little modification to the timebase? Could you please state the modifications, if any?—H. Crews (Altrincham).

It is not possible to use a tube larger than 12in. on a standard type Viewmaster as all larger tubes

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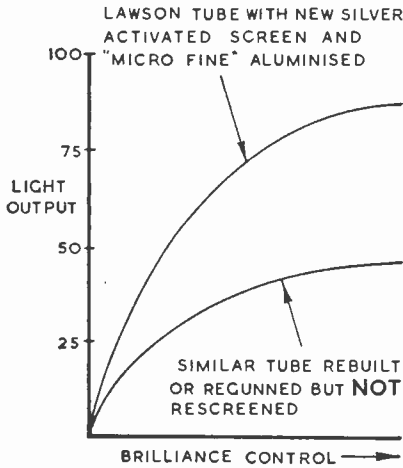
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### REGENTONE

This set is fitted with a 17in. wide-angle tube. It was working perfectly but recently, after an hour or so, the brilliance will suddenly reduce by about 50per cent and it cannot be restored when the controls are set at maximum, also no raster is obtainable. After a while the picture may return accompanied by quite a loud "pop" or, it may black out altogether. The sound remains normal for a while then this too drops suddenly to zero. Occasionally, after a cooling period, the cycle may be repeated. Changing valves PL81 and PY81 has restored the picture and sound for a while but the process is again repeated.—H. Cowell (London E.18).

Since both the sound and vision are affected the trouble lies either in the H.T. circuits or in the stages common to both sound and vision. Check the H.T. voltage when the fault occurs and if it is lower than normal, suspect the H.T. rectifier, smoothing, etc. Otherwise, check the valves preferably by substitution, in the tuner and common I.F. stage.

### MASTERADIO TG7T

The receiver section of the set is perfect but the picture suddenly lost height and is now approximately 1½in. in height across the centre of the screen. The width is complete, but in spite of all efforts I cannot increase the height to the full size, 17in. The picture is still there however. All the valves in the set have been tested and both 12BH7 valves have been changed. I have also checked all the resistors associated with these valves. (I have a circuit diagram.)—R. Hefferan (Clydebank).

Check the resistor connected to the height control. Shorted turns in either the frame blocking oscillator transformer or frame output transformer are a frequent cause of the trouble mentioned.

### H.M.V. 1824

A few minutes after switching on the picture fades and the brilliance increases showing white lines about 1in. apart across the screen, rising slightly from left to right until finally only the raster and white lines are left. V5 was substituted and V3 and V4 were also exchanged for others with no improvement.—R. Myles (Avonmouth).

This may be caused by a progressive leak between the heater and cathode of the CRT, as it warms up. If this is proved to be the case, the use of an isolating transformer would effect a cure.

### STELLA 8314U

On switching on, the sound can be heard almost at once, clear with plenty of volume. The picture

begins to develop after ten minutes to the full width of the screen. However, there is a 2in. gap at the top and bottom edges of the picture which are very bright. The picture very slowly fills the whole screen for perhaps the next half hour or so and the picture keeps going from bright to dim and vice versa, showing fly-back lines. For the remainder of the evening it will be quite good. The set cannot be used during daylight unless it is screened from the light.—F. Stone (Timperley).

Low H.T. voltage (check H.T. rectifier) accompanied by low emission of the frame amplifier valve would appear to be the major troubles in your set. The flickering picture should lead to a check of the connections between the valves and valveholders. Try cleaning the pins and make sure that the holders are in good order. The dim picture would indicate a low emission picture tube.

### COSSOR 937

I wish to fit a booster transformer to the above set in order to restore picture brightness.

What is the standard heater voltage, and how do you connect the transformer? — K. Glover (Roby).

The standard heater voltage is 6.3V. Connect the secondary of the boost transformer to pins 1 and 12 of the CRT, having first removed and shorted out the previous wires. Mains for the transformer can be taken from between the chassis and the thick pin of the voltage selector, plug B.

### MARCONIPHONE VT 69 DA

After the receiver has been on for about five minutes the picture disappears, leaving a vertical white line in the centre of the screen for a second, then there is a blank screen. The sound is normal. I had the N152, U153 tested and replaced the U151 EHT rectifier, but the fault still persists. Do you think it is the line transformer? Is there a special way to remove the EHT connector from the tube as it does not seem to be a cap type?—F. Conway (Wallsend-on-Tyne).

A valve test will not reveal a defect in a valve which functions perfectly for five minutes or so. You should replace the N152 (PL81). If there is no improvement, replace the U153 (PY81). The EHT connector is of the cavity type, similar to a press stud.

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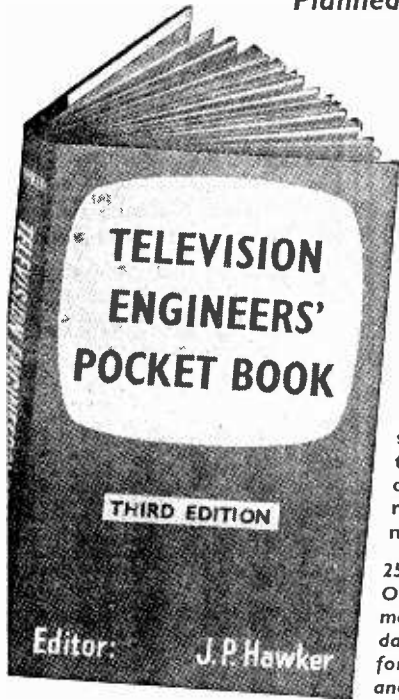
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EF50	4/-	U52	7/-	10F1	6/-
EF80	4/8	U191	18/-	10C1	10/-
EF91	3/-	U281	12/6	10C2	13/-
EL32	5/-	U382	10/-	10F13	8/-
EL33	8/8	U41	10/-	10F19	9/-
EL38	14/6	U801	22/6	12AT7	5/6
EL84	7/-	UAF42	8/-	12AU7	6/-
EY51.S.E.		UBC41	7/9	20D1	8/8
		UBC42	7/-	20P2	9/-
EY51	8/8	UF41	8/6	20L1	12/6
EY86	8/8	UF42	5/9	20P1	10/8
EZ40	6/8	UL41	7/3	20P4	17/6
KT30C	9/8	UL46	7/3	27SU	16/-
KT36	12/6	UL44	11/6	30C1	7/3
KT66	15/-	UY1	6/6	30L1	7/3
PCF84	7/3	U08	14/6	30P4	12/9
PCF89	13/6	U09	6/8	50CD6	22/6
PCF90	7/3	SP41	2/6	185BT	32/-

These are only examples of our valves: if you do not see what you require send stamped addressed envelope for special quotation.

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Complete New Gun fitted in every Tube	
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# SENSATIONAL NEW 1961 DESIGNS— LOW PRICES ★ PICTORIAL STEP-BY-STEP PLANS

## THE NEW "LISBON" TRANSISTOR SET

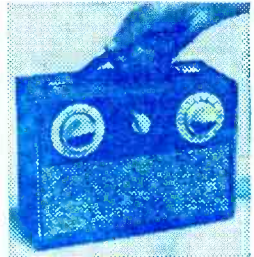
Build the miniature highly sensitive "LISBON" design. This is a pocket 2-stage transistor set not much larger than a matchbox. Excellent clear reception covering all medium waves and working for months and months off a tiny 14 or 3 volt battery costing only 3d. A very simple set to build and an excellent introduction to transistor circuitry. Everything can be supplied down to the last nut and bolt including **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS FOR ONLY 19/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

**19/6**



## "MAJORCA" 7 TRANSISTOR RADIO

Build this 7-TRANSISTOR **£10.19.6** "MAJORCA" superhet portable with Car Radio aerial attachment. An exceptionally high quality design giving remarkable tone with push-pull output. Can be built for **ONLY £10.19.6**, including everything down to the last nut and bolt and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**. Post and packing 3/6 (C.O.D. 3/- extra). Parts sold separately.



## OUR NOVEL WRIST RADIO

Our engineers have designed this novel Wrist Radio using latest transistor techniques. Size only 1 1/4 x 1 x 1/4 in. "Featherweight" yet gives clear, crisp reception over all medium waves. Tiny battery lasts months and months costing only 4d. No snags—anyone can build it in an hour or two using our **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**. All parts can be supplied including case and strap **FOR ONLY 22/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

**22/6**



## THE NEW "FLORIDA" VALVE RADIO

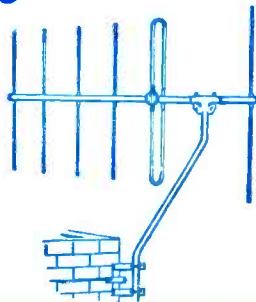
This sensational "FLORIDA" model is one of our most sensitive valve radios. It is a highly compact self-contained miniature push-button base, valve pocket radio at absolutely rock bottom building cost. Covers all medium waves with very latest circuitry bringing in stations from all over Europe without fuss. Size only 4 1/4 x 2 1/4 x 1 1/4 in. A fascinating pocket radio. We can supply all the parts including beautiful 2-tone case and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**, screws, wire, etc. Can be built for the exceptionally **LOW PRICE OF 27/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

**27/6**



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**TYPE A. OPTIONAL 25% and 50% BOOST.**  
 2 V. OR 4 V. OR 6.3 V. OR 10.3 V. OR 13.3 V. MAINS INPUT. 12/8  
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**TYPE B. MAINS INPUT, MULTI OUTPUT 2, 4, 6.3, 7.5, 10 and 13 VOLTS. BOOST 25% AND 50%. LOW CAPACITY. 21/-**  
 Full instructions supplied

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 5 watt 1/3  
 10 watt 1/8  
 15 watt 1/8  
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 25 ohms—10,000 ohms 1/8  
 12.5k to 50k 10 w. ... 3/-

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 Double Play 7in. reel, 2,400ft 60/- Spare Plastic Reels 1/8  
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 Standard 7in. reel, 1,200ft 25/-  
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**O.P. TRANSFORMERS.** Heavy Duty 50 mA, 4/6. Medium push-out 7/6. Miniature, 384, etc. 6/6. Push-pull 10 w., 15/6. L.F. CHOKES 15/10 H. 60/65 mA, 5/-; 10 H., 85 mA, 10/6; 10 H., 150 mA, 14/-.

**MAINS TRANSFORMERS 200/250 v. A.C. STANDARD.** 200-0-250, 80 mA, 6.3 v. 3.5 a. Tapped 4 v. 4. Rectifier 6.3 v. 1 a. 3 v. 2 a. or 4 v. 2 a. ditto, 350-0-350 ... 22/6  
 MINIATURE 200 v. 20 mA, 6.3 v. 1 a. ... 10/6  
 MIDGET, 220 v. 45 mA, 6.3 v. 2 a. ... 15/6  
 SMALL, 220-0-220, 50 mA, 6.3 v. 2 a. ... 17/6  
 STD., 250-0-250, 65 mA, 6.3 v. 3.5 a. ... 17/6  
**HEATER TRANS.** 6.3 v. 11 amp. ... 7/6  
 Ditto, tapped sec. 2, 4, 6.3 v., 11 amp. ... 5/6  
 Ditto, sec. 6.3 v. 3 amp. ... 10/6  
**GENERAL PURPOSE LOW VOLTAGE Ta.** 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. ... 22/6  
**AUTO TRANSFORMERS.** 150 w. ... 22/6  
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**LOUDSPEAKER P.M.T. 3 OHM.** 5in., 5in., 10in., 17/6.  
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 6in. Rola, 12/6. 10 x 6in., 27/6. 10in. Rola, 30/-.  
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**STENTORIAN HF1012.** 10in. x 10 v. 15 ohms, 10w., 90/-12in. Baker 15 watt 3 ohms, or 15 ohms, 105/-  
**CRYSTAL DIODE (G.A.C.) 2/-.** GEX34, 4/-  
**HIGH RESISTANCE PHONOS.** 4,000 ohms, 15/- per  
**MIKE TRANS.** 50 1/3, 5/6. 100 1/3, 10/6. 100 1/3, 10/6.  
**SWITCH CLEANER.** Fluid squirt sprout, 4/3 tin.  
**TWIN GANG TUNING CONDENSERS.** 365 pF miniature (lin. x 1 1/2in. x 1 1/2in., 0.0005 standard with trimmers, 9/-; less trimmers, 8/-; midget, 7/6.  
**SINGLE.** 50 pF, 2/6; 1 pF, 100 pF, 10/-; 100 pF, 7/6.  
**SOIL dielectric (100, 300, 500 pF, 5/6).  
**SPEAKER FRET. GOLD CLOTH.** 17in., 25in., 5/- 25in. x 35in., 17/-; Tysan 4ft. 6in. wide, 10/-; 2ft. 3in. wide, 5/-; Brown, green or red, Sanyas S.A.E.  
 New and Boxed **VALVES** 90-day Guarantee.**

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6Y3	7/6	6V6	8/6	EB42	10/6	PC12	11/6
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6A6E	5/-	12AT7	8/6	EB39	9/6	PL1	7/6
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6D6	8/-	12K7	8/6	EP92	6/-	1R4	9/6
6BE6	7/6	12Q7	8/6	EB32	5/6	PL142	9/6
6BE6	7/6	3Z5	9/6	EB39	9/6	PL1	9/6
6C5	5/6	35Z4	7/6	EB39	9/6	UL41	8/6
6C6	5/6	80	9/6	EB39	9/6	UL41	8/6
6J7	8/6	807	5/6	EZ40	7/6	122	8/6
6K8GT	6/6	954	1/6	EZ50	7/6	VR105	8/6
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Attractive plastic cabinet. Ferrite rod aerial for A.M., telescopic aerial for F.M. Order now, lowest prices.

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 Audio OX71 10/- RF OC44 ... 15/6  
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 1, 2, 4, 3, 8, 25, 50, 100 mfd. 3/- each.  
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 Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)  
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**ALUMINIUM PANELS.** 18 s.w.g. 12in. x 12in., 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3.

**JASON F.M. TUNER COIL SET, 29/-.** H.F. coil, aerial coil. Oscillator coil. Two I.F. trans. 10.7 Mc/s. Ratio Detector and heater choke. Circuit book using four 6AM6, 2/6.

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**BBC TRANSISTOR RADIO.** Med. and Long Wave. Two transistors and diode. Complete kit, 32/6, phones 7/6 extra. Deaf Aid Earpiece with Special Lead, 12/6. Details 6d.

**CYLDON TURRET TELETUNER**  
 I.F. 33.88 mc/s, complete with trans-grid valves, 3001, 30115. With coils for TV and FM channels 1 to 13. Brand new, price 45/-, operating data and circuit supplied. IDEAL for P.T. "OLYMPIC".

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 Long spindles. Guaranteed 1 year. Midget 5K ohms to 2 Meg. 50c. No Sw. D.P. 5/6. Linear or Log Tracks. Fringe Quality 1/- per ft. Semi-air spaced. Lin. Air Spaced. 6d. per ft.

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**BALANCED TWIN FEEDER** 1/6. 80 or 300 ohms. DITTO SCREENED per yd. 1/8. 80 ohms only. **WIRE-WOUND POTS, 3 WATT.** Preset Min. TV Type. All value 25 ohms to 25 K. 3/- ea. 30 K. 50 K. 4/- (Carbon 30 K. to 2 meg. 3/-) **WIRE-WOUND 4 WATT.** Pres. Long. Spindle Value, 50 ohms to 50 K. 8/6; 100 K. 7/6. **CONDENSERS.** New Stock. 0.001 mid. 7 kV. T.C.C. 5/6; Ditto, 20 kV., 9/6; 0.1 mfd., 7 kV., 9/6; Tubular 500 v. 0.001 to 0.05 mfd., 8d.; 0.1, 1/-; 0.25, 1/6; 0.5-500 v., 1/8; 0.1/350 v., 8d.; 0.01/2,000 v., 0.1/1,000 v., 1/8; 0.1 mid., 2,000 volts, 3/6. **CERAMIC COND.** 500 v. 0.3 pF to 0.01 mfd., 9d. **SILVER MICA CONDENSERS.** 10% 5 pF to 500 pF, 1/-; 500 pF to 3,000 pF, 1/3. Close tolerance ( $\pm 1$  pF) 1.5 pF to 47 pF, 1/6. Ditto 15% 50 pF to 815 pF, 1/8; 1,000 pF to 5,000 pF, 2/-.

**I.F. TRANSFORMERS 7/6 pair**  
 465 Kc/s. High Tuning Miniature Can. 1 1/2 x 1 1/2 in. Slot Q and good bandwidth. By Pro Radio. Data sheet supplied.  
**WEYMOUTH, Standard size, 465 Kc/s. 12/6 pair.**

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TUBULAR	TUBULAR	CAN TYPES	
1/350v. 2/3	50/350v. 5/6	16/450v. 5/-	
2/450v. 2/3	100/25v. 2/6	32/350v. 4/-	
4/450v. 2/3	250/25v. 2/6	100/270v. 5/6	
8/450v. 2/3	500/12v. 3/-	2,500/5v. 4/-	
8/500v. 2/3	8-8/450v. 5/6	5,000/2v. 5/-	
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32/450v. 3/6	16-16/450v. 4/6	32-32+32/350v. 7/-	
50/25v. 1/8	16-16/500v. 6/6	64-120/350v. 11/8	
50/50v. 2/3	32-32+32/50v. 4/6	100-200/275v. 12/8	

**RECTIFIERS SELENIUM** 300 v. 85 mA, 7/6.  
**CONTACT COOLED** 250 v. 50 mA, 7/-; 50 mA, 8/6; 40 mA, 9/6; 200 mA, 21/-; 300 mA, 27/6.  
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**FERRITE ROD AERIALS.** M.W. 8/9; M. & L. 12/6.  
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**FERRITE ROD.** sin. x 2in. dia. 2/6.  
**PULL WAVE BRIDGE SELENIUM RECTIFIER:** 2, 6 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/6.  
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**WAVECHANGING SWITCHES**  
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 3 p. 4-way, or 1 p. 12-way long spindle 3/6  
**VALVEHOLDERS.** Fax Int. Oct. 4d. EF50, EA60, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6 and 7 pin, 1/-.  
**MOULDED MAZDA** and Int. Oct., 6d.  
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