TELEVISION WITHOUT MAINS

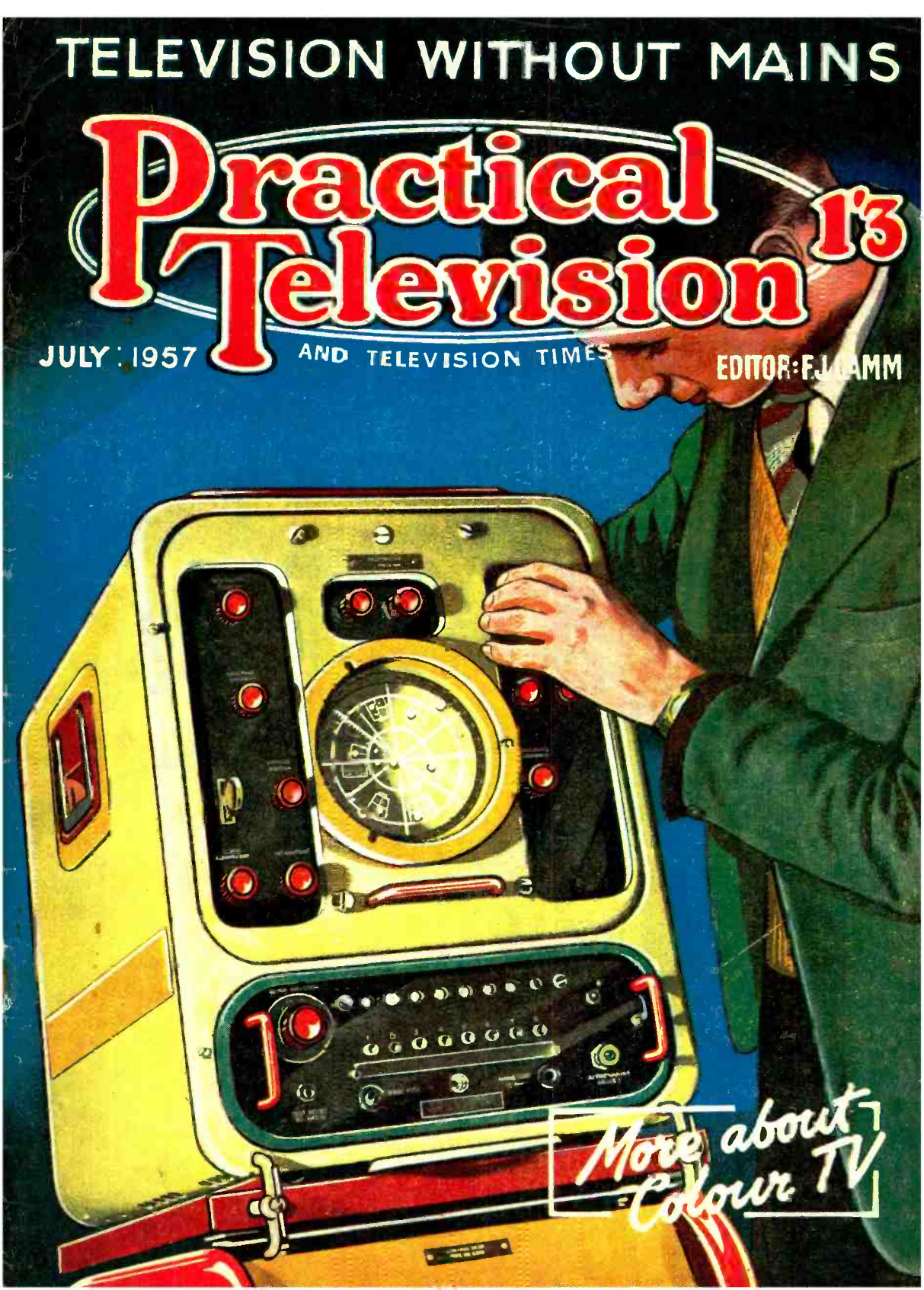
Practical Television

1'3

JULY : 1957

AND TELEVISION TIMES

EDITOR: F.J. CAMM



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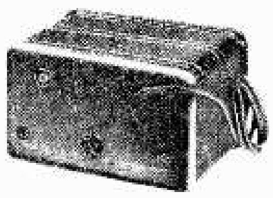

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EA50	2/-	EF73	10/6	KTW61	8/-	PM12	4/-	UCC85	11/6	Z63	10/6
EA76	9/6	EF80	8/6	KTW63	8/-	PM12M	6/6	UCH42	10/-	Z66	20/-
EABC80	7/6	EF85	7/6	KTZ41	6/-	PY80	9/-	UCH81	11/6	Z77	9/-
EAC91	9/-	EF86	12/6	KTZ63	10/6	PY81	9/-	UF41	9/-	Z719	12/6
EAF42	10/6	EF89	10/-	L63	6/-	PY82	7/6	UL41	10/-	Z729	12/6
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Practical Television

& TELEVISION TIMES

Editor : F. J. CAMM

Vol. 7 No. 84 EVERY MONTH JULY, 1957

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CONTENTS :

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to : The Editor, "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of radio apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

TELEVIEWS

TV SOCIETY TRANSMITTER

THE transmitter of the Television Society is now in operation at Norwood Technical College. It has the dual object of providing a service to the radio industry for testing Band 4 reception and providing a means of training students. It is hoped that in the future it will be possible to televise the lectures given at the college. The TV Society has just held its 28th Annual General Meeting, when it was stated that transmissions would take place on Mondays, Wednesdays and Fridays, from 7 p.m. to 9 p.m., with Test Card C and a tone.

AUTOMATION IN THE STUDIOS

AUTOMATION, already in use in factories, is creating some man-power problems in America, since it was introduced into the transmitting studios. The introduction of magnetic tape recording, which will eventually replace the slower and more costly picture tube or Tele-cine system, is the cause. The reduction in man-power is naturally creating wage problems. Whilst the BBC and I.T.V. have not developed automation to the same extent as America it is obvious that the problems must soon occur over here.

OVER 7 MILLION !

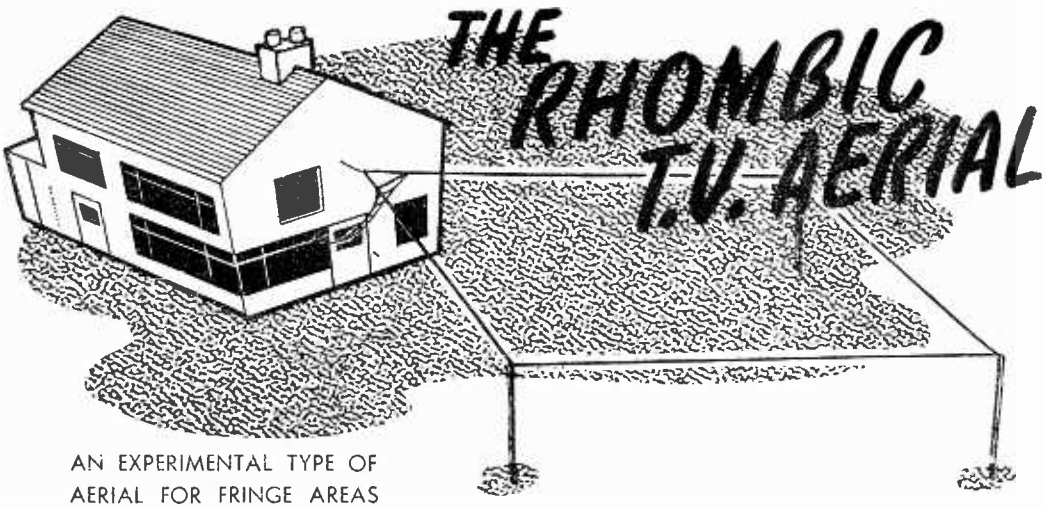
WHEN the first issue of this journal went to press five years ago there were approximately 285,000 viewers, and they were concentrated in the Home Counties. In May of this year it was announced that the 7 million mark had been passed, and the figures continue to increase. In those five years we have seen television extend to practically the whole country and the introduction of I.T.V. Shall we have colour television within the next five years, and stereoscopic television within the next 10? Will TV tubes get smaller and pictures larger as discussed on page 579? In view of the rapid changes in technique all these things are possible.

THAT EXTRA £1 !

THE £1 excise duty (provided for in the Budget) on combined television and sound licences is the first tax of its kind since broadcasting began. Although it is not calculated to affect the sale of sets, it is known that the tax is not welcomed by the industry, the BBC and the I.T.V. The number of combined licences is over 7 million and is increasing at the rate of over 1 million a year. The Chancellor of the Exchequer in our view under-estimated the yield which he placed at £8 million. The average price of a television receiver to-day is £70 inclusive of the punitive 60 per cent. purchase tax. Television, however, is still the cheapest form of entertainment.—F. J. C.

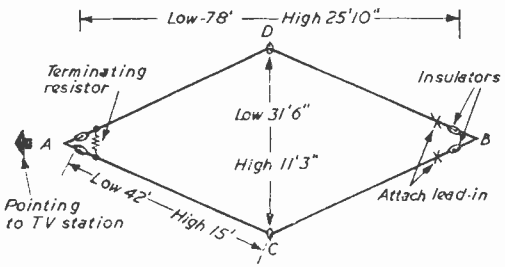
Our next issue, dated August, will be published on July 19th.

THE RHOMBIC T.V. AERIAL



AN EXPERIMENTAL TYPE OF AERIAL FOR FRINGE AREAS

FROM time to time we have received enquiries concerning practical data on the rhombic aerial, a type of aerial system which is not found much in this country. In America, however, it is used fairly widely by amateurs, mainly on account of the long ranges which have to be covered and the fact that many viewers are situated in open country, or their houses are widely spaced. A recent article in the American magazine "Science and Mechanics" gave constructional details of an



200'Wire - No 12copper
6-Insulators
1-Resistor-820 OHM ±10%, ½ Watt, carbon.

Fig. 2.—Plan of rhombic with measurements.

aerial of this type, and many of the details will, no doubt, prove of value to those amateurs who are interested in this form of aerial. We accordingly give below a modified reprint of the article in question, which we hope will be of use to those who like experimenting with various aerial systems.

Meaning of the Word

Rhombic simply means "diamond shaped." There are various ways in which a rhombic can be erected, depending on the space available. First here is the theory of the rhombic.

Since the ordinary "dipole" (Fig. 1) receives best at right-angles to its length, it is aimed broadside to a station. Stretch out the aerial so that it is longer than a wavelength, and it receives best from a diagonal direction. Tie four long aerials together in the diamond shape shown, and the four "lobes" on the individual legs which point in the same direction add forces, while the remainder, operating in opposite directions, cancel each other. Thus, signals coming from the lengthwise direction are received strongest, picking up more energy as they go down to the lead in the TV set. Reflection and interfering noises from all other directions are lost.

To remove unwanted signals from the aerial, a "terminating resistor" short circuits the end opposite to the receiver connection.

Constructional Details

Fig. 2 is a plan view, showing dimensions for both the "low" channels from 2 to 6 and the "highs" from 7 to 13. If your interest is only in the high band, use the smaller dimensions. For reception of the low band stations, or some of both high and low, use the large dimensions. If, because of space limitations, it is not possible to adhere to these specifications, it is not necessary completely to abandon the idea of the rhombic. A compromise design for mounting the rhombic inside the attic or even under a room rug may still give better reception than would be obtained with a heavy array of aluminium on the roof.

By using trees, houses and other nearby objects from which to hang corners of the aerial, the amateur

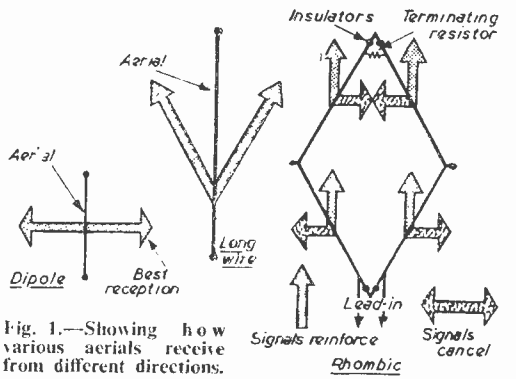


Fig. 1.—Showing how various aerials receive from different directions.

can quite often manage with one or two poles at the most. The aerial does not have to be close up to the window, so it may be located where there is the maximum of already existing support. Hang the aerial as high as possible, 12ft. to 15ft. where the signal strength is not too low, up to 30ft. to 40ft. in extremely poor fringe reception areas. If you do not know the signal strength at your location, place a hand-held dipole "probe" at different levels. At any point where the dipole picks up the signal, the rhombic aerial should work.

The prime requirement for laying out a rhombic aerial is that it be pointed accurately at the desired station. Unlike other aerials, this type is sharp, and a 10 deg. error is enough to miss the signals completely. You might be able to adjust the ends one way or the other to improve the response when the aerial is up, but it is obviously better to point it right in the first place.

To do this you need a chart, protractor and a compass. The chart should be the navigational kind, either aeronautical or marine, not a road map.

Mark the locations of your site and the TV transmitting station accurately on the chart, draw a line between the two points, and this is the line down which the rhombic should point. Now draw a vertical north-south line through your situation and take the protractor in hand. If the TV station is to your east, the angle measured clockwise between north and the station line is the true bearing of the station. With a station to your west, measure counter-clockwise from north, then subtract this angle from 360 deg., and the resulting angle will be the true bearing of the station.

On the chart find the "variation," "magnetic declination" for your locality. To change the true bearing from the chart to a compass bearing which can be laid out on the ground, add westerly variation to the true figure, or subtract easterly. In case the true figure is not large enough to make subtraction possible, first add 360 deg. to it. On the other hand, if the sum of your addition is greater than 360 deg., subtract this amount from the result. The end result in any event will be a compass bearing figure between 0 deg. and 359 deg.

Now on the ground below the point where the TV set end of the rhombic will hang (A in Fig. 2), place the compass. Rotate the compass case so that the zero mark on the scale comes under the north end of the needle. Then have an assistant with a flag-marked stake walk several feet down the approximate bearing line. Sight over the compass centre through the bearing figure, and have your assistant drive the stake exactly on this line. Lay out the dimensions of the desired rhombic along this line on the ground, and plant poles or string ropes from nearby objects for support. Points of support

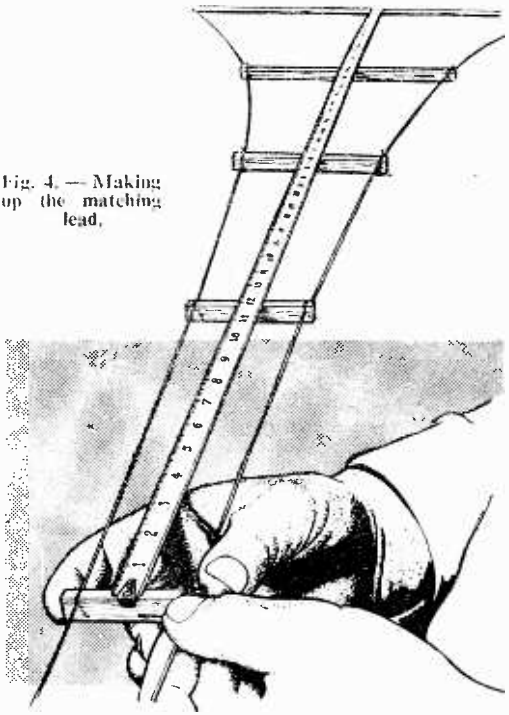


Fig. 4.—Making up the matching lead.

should all be at the same height so that the aerial will be level. Clothes line pulleys and rope can be used for halliards to hoist the rhombic into the air.

It is preferable to build the aerial on the ground. Following the dimensions of Fig. 2, drive a small stake at each corner. Temporarily fasten two insulators to each end stake (Fig. 5), and one insulator to each side stake. Run a length of stranded copper wire through each side insulator, pull taut and secure the ends into the insulators. The result is two lengths of wire, insulated from each other, each forming one side of the diamond.

At the end of the aerial facing the TV station (A in Fig. 2), solder the terminating resistor, then cover it with a protective wrapping of plastic insulating tape. Form the leads so that the resistor will ride above the side wires, to prevent its collecting water.

The lead-in line to the TV set is attached to the other end (B in Fig. 2). With a rhombic aerial the lead-in requires an "Impedance Transformer" between the aerial and the conventional lead in. The rhombic aerial impedance is 800 ohms, whilst the ordinary feeder is at low value, so a line section with a gradually changing resistance is used. This is called an "exponential line," and it is simple to make (Fig. 3). Attach two 11ft. lengths of No. 18

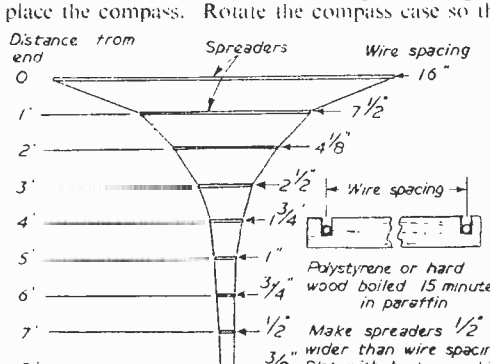


Fig. 3.—The matching lead.

copper wire to points 16in. apart, and pull the other ends tautly together at one point. Give the wires a good jerk to pull out the kinks. Then fit the spreaders to the line at 1ft. intervals (Fig. 4), securing them with a wrap of No. 18 wire as you go. The result will be a line section with the required resistance taper.

The large end of the exponential line (Fig. 3) is soldered to the aerial wires at the point where they are separated just 16in. Cut the tapered line to a 10ft. length and solder regular feeder cable to the small end. If the exponential line tends to twist at the small end, add spacers until the wires cannot tangle.

Now attach the halliards to the corner insulators.

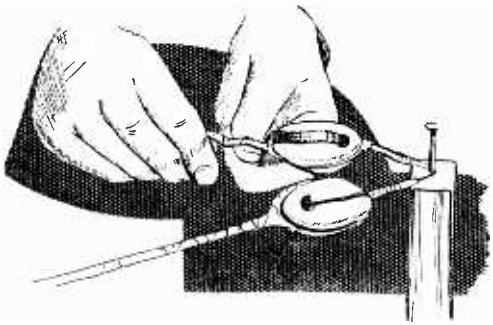


Fig. 5.—Fastening insulators to the supports

disconnect the stakes, and hoist the rhombic into position. Trim the adjustment of the halliards very carefully so that the diamond lies flat and is aimed horizontally.

Since long distance TV waves may not follow a straight line, it is wise to "touch up" the aiming of the rhombic after it is in place by pulling the ends one way and then the other, and also raising and lowering them a few degrees while someone watches the TV picture. The aiming which gives the best picture is the one to use and sometimes a correction in the pointing of only a few inches can make a difference.

Rhombics for Town Dwellers

Town dwellers or those with no garden space can often benefit by the use of a "jury-rigged" rhombic. Suppose there is not room for a 60ft. or even a 20ft. wire diamond "out in the clear." A smaller rhombic aerial can be strung between the stub post of the roof, or even between rafters in the attic. And upper floor dwellers (if the rooms aren't metal lathed) may find that a rhombic under the rug will prove better than the usual inside aerial or a conventional dipole on the roof.

No strict rule can be laid down for the angles or dimensions of the jury-rigged rhombic because of the varying effects of nearby objects. But in general, as a rhombic is made smaller, it should broaden out. With the aerial temporarily in place, the sides and the corners can be pulled out and back, using strings or dry pieces of wood to alter the aim, while somebody watches the TV picture for best response.

As in erecting full-sized aerials, the first thing is to determine the direction of the transmitting station. In crowded areas, this can be judged from the alignment of nearby dipole aerials. The rhombic should point at right-angles to the dipole arms.

On flat roofs, light halliards can be attached to the building parapet or short posts erected at the diamond corner points, so that the aerial hangs a few inches above the roof surface. The main requirements are that the wire should be above the water or snow level and that it does not come in contact with pipes or other wires.

If a sloping roof house is facing the correct way and approximately square, the rhombic may be hung around the edges of the roof at the eaves or on stub posts nailed to the corners. Or again, if the house is suitably oriented you can hang two opposite corners of the diamond on the opposite peaks of the roof, supporting the other corners by centre post of the roof sides, rising up to the peak height.

The aerial may be hung indoors in an empty attic. Insulated No. 20 wiring-up wire can be used inside, with heavy string or cord for insulation and support. Find the line of the aerial with a compass, then drive nails in the rafters above and outside the corner points so that the spans of wire will hang level and uniform.

A rhombic can even be laid under the rug if you live above ground door and the building is not metal lathed or otherwise screened. Either roll up the rug and "Scotch tape" No. 20 insulated wire to the floor, or slide the wire under the rug from the diamond corner points, pulling it taut for straight sides. Make use of all the space available, so that the aerial is as large as possible, and use the same care in orienting it as you would outside.

With an under-the-rug rhombic, niceties like the exponential line transformer may be impossible to accommodate. In this event, simply attach lead-in ribbon to the aerial wires. The terminating resistor can also be eliminated if it is found that no increase of noise results.

TV Without Mains

HINTS FOR THE USE OF TV RECEIVERS IN PLACES WHERE NO MAINS FACILITIES EXIST

By H. Peters

WITH over 90 per cent. of the country covered by the BBC Television Service, and the I.T.A. rapidly expanding, there are countless thousands of isolated cottages and farms where television would be really appreciated, but whose occupants shrink from buying or making a set because their electricity does not come from the national grid. Providing the set and the power supply are carefully chosen, however, it is possible to enjoy good television from almost any generating plant or farm lighting set.

Receivers Available

The choice of set will depend a lot on the nature of the local supply. If it is 200 volts A.C. or D.C., or 100 volts A.C. (or thereabouts) almost any of the commercial receivers will do. It is advisable to choose a set without a mains transformer, on grounds of economy in running, and to avoid those which have flywheel sync. as these may produce wavy verticals. The current consumption of the average modern A.C./D.C. set is about 150 watts (or .75 amp. at 200 volts).

On D.C. supplies between 50-100 volts, a rotary or vibrator converter is necessary, and must be of sufficient rating to cope with the 150 watt load.

Below 50 volts the most economic set to run is the 9in. Ekco portable, which only consumes 90 watts, and will run off a 12 volt car battery if float charged from the lighting plant. On 50 volt D.C. supply, this can be done via the 100 watts dining room lamp, which can be left on during the day in series with the car battery. It can even be left on with the set running, and will then reduce the drain on the battery by 2 amps. This particular TV will run straight off a 12 volts car battery, which will need changing every other night if the set is used a lot. Now to deal with some of the snags which may crop up :—

C1–3 ·01 1000V. Paper.
C4–6 470 pf Disc ceramic
L1 & 2 5amp. suppressor chokes
L3 & 4 1 amp. suppressor chokes

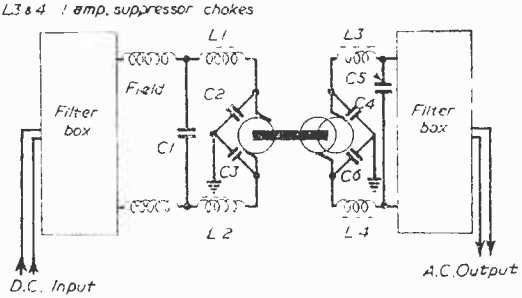


Fig. 1.—Extra suppression fitted to rotary converter.

1. Interference

This can be divided into two parts : interference from the generator house, and interference from the rotary converter or vibrator.

Generator interference is best dealt with by car radio technique, fitting suppressors to the sparking plugs (if any) and clipping automobile type condensers on the dynamo, fuel pump, and ignition coil if required.

The mains output can be fed through choke-condenser networks to remove any spark interference or rough waveforms, and the values here depend on the voltage, total load, and whether A.C. or D.C. If in doubt consult the supplier or manufacturer.

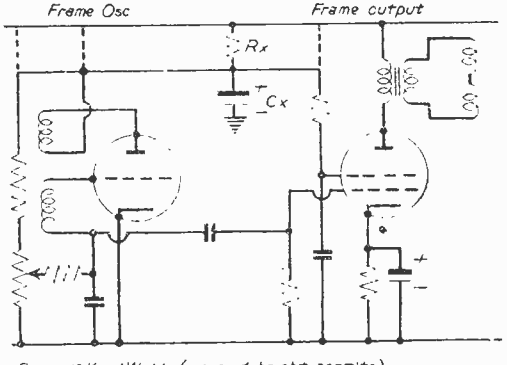
The most common interference comes from rotary converters and vibrator packs. The former are usually enclosed in sponge padded metal cases, which should be earthed and bonded to the frame of the converter. These instruments usually have filter networks incorporated in tin boxes filled with pitch, and these have a habit of becoming hygroscopic and causing trouble.

Extra suppression can be applied at the brushes with small iron-cored chokes in series with the field windings, and with High-K ceramics from the brushes to the frame.

Vibrator packs are usually well suppressed and very little can be added to improve their efficiency. The commonest parts to fail, apart from the vibrators, are the high-voltage-working buffer condensers across the secondary, without which a very peaky waveform would result.

2. Strobing

This is a trouble from which most sets that run



Rx 10K 1Watt (more if height permits)
Cx 100 µF. 350V (use reservoir on D.C. mains)

Fig. 2. Extra decoupling fitted to steady the frame timebase.

from asynchronous mains suffer, as transmitted television waveforms are locked to the national grid. Faults such as poor frame linearity, modulation hum, and bent verticals which pass unnoticed on receivers running off the grid will, on a set run off a local A.C. supply, produce a crawling bar or wavy picture which is very hard to watch, whilst on D.C. supplies which do not feed the set via a converter, frame "judder" or "bounce" is usually the worst offender.

These troubles can be minimised at the outset by selecting a receiver without flywheel sync. which you are permitted to see demonstrated on a test card, and which for preference has two frame linearity controls, one for "top" correction and one for overall

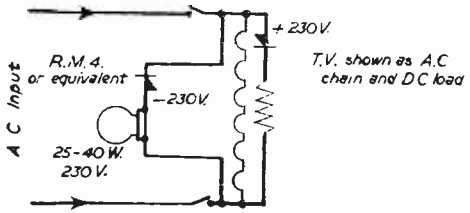


Fig. 3.—Circuit for balancing out negative D.C. feedback.

linearity. To cure them, some additional smoothing will have to be fitted, but not across the reservoir condenser!

Frame bounce and non-linearity are the easiest to tackle. Disconnect from the H.T. rail the feeds to the frame oscillator, and the screen of the output valve, but not the anode connection. Group these together and decouple with a 10 K, 1 watt resistor, and a 100μF 450-volt electrolytic as in the diagram.

On 230-volt D.C. supplies the main reservoir condenser which is normally disconnected to save the "switch on" surge will do, but a note should be made in case the set is ever run off A.C. mains.

Modulation hum of the cathode-ray tube can be tracked down by the time-honoured methods used on radio sets. Check the mains buffer condensers, mains polarity and the heater-cathode insulation of the local oscillator and video detector. Also trace out the frame fly-back suppression system if fitted, and try disconnecting it.

Bent verticals due to phase modulation of the line (flywheel) timebase are a bit tricky to cure, and general principles are difficult to apply as circuits vary. If the signal strength permits, the circuit can be rewired to disconnect the coincidence detector and a conventional sync. feed can be taken from the sync. separator anode via a 3 to 10 pF condenser to a suitable point on the line oscillator. It should be remembered that reference pulses from the line output stage are normally fed to these stages as well as to any gated A.G.C. system which may be employed, and the former must be removed without distorting the latter.

A useful tip to service engineers who wish to simulate the customer's conditions in their workshops is to run a true pattern generator unlocked from the mains and use this as a signal source.

3. Wear on Rotary Converter Brushes

This and overheating can be baffling especially if the converter checks O.K. and has previously run the radiogram for years without any bother. It is usually due to saturation of the secondary by an unwanted negative D.C. component fed back from the TV in the following way:

The average TV consumes .5 amps from the A.C. mains of which .3 amps is used for the heaters, and the remainder converted into D.C. for high tension. Only the positive half cycles are used for the latter, which leaves a negative D.C. component of about 40 watts to dissipate itself in the power supply. Here it overheats the brushes and saturates the windings, reducing their efficiency.

This can be overcome by fitting a metal rectifier RM4, 14A86, or similar, in series with a 25-40-watt lamp across the supply, and wired to give negative output equal to the H.T. positive drain.

An old rectifier discarded for low output is ideal for the job, and a convenient mounting place is at the rear of the TV, where the diffused lighting can be decorative, and where the supply to the unit can be tapped off the set side of the TV on-off switch.

Service engineers who have to remove rotary converters to the workshop for servicing will be interested to know that an improvised source of D.C. supply for testing them can also be made from old metal rectifiers. Four or five in parallel will do, fed from an auto-transformer which delivers about 30 per cent. more A.C. output voltage than the D.C. input required by the converter. The author has used a mixture of RM4 and 14A86 types without any ill effects.

Radio Engineers Use Mountain Obstacles to Strengthen Radio and TV Signals

METHODS for using high mountains between a radio or television transmitter and receiver to improve, rather than hinder, the reception of ultra-high-frequency signals were described recently at the opening session of the Institute of Radio Engineers' four-day national convention.

Speaking at the Waldorf-Astoria Hotel, R. E. Lacy, of the Signal Corps Engineering Laboratories, Fort Monmouth, N.J., described an extensive series of tests made at 40 different locations in California, which verified that sharp mountain peaks blocking the transmission path will actually strengthen the signal on the other side by as much as 100 million times compared to what it would be with no mountain in the way. The tests were conducted over a wide range of frequencies above 50 Mc/s—the range used for V.H.F. and U.H.F. television as well as other communication services.

This phenomenon, technically known as "obstacle gain," was first noticed by American G.I.s during the Korean War, who discovered that radio reception was unaccountably improved in the mountainous terrain of Korea. It was later deduced that ultra-high-frequency radio waves, which act much like light waves, are bent down toward the ground when they pass over sharp mountain ridges, just as light waves are diffracted when passing by the edges of opaque objects. Previously, such mountain obstacles were avoided as ruinous to good radio reception.

The information gained from the California tests, Mr. Lacy reported, makes it possible to compute the "obstacle gain" accurately and to locate transmitting and receiving sites to take advantage of the phenomenon.

A Frame Pulse Separator

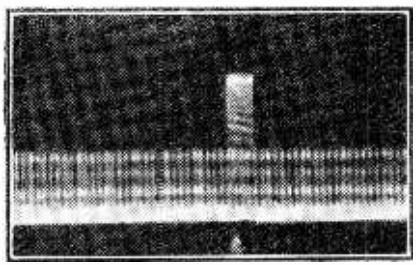
AN IMPROVED CIRCUIT FOR BETTER INTERLACING

By S. V. Brown

BECAUSE of the differing output waveform of the normal frame pulse integrator, an accurate interlacing of odd and even frames is difficult, if not impossible, to attain.

The following method of separating the frame from the line pulses does not depend on any form of integrating network.

As a matter of fact with this kind of separator only the leading frame pulse is required for triggering the timebase oscillator, although all eight are produced in the output.



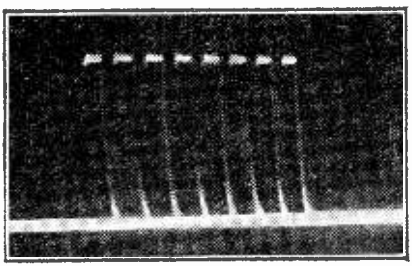
Waveform at grid of V2.

This does not mean that perfect interlacing is ensured, as so much depends on the accurate firing of the timebase. But a definite improvement should result, even if it tends to fire erratically.

Function

The working of the circuit is fairly straightforward. A negative gaining sync. input is required.

V1 clips the sync. pulses and reverses their phase, producing a positive-going signal at the anode. L and C3 form a combination which works like a rejector circuit for the line sync., leaving the frame pulses practically unattenuated. C2 is merely a coupling condenser.



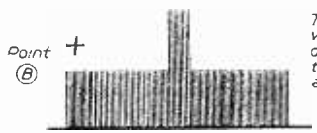
Waveform at anode of V2.

V2 is the frame pulse separator. Working as an anode bend detector it is biased beyond cut-off, only the frame sync pulses causing anode current to flow. The bias, and thus the amplitude of the output, is adjusted by R7.

The circuit is very stable in operation. V2 bias being set to a satisfactory point it can then be left, as all pulses at V1 anode will be of constant amplitude, provided the sync input to the grid is sufficient to cause clipping of the pulses.

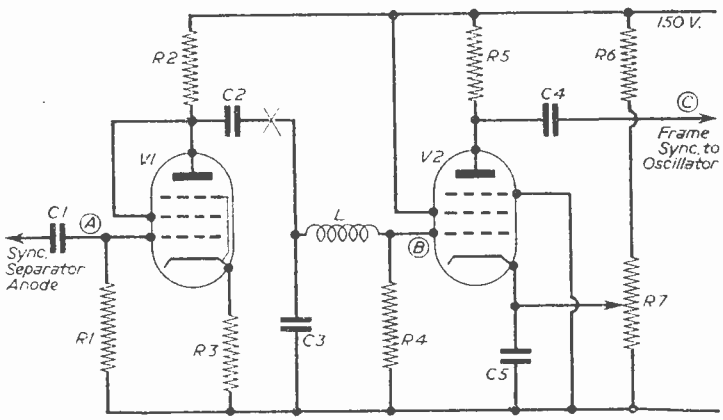
(Concluded on page 558)

Combined Line and Frame pulses of equal amplitude



The Frame pulses, which are about double the height of the Line, have an amplitude of approx 50 v.

The 8 separated Frame pulses. Their amplitude may be varied up to about 70 v. by adjusting R7



The circuit, and above, the waveform at the points indicated.

LIST OF COMPONENTS

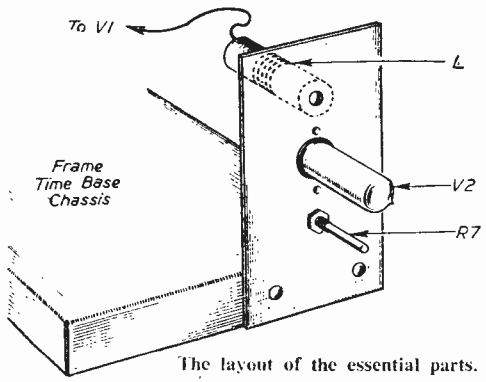
V1 6AK5 or 6AM6 for .3 amp. series heater operation.
V2—6AM6. 2 B7G holders.
R1 22 KΩ ½ w.
R2, R5 47 KΩ ½ w.
R3 - 150 Ω ½ w.
R4 2.2 MΩ ½ w.
R6 -33 KΩ 1 w.
R7 10 KΩ, wire wound.
C1, C2, C4, C5 .1 μF paper
C3 .0003 μF mica.
L Wearite PHFL longwave coil with the aerial winding removed.

Construction

For ease of insertion into an existing receiver the circuit can be built up on two small chassis, or even small aluminium sheets which can be bolted to the existing chassis at convenient points. At point X, the lead can be broken and extended by up to a foot, provided it is kept away from points of interference like the line timebase.

It is left to the constructor to calculate the value of resistors for dropping the H.T. to about 150 volts from the H.T. rail of his receiver. Large value decoupling condensers can be used to ensure no 50 c/s ripple, or interference, on the H.T. line, affecting the pulses.

These components are best fitted in the existing receiver so the unit(s) can be made as small as possible.



The layout of the essential parts.

Scottish TV

SOME DETAILS OF THE BLACK HILL TRANSMITTER

THE new transmitting station now being built by the Independent Television Authority at Black Hill, Lanarkshire, will provide a service for about three-quarters of the population of Scotland.

The coverage map shows that it is estimated that the reception area of this station will extend from Dundee to Dunoon and from Dunbar to Ayr. By using an entirely new design of aerial array the I.T.A. has succeeded in beaming the highest possible towards the most populated areas and over 3½ million people will be within the primary service area. It is estimated that reception conditions will be as follows :

Primary Area extending from Cupar to Greenock and from Dunbar to Cumnock. This area has a population of 3,310,000 and most viewers there unless they are situated in particularly unfavourable positions should receive a consistently satisfactory service.

Secondary Area with a population of 460,000. In this area a substantial proportion of viewers should receive a satisfactory service, but in a few unfavourably situated places reception may be poor.

Fringe Area with a population of 50,000 people. In this area acceptable reception should be secured in many locations although this service may be subject to some interference from time to time.

The Black Hill transmitting station will transmit towards the north-east the most powerful Band III signal in the world ; the effective radiated power will be 475 kilowatts towards Dundee, 200 kilowatts towards Ayr and 65 kilowatts towards the north-west and south-east. It will use the highest mast yet constructed for the Independent Television Authority; this mast will be 750ft. high and as the site is 850ft. above sea level the top of the aerial will be 1,600ft. above sea level.

The station will operate on Channel 10 and the frequencies will be 199.7305 Mc/s for vision and 196.2395 Mc/s for sound.

The station building at Black Hill is now virtually complete and much of the equipment has already been installed. The mast has been erected to the 600ft. level and installation of the aerial array at the top should begin shortly.

Scottish Committee

Sir Kenneth Clark, Chairman of the Independent Television Authority, announced the appointment of a Scottish Committee to advise the Authority concerning the general conduct of Independent Television in Scotland. It is the first committee of its kind to be established by the Authority.

Sir Kenneth, speaking at a Press conference in Glasgow, also revealed that Mr. Noel Stevenson had been appointed I.T.A. Executive Officer in Scotland.

Commenting on the committee, Sir Kenneth said : " I must say one thing in anticipation of their troubles. It is no part of their function to interfere directly with the programmes of Scottish Television Limited ; they are being asked to advise us on the general conduct of Independent Television in Scotland with particular emphasis on those aspects for which, under the Act, the Authority has a special responsibility. I am thinking in particular of programmes concerned with Political and Industrial controversy, of the religious programmes which cannot be put on without the Authority's consent, of programmes for children and the need for accuracy and impartiality in the news."

Earlier Sir Kenneth had recalled that the Authority was a Public Corporation appointed under an Act of Parliament. Its first duty was to build stations and transmit programmes from them. The station at Black Hill had been built and would be run by the I.T.A. Its next duty was to appoint contractors who would produce the programmes ; their first contractor in Scotland was Scottish Television Limited which worked under the dynamic direction of Mr. Roy Thomson.

Sir Kenneth said : " We are confident he has the energy and resourcefulness and knowledge of the medium to ensure that Scotland gets programmes at least equal to those in any part of the British Isles. We will always be grateful that he had the courage to take on television in Scotland at a time when things did not look so rosy as they do to-day."

Sir Kenneth said that viewers in Scotland would want to see the best of what was being initiated south of the border—and across the Atlantic. But he

believed that, through television, Scotland might also become more conscious of its own culture. He was not suggesting that the great achievements of Scotland in the age of enlightenment—the achievements of Hume, Adam Smith, Allan Ramsay, Robert Adam or Mansfield—were likely to feature very prominently on television, though heaven knew this Scottish achievement ought to be better known than it was. Television was a popular medium and the culture which it nourished must be rooted in the people as was the best par. of Robert Burns' poetry.

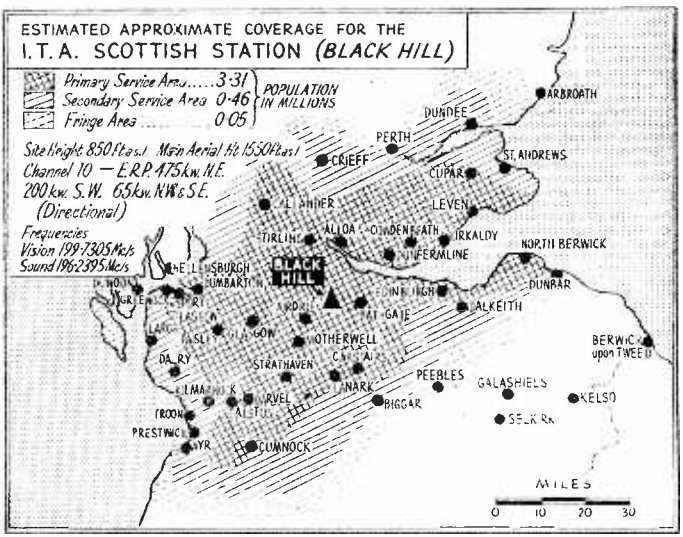
And it seemed to him that the Scottish tradition had elements which would be ideally suited to this popular medium. He was thinking of the narrative element in Scottish poetry and prose which might be called the ballad-making faculty of the Scottish people. Television depended very largely on romantic narrative and on the kind of heroic folk-lore of which both Westerns and Robin Hood were examples. That was a field in which Scotland was stronger than any part of the world, except perhaps the Western States of America and he believed it would yield a rich harvest of television programmes. They were also fond of disputation ; and discussion programmes were the best means by which the viewers could be led to take an active interest in the chief issues of contemporary life.

" For all these reasons," he added, " Independent Television in Scotland may show an even more vigorous growth than it has done south of the border. How rapid and vigorous that has been."

Mr. Thomson, who attended the conference, replying to a question, said that they had prepared programme schedules for the autumn which called for 20 per cent. of live local productions. He rather thought they would start with 15 per cent. and build up to 20. There would be no problem in producing 20 per cent. of the programmes in Scotland.

Replying to another question, Sir Kenneth said that there would be parts of Scotland which would not be covered when Independent Television was introduced on August 31st and it was the responsibility of the Authority to cover the whole of the country. They would not be appointing a second programme contractor for several years and he admitted it would be " lean pickings."

Mr. Bernard Sendall, Deputy Director General, I.T.A., pointed out, however, that there was a population of not far short of three-quarters of a million in the north-east of Scotland and he would be surprised if they did not find that there were independent groups interested in trying to secure the contract.



Map showing the approximate area to be covered by the Scottish transmitter.

I.T.A. Scottish Studios

BRITAIN'S most modern television studios are speedily taking shape in the former Theatre Royal, Glasgow. Work on the massive job of converting the theatre is proceeding ahead of schedule in preparation for the August opening of Scottish Independent Television.

There is no question that the theatre will be the best television centre in Britain when it is completed.

First, it is bigger, and secondly, there has been more time to make a proper conversion. The contractors have been able to get the best of all the experience of the people in England, and are determined to take advantage of that experience.

Already the old theatre has been altered radically. Two studios have been created out of the front stalls, stage and back-stage areas. Facing the stage of the main studio will be a control box, housing the latest equipment, and underneath the former stage fitting-out work is continuing on the master control room, telecine and film departments.

The installation of electronic equipment in the master control room will be completed within a week.

Stalls and circle seats have been left intact. Almost 800 people will be able to attend " live " telecasts from the theatre. Two boxes, flanking the new stage in studio " A," will accommodate visiting celebrities.

In studio " B " light grids are being hung at present and the suite of offices on the first floor are 70 per cent. complete, which means that they can be partially in use within two weeks.

Queen of Scottish TV

The fine weather caused quite a commotion at the Scottish Television Stand at the Television and Radio Show at the Kelvin Hall, Glasgow.

Extra supplies of entry forms for the search for the " Queen of Scottish Television " had to be rushed from the printers to cope with the demand. The reason was that the good weather brought the girls out in their summer best, and that " dressed-up feeling " encouraged them to enter the contest.

Another inducement is the fact that the prize at stake was a TV contract for the winner when Scottish Television opens up on August 31st. No details have been received up the time of going to press as to the winner of this event.

A Beginner's Guide to Television

TECHNICAL TERMS (contd.)

By F. J. Camm

Reversed Image

A REVERSED image on the screen of a television receiver may manifest itself in two varieties. It may take the form of a negative image, similar to that seen in a photographic negative, in which the white parts of the original picture appear black, and vice versa, or the image may be laterally reversed, i.e., one in which the right side of the original appears on the left side of the television screen and the left side of the original on the right side of the screen, this type of reversed image giving rise to the term " mirror effect."

Reversed images in television reception are nearly always associated with faulty adjustments, either electrical or mechanical, of the apparatus, and they are remedied without much difficulty.

Ringing

Term applied to the fault which gives rise to white outlines and is almost synonymous with oscillation. Correction chokes which are used to improve H.F. response can be shock-excited into oscillation and produce this effect. Usually prevented by shunting the chokes with a resistor to damp them.

Scanning (Exploring)

(a) In a transmitter. The process of analysing the scene or object into picture-elements or elemental areas ; (b) in a receiver. The process of building up the image from picture-elements or elemental areas.

Scanning Lines

Term referring to the vertical or horizontal lines in which a scanning spot sweeps over an image. Other factors being equal, the greater the number of " lines," the more detail there will be in the received image.

Scanning-line (Picture-strip)

A sequence of picture-elements extending throughout one dimension of the picture and represented by successive signal values.

Scanning Field

The area explored by the scanning-apparatus at the sending or receiving ends.

Scanning Coils

The two sets of coils which are used in an electro-magnetic type of tube to deflect the beam and build up the raster.

The majority of modern picture tubes are of the electro-magnetic type.

Scanning Spot

The small light spot which, by one method or another, is made to sweep continuously over every portion of the picture or image to be televised, thus enabling the picture to be split up into a large number of small areas, or " picture-elements."

Other factors being equal, the smaller the scanning spot, the finer in detail will be the televised image, for a small scanning spot will enable the light and shade (in other words, the detail) of the picture to be picked up and transmitted with precision, a task which becomes more and more impossible with increase in size of the scanning spot.

Scansion

The operation of scanning.

Screen

In connection with cathode-ray tube working this term refers to the flattened end of the cathode-ray tube which is coated with a fluorescent material, and which provides a screen which glows brightly under the impact of the rays, and upon which the picture is formed.

Selenium

Chemical symbol : Se. Atomic Weight, 79. Melting point, 217 deg. C. Specific gravity : 4.28-4.80 (varies).

A non-metallic element, closely allied to sulphur in many of its properties. Selenium exists in a number of different forms, some of which are light-sensitive, and are used in the construction of selenium cells.

The light-sensitivity of selenium was first noticed by a Mr. May, a telegraph operator in the employ of the Telegraph Construction Company, 1873, when experimenting with high resistances composed of selenium at the Cable Station on Valentia Island, off the south-west coast of Eire.

The name selenium (from the Greek, *selene*, the moon) was given to the element by its discoverer

J. B. Bezelius, the great Swedish chemist, in 1817, owing to its resemblance in some respects to the metal tellurim (Latin, *tellus*, the earth), which had been discovered some years previously.

Shield

Name given to a small metal cylinder which, in some cathode-ray tubes, encloses the filament or cathode and extends nearly as far as the anode. The shield is given a negative electrical bias, this enabling it to repel any of the electrons emitted from the filament which may happen to come near it. It acts in much the same manner as the grid of a valve, its function being to concentrate the electron stream from the filament or cathode into narrow beam, which will pass almost uninterruptedly through the central aperture of the "gun," or positively charged anode.

The shield of a cathode-ray tube is sometimes known as a Wehnelt cylinder, after its inventor, also any electrical or magnetic screen placed inside or outside the tube.

Spectrum

Name given to the multi-coloured band of light which can be thrown on to a screen after passing a beam of white light through a prism, or light-splitting device.

The colours of the spectrum are seven in number. In order they are: violet, indigo, blue, green, yellow, orange and red. Beyond the violet and the red ends of the spectrum are, respectively, the ultra-violet and the infra-red rays, both of which are invisible to the human eye. It is from combinations of the various coloured rays of the spectrum that all kinds of visible light are made up. The exact constitution of the light used is very often a matter of greatest importance in television technique. From the Latin, *specere*, to see.

Spherical Aberration

A defect inherent in some lenses of poorer quality whereby all the rays of light transmitted by the lens are not focused accurately in the one place, the light rays passing through the margins of the lens coming to a different focus from those passing through the centre of the lens. It is a defect which is corrected in all good quality lenses.

Split Picture

Term referring to a condition in a television receiver when, owing to faulty synchronisation adjustment, the received picture is split down the middle and displaced to both sides.

Striking Voltage

Term used in connection with neon lamps and tubes to denote the initial voltage which must be applied across the electrodes in order to start the electrical glow-discharge within the tube. Once this has been commenced, the applied voltage can be reduced considerably without stopping the glow.

Synonym: Firing voltage.

Stroboscope

A device by means of which the periodic motion of a mechanism may be rendered apparently stationary.

A stroboscopic disc is a disc of metal, card or other material, specially marked, and which, when rotated under intermittent illumination (as for instance, that of an A.C. incandescent lamp) appears stationary when its rate of revolution attains a certain pre-calculated degree. On account of this effect, stroboscopic discs of varying patterns and forms of construction are used extensively for speed measurement purposes.

From the Greek, *strobos*, a turning, *skopien*, to see.

Synchronising Valve

Name given to the valve which in television circuits deals with the synchronising currents.

Synchronism

A term signifying the exact coincidence of events in time.

The operating-condition which obtains when all the elements of the image are reproduced in the same spatial relationship as the elements in the scene.

The obtaining of perfect synchronism between the moving parts of a transmitter and receiver is of fundamental importance for the success of practical television.

From the Greek, *syn*, together, *chronos*, time: also *isos*, equal.

Tele-cine Transmitter

A device for transmitting cinematograph films by means of television. It comprises an ordinary cinematograph film projector working in conjunction with a special form of television transmitter.

Thyratron

A gas-filled triode, used for rectification, and in connection with television timebase generators. It is a registered trade name owned by the B.T.H. Co. Ltd.

Timebase

Name given to the fluctuating voltage applied to deflection coils or across one pair of deflector plates of a cathode-ray tube in order to vary the lateral position of the light spot on the fluorescent screen of the tube. So called because the side-to-side variations in the position of the light spot which occur at every succeeding instant appear as if the voltage on each pair of deflector plates has been charted against a time basis.

A "Timebase Circuit" is an electrical circuit, the purpose of which is to vary the voltage impressed upon a pair of deflector plates or to a set of coils, and thus to set up the motion of the light spot across the fluorescent screen of the cathode-ray tube. Timebase circuits are of several types.

Tracing Spot

See scanning spot.

Transitron

A valve circuit whose action depends on the negative transconductance of the supressor grid of a pentode with respect to the screen grid. An oscillator, used for purposes similar to those for which the dynatron is employed. The transitron has the advantage that its operation is not impaired by continued use of the valve, whereas in the case of the dynatron the condition of the anode surface has a marked effect on behaviour.

(To be continued)

Fault Finding on A.G.C. Systems

HOW TO LOCATE TROUBLES IN CIRCUITS WHICH ARE PICTURE CONTROLLED

By F. E. Apps

DEVELOPMENT of television circuits has followed very much the same lines as radio. The earliest radio sets had no automatic volume control. This meant that the user had to be continually varying the manual volume control to obtain the desired level of signal. Television sets up to a few years ago had no such arrangement of A.V.C. as it was not considered necessary, there only being one station to receive.

Nowadays, however, all television receivers of fairly recent design have a similar type of control. With television it is called automatic gain control.

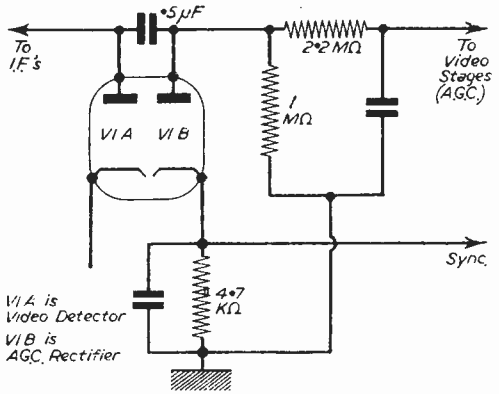


Fig. 1.—A simple A.G.C. detector circuit.

which actually should have been the correct term for the radio's automatic volume control. The principle of attaining this control, however, must of necessity be different from radio. When one considers the difference in the make-up of radio and television signals, this is apparent.

Ordinary A.G.C.

It will be appreciated that A.G.C. cannot possibly follow a rapidly varying video waveform. A valve is required which will be indicative of the strength of the carrier and which does not change with anything but the carrier. The synchronising pulses do just this. If the carrier received is constant in strength, the level of the synchronising pulses will always reach the same value. Should the carrier diminish in strength, the sync pulses will also do so. Thus the level of the sync pulses can be used as a reference level for the A.G.C. system. A simple system is given in Fig. 1. Here the A.G.C. detector is one half of a double diode and receives the incoming signal from the video I.F. stages via a .5 μF condenser. The load is the 1 megohm resistor. It will be seen that until the anode of the A.G.C. diode is positive with respect to its cathode, it will not conduct.

When the anode becomes positive, current flows from cathode into the .5 μF condenser where it is stored. This condenser will charge up to the peak of the applied voltage which will be the value of the sync pulses. When the anode becomes negative no current flows through the diode but the condenser will discharge slowly through the diode load. Before it can completely discharge, the anode, in response to the carrier, becomes positive again. The diode, however, will not conduct immediately owing to the charge still on the .5 μF condenser. Thus we will have the position where the diode only conducts at the peak voltages, which are, of course, the sync pulses. It will be noticed from Fig. 1, that in this simple system, the sync pulses are also supplied to line and frame, because as the diode only conducts at sync pulse times, voltages will appear across the 4.7 K resistor in the cathode circuit and be applied to the sync separator.

Keyed A.G.C.

It will be noticed from Fig. 1, that an ordinary A.G.C. system uses high value resistors and capacitors. These are necessary, because they act as filters for the line and frame ripples. If the frame ripple were not suppressed, the result would be that the controlling bias on all controlled valves would rise during the frame sync interval and act to depress these pulses. It can, therefore, be seen that for slow changes in carrier strength, ordinary A.G.C. would be satisfactory, but not so for a quick change.

A keyed A.G.C. system (see Fig. 2) has lower values of resistors and capacitors. This enables it to react instantly to a rapid carrier fluctuation. A portion of the video signal is applied to the control grid of the pentode V2, which is so biased that it will not conduct unless grid and anode are *both* driven positive.

The grid receives the line sync! mpulses from the video amplifier. Thus both grid and anode are positive in time with the line sync pulses and the valve conducts. It will be seen that as this valve only conducts when the pulses arrive at the grid and *not*

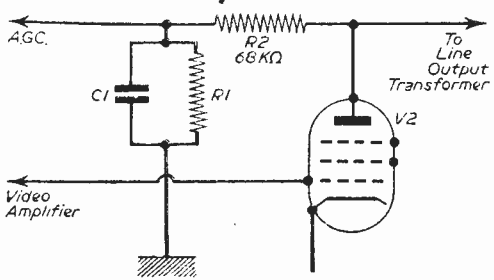


Fig. 2.—A keyed A.G.C. system.

at any other time, the valve and the A.G.C. system are only responsive to unwanted pulses for a very short time. One can see, therefore, that a keyed A.G.C. system has a better performance than an ordinary system. For instance, in an ordinary A.G.C. system, though they are supposed to be unresponsive to all but sync pulses, this can only be true if the amplitude of the sync pulses is greater than any noise pulses. Should any noise pulse have a greater amplitude, then current will flow in the A.G.C. diode and will develop a greater negative voltage in the A.G.C. network than that obtained from the pulses. Gain will be lowered until this voltage diminishes.

The values of R1 C1 in Fig. 2 are adjusted to filter the line ripple.

In applying the sync pulses to the grid of the pentode, care must be taken to see that they are aligned to the same level. The amount of current

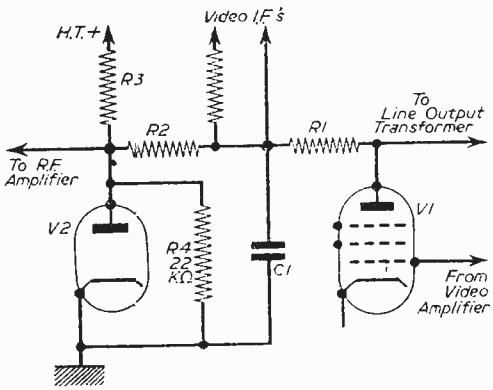


Fig. 3.—The addition of a diode clamp.

flowing through the valve depends upon the amplitude of the sync pulses. As these vary, so will the valve current, and with this the A.G.C. bias developed across C1 R2 and supplied to the controlled valves. Here it should be noticed that the D.C. component of the signal remains, otherwise the sync pulses will not be aligned.

Keyed A.G.C. for Weak Signals

In the case of sets in fringe areas, it is essential that the A.G.C. keeps the bias on the R.F. amplifiers as low as possible. It then becomes necessary to include an additional valve, usually a diode, in the A.G.C. line. This keeps the bias at nearly zero level until the incoming signal reaches a moderate level. Thus the sensitivity is high for weak signals but reduced when signals are strong (see Fig. 3).

The action of this circuit is as follows: V1 acts as a keyed A.G.C. valve and develops a negative voltage in its anode circuit, filtered by R1 C1 and fed to the video amplifiers. The diode is inserted at this point in the circuit, and is isolated from the rest of the A.G.C. line by R2. Also connected at this point is a high resistor (approximately 3 megohms), and another one of about 22 K. ohms. The other end of the 3.3 megohm resistor is connected to an H.T. source of about 300 volts. This allows just enough volts on the anode of the diode to conduct. Thus the connection to the R.F. amplifier is kept very close to zero. When an incoming carrier is weak, the A.G.C. negative bias is small, but the video amplifiers, under the same conditions, have a higher bias. When the carrier increases in strength, so does the negative A.G.C. bias, and part of it overcomes the slight positive potential on the anode of the diode, which no longer conducts and thus raises the negative bias on the R.F. amplifier.

As the discerning reader will have already noticed, these methods of A.G.C. are not suitable to the television system that is employed. To the unenlightened, this is owing to the fact that these systems can only be used on negative-going modulation, and thus taking the peak of the pulses as a standard. These systems were used only as a simple means of showing how A.G.C. is obtained. The next article will show how A.G.C. is obtained with positive-going modulation, where the sync pulses drop to zero carrier amplitude. *(To be continued)*

The Growth of Television

AT the end of March, 1957, there were 6,966,256 television licences in force throughout the country, an increase of 396,159 over the figures at the end of December, 1956. The increases were as follows:

England (excluding Monmouthshire)	From 5,776,673 to 6,108,104
Wales and Monmouthshire	From 297,191 to 316,372
Scotland	From 440,401 to 478,432
Northern Ireland ...	From 55,832 to 63,348

London Postal Districts

The number of licences increased from 709,511 to 736,021. The South Eastern District had the highest number of licences with 155,364, followed by the Eastern District with 145,966 and the Northern District with 131,077.

Wales

Of the Welsh counties, Glamorganshire had the largest number of licences with 173,111 and of the towns, Cardiff headed the list with 61,441, followed by Newport with 50,897. Barmouth and Blaenau Festiniog share the lowest positions on the table with 122 and 119 respectively.

Scotland

Glasgow led in Scotland with 149,059, followed by Edinburgh with 60,609.

Northern Ireland

Belfast had 50,159 licences and Strabane had the lowest figure with 81.

There are 130 towns and districts throughout the country where the number of combined sound and television licences exceed those of sound only—47 in and around London, 26 in the North-West, 16 in the North-East, 28 in the Midlands, 10 in Wales, 2 in the South-West, and 1 in Scotland. Since the December quarter 31 more towns or districts show an excess of television over sound licences.

This information is taken from the "Quarterly Return of Broadcast Receiving Licences," which is issued by the Post Office. Copies of the return may be purchased at 15s. each by written application to G.P.O. Accountant General's Department, Ledger Branch III, 12-15, Finsbury Circus, London, E.C.2.

Servicing TELEVISION RECEIVERS

No. 31.—THE ETRONIC ECV1523 AND ECV1527

By L. Lawry-Johns

(*Continued from page 511, June issue*)

Variations in Intermediate Models, etc.

OTHER than the differences already mentioned slight variations may be encountered. On some ECV1527 models, a CRM121 was used whilst on others a CRM121A may be fitted. The latter tube required a slightly higher final anode (EHT) voltage, greater than that required for the 1523 or the 1527 using the CRM121 tube. To obtain this extra voltage, the three 10 MegΩ resistors R22, R23 and R24 are left out of the circuit. L20, the line linearity inductance is only fitted to the ECV1523. As this model has an ion trap tube assembly, the small magnet is required to be set to that position which gives maximum brilliance, adjustment to eliminate corner cutting may be made provided this does not affect the brilliance.

Picture Faults

Fading.—Variations in contrast are normally caused by improperly seated 6AM6 valves or poor contact between the pins and the valve base. Moving each valve gently will usually denote which is at fault. Cleaning the pins with fine glasspaper and refitting will generally put things right. However on several occasions, the aerial plug and socket have been found to cause considerable fading. Where this is a persistent source of trouble, it is quite a simple matter to modify the plate to take a coaxial socket of the conventional type.

Uncontrollable Brilliance.—Check V5 (6AL5), the interference limiter section often develops a heater/

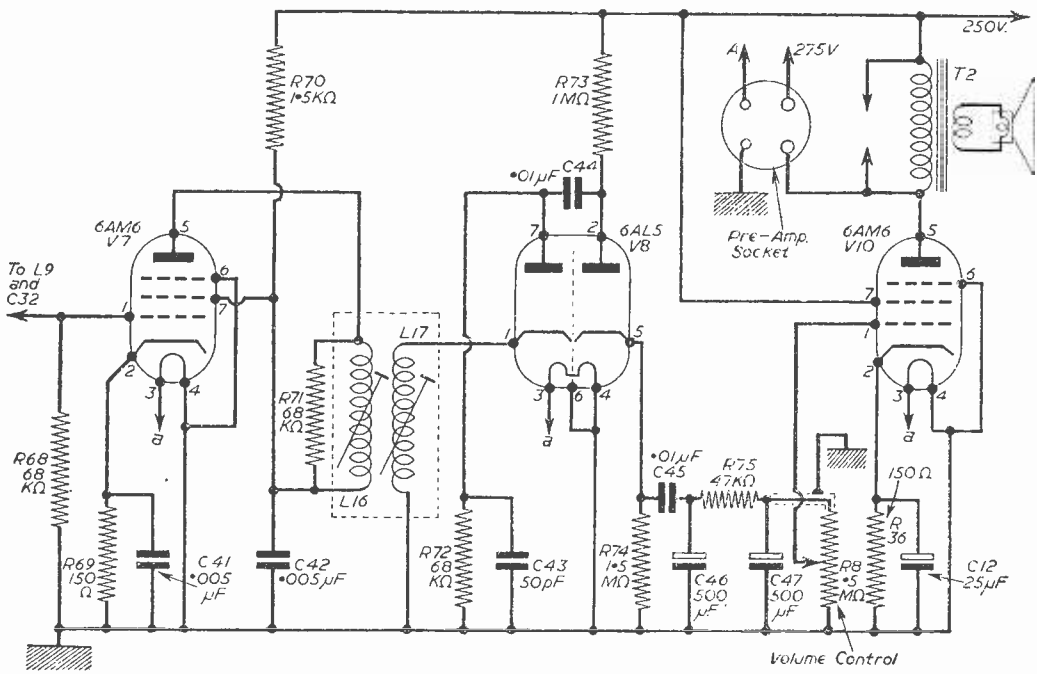


Fig. 8.—The sound section.

cathode short thus taking the video anode and CRT cathode to chassis potential.

Poor Picture.—Advancing brilliance shows flyback lines and defocuses images, advancing contrast inverts images turning blacks white and whites black, again with poor focus. Picture only viewable in a darkened room. Almost certainly a failing tube, replacement being the best long-term policy but a temporary increase in emission and thus picture brilliance may be obtained by increasing the heater voltage by means of a booster transformer. For the 1523 employing the Cossor 108 K 10in. tube, a 6.3 volt transformer will be required. For the 1527 employing the CRM121, etc., a 2-volt type should be used.

The usual heater cathode troubles will be encountered on the 12in. models, the symptoms being, bands of defocused illumination across the screen, intermittent loss of hold, mainly horizontal, ragged outlines in strips down the picture, etc. The same type of 2-volt heater transformer used for boosting may be employed, the "Nuray" being an extremely useful unit, having simple plug and socket action and three degrees of boost available.

COIL D.C. RESISTANCE READING

T3	Prim 1,000 Ω; Sec. 5 ohms.
T4	Prim. 50 EHT winding 25.
	Sec. Green/Yellow .5 ohms.
	Yellow/Red 3 ohms.
T5	Prim. 400 Ω (700 in some models).
	Sec. 200 Ω(350 in some models).
L18	40 Ω.
L21	7 Ω.
L22	6 Ω.
Sound I.F.	10.5 Mc/s.
Vision I.F.	11 - 13.5 Mc/s.

Timebase Faults

A horizontal white line across the tube face should direct attention, first to the 7C5 valves and then to the frame blocking oscillator transformer, the primary winding of which seems to become open circuited very frequently. A replacement type may be found to be different both in size and in the D.C. resistance of the windings. In general, the original may be said to be of small size and of the Plessey type. A larger Plessey or Igranic is normally supplied for replacement purposes.

Loss of Frame-hold.—Check the 7C5 oscillator and if the frame-hold control is at the end of its travel, change the 1.4 MΩ resistor R18 in series with it. *Loss of Height*, not due to V13 or V14, check R26 2.2 MΩ (in series with height control).

Loss of Sync.—Check R39 1 MΩ screen dropping resistor of V9, V9 itself and, if fitted, the 32 μF. H.T. feed decoupling capacitor.

Line Timebase.—Failure of the line timebase will result in no picture since the EHT is derived from the line flyback, rectified by the EY51 on the line output transformer. The line output transformer is the weak link in this section and in a large number

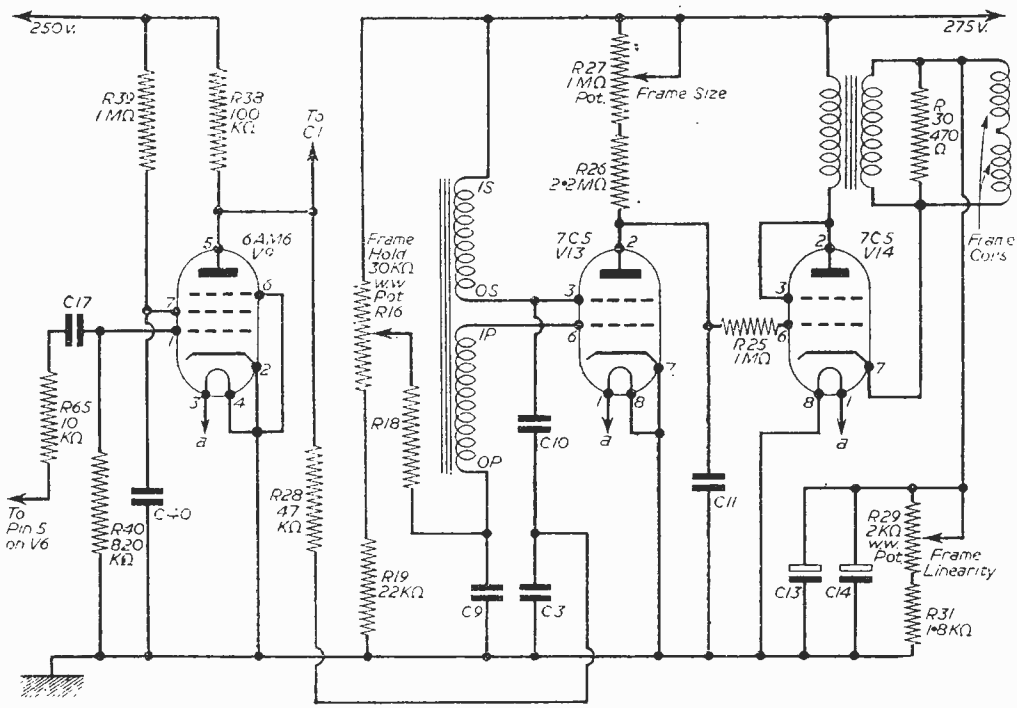


Fig. 7.- The frame timebase. Condenser values are as shown below.

C17—.1 μF. C9—.02 μF. C10—.02 μF. C13—50 μF 25 v.

C40—.1 μF. C3—.05 μF. C11—.05 μF. C14—50 μF 25 v.

of cases, timebase failure is due to this component becoming defective. Open circuited winding, short between winding and core, sparking between windings, etc., are typical faults which occur.

Sound Channel Faults

Low and distorted sound, check V7 and V10 6AM6 valves and R73-R74 associated with the 6AL5 (second section) noise limiter. Loud buzz varying with white content of the picture; check setting of oscillator core (L4) setting for maximum sound consistent with a picture undisturbed by sound modulation.

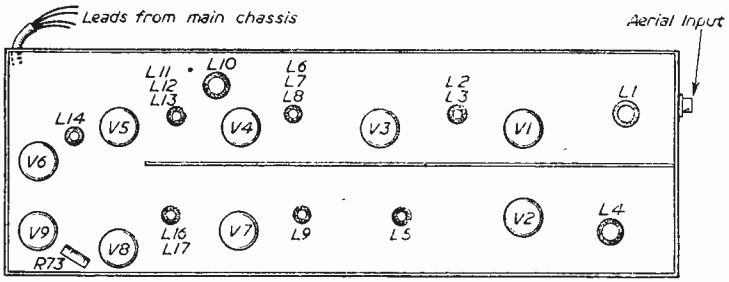


Fig. 9. — Below chassis view of the R.F. unit.

Readers are again notified that the Etronic company is no longer in existence, and that we are not able to supply Service Manuals or Data sheets for these models.

Colour Television for Surgery and Medicine

THE joint meeting of the Royal College of Surgeons and the French Academy of Surgeons, held at the Royal College of Surgeons at the end of May, witnessed a milestone in the history of the teaching of medicine. At this meeting there was a demonstration, on a closed circuit, of colour television as an aid for medical teaching. Other demonstrations were given each day from June 4-7, during the Harvey Tercentenary Congress which was also held at the Royal College of Surgeons.

Further demonstrations have been arranged outside London, and will be given at a special meeting of the Royal College of Surgeons of Edinburgh, to be held in Edinburgh on July 8 and 9; this will be closely followed by demonstrations given each day from July 15-19 at the Annual Scientific Meeting of the British Medical Association, which this year is being held at Newcastle upon Tyne. It is expected that other meetings will be arranged in other provincial centres which will enable more doctors to see this new teaching aid.

All these demonstrations are being sponsored by Smith Kline and French, the London manufacturing chemists who have arranged for the development and manufacture of this colour television equipment as a contribution to the advancement of medical teaching. Their experience in other parts of the world, especially the United States, where the company introduced colour medical television, has shown that teaching by this medium promises to add a new dimension to the time-honoured teaching methods of the profession. Such a method not only brings first-hand observation but also enables larger audiences to witness surgical techniques and medical procedures. Another advantage is that audiences can hear the operating surgeon's instructions and comments. Conveniently attached to the surgeon's mask is a very small microphone which enables everyone in the audience to hear him. This brings to the observers something of what has hitherto been audible only to the assisting surgeon and staff in the theatre.

Vital Aid to Learning

The advent of natural colour television in medicine has evoked the interest of many eminent bodies of British surgery and medicine in the United Kingdom. The demonstrations that will be seen during the next few months will afford a specially good opportunity for doctors and surgeons to see colour television used under a variety of conditions. It will also enable them to get a comprehensive view of the potentialities of the medium in the teaching of medicine because what they see on the screens they will know is really happening at the moment of viewing; that the issue of events is still unsettled, and, that the unexpected may come up at any moment and have to be dealt with. This sharp sense of actuality is peculiar to television, and natural colour television in particular, and commands the attention to an extent seldom possible with any other media. It contributes enormously to coherence, vividness and sequence of presentation of a complete surgical or clinical picture.

Smith Kline and French have sponsored similar demonstrations of colour television methods of teaching in many parts of the world. It was at the annual meeting of the American Medical Association, held at the John Hopkins Institute, that the first public showing of medical colour television was presented. Since then they have carried their team and equipment all over the United States and the Continent of Europe. The Canadian Medical Association was host to the first programme in that country. Since the first demonstration was given it is estimated that 372,000 doctors and students have seen the proceedings. The response of audiences to the programmes has left no doubt that this new medium can no longer be regarded merely as an interesting novelty but must be seriously appraised as a development in teaching which possesses far-reaching advantages. As techniques and equipment are improved these advantages become more manifest every year.

Big Screen

The programmes to be televised in the United Kingdom will be transmitted "live" from various hospitals conveniently situated to the meeting places, to a screen measuring 8ft. by 6ft. It is expected that several thousand members of the medical profession will see the operations, which will have all the realism of the operating theatre and the added advantage of close proximity for the viewer. In effect by the addition of one more spectator in the operating theatre—the television camera—it will be possible for many hundreds to see what has before been limited to only a few.

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1T4	7 3	6X4	7/-	DF96	8/6	EF85	7 6	PY80	9 -
3Q4	9/-	6X5GT	6/6	DH76	8/6	EF86	12 6	PY81	8 -
3Q5GT	9/6	7B7	8/-	DH77	8/6	EF89	10 -	PY82	7 -
3S4	7/6	7C5	8/-	DK32	12/6	EF91	6/-	PY83	9 6
3V4	8/6	7C5	8/-	DK92	9/-	EF92	5/6	PZ30	18/-
5U4G	8/-	7H7	8/-	DK96	8 6	EL32	5/6	SP41	3 6
5Y3GT	7 6	7S7	9/-	DL33	9/6	EL38	22 6	SP61	3 6
5Z4G	9/-	7Y4	8/-	DL35	15 6	EL41	10 -	U25	13 6
6AB8	7 6	10C2	13/-	DL96	8 6	EL42	11/-	U50	7 6
6AK5	4 6	10F1	15/-	DM70	8/6	EL84	9/6	U76	8 -
6AL5	6 6	12AH8	10/6	EABC80	7 9	EM34	10 -	U78	7 -
6AM5	5/-	12AT7	8 6	EAC91	8/-	EY51	10/6	U404	8/6
6AM6	6 -	12AU7	7/-	EAF42	10 6	EY86	9 6	UABC80	
6AQ5	7 6	12AX7	9/-	EB91	6/6	EZ40	8 -		11/6
6AT6	8 6	12J7GT	11/-	EBC33	7 6	EZ80	8/6	UAF42	10 6
6BA6	7 6	12K7GT	8/6	EBC41	10/-	EZ81	10 -	UBC41	8 9
6BE6	7 6	12K8GT	14/-	EBF80	9/6	FW4/500		UBF80	9 6
6BJ6	7 -	12Q7GT	8/6	EBF89	9/6		12 -	UCH42	10 3
6BW6	7 6	12Z3	7/6	ECC81	8 6	GZ32	12/6	UF41	9 -
6BX6	7 6	14S7	13/6	ECC82	7 -	KT33C	10/-	UF89	10 6
6CH6	7 6	25L6GT	9/-	ECC83	9 -	KT44	6/6	UL41	10/-
6F1	14/6	25Z4G	9/6	ECC84	10/6	KT63	6/6	UL84	11 6
6F6G	6/6	25Z6GT	9/6	ECC85	9/6	KTW61	6/6	UY21	15 6
6F12	6 -	35L6GT	9/6	ECC91	5/6	MU14	8/6	UY41	8 6
6F13	13 -	35Z3	10/6	ECF80	12/6	N78	12 6	UY85	10 6
6F15	14 9	35Z4GT	8/-	ECF82	11/-	P61	3 6	VP41	7 6
6J6	5 6	35Z5GT	9/-	ECH35	9/6	PCC84	8/-	W76	8 6
6K7G	4/6	50L6GT	8/-	ECH42	10/-	PCF80	7/-	W77	5 6
6K7GT	6/-	80	8 6	ECH81	8 -	PCF82	11/6	X79	12 6
6K8G	7 9	B36	19 6	ECL80	9 -	PCL82	12/6	Y63	6/-
6K8GT	9 6	CL33	16.6	EF37A	9/-	PCL83	12 6	Z77	6/-

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Fault Finding Without Instruments

AID FOR THE BEGINNER OWNING A HOME-MADE SET, OR TRACING A BREAKDOWN

OBTAINING an elusive video signal can be a very tricky job—especially for the fringe viewer—and not a few beginners give up at this point. It is much easier for those lucky people who possess a good signal generator.

However if the job is tackled systematically the trouble can be found without the aid of expensive gear. The main emphasis is on the word *systematically*: it is useless to go around prodding this and that, and fervently hoping; that process is a mere waste of time; the circuit should be checked stage by stage from the input to the C.R.T. to the aerial, and the following details show how to trace a fault with only a good voltmeter and a milliammeter.

First Stage

As this section is mainly concerned with the vision signal itself we will assume that the raster has been obtained and is functioning satisfactorily. The brilliance control should be turned down until the raster just disappears; the contrast control should be advanced, and the screen should then show one of three things:

(a) A jumble of black and white lines moving across the screen.

(b) A white raster which is completely devoid of picture content.

(c) Little specks of white which tend to merge into each other as the contrast control is advanced.

(d) A completely blank raster.

If (a) is received, all that remains to be done is to adjust the line hold control until the picture resolves itself, and then to adjust the frame hold to prevent the picture slipping up or down.

It may be found that it is not possible to obtain the picture by any adjustment of the line hold control; two pictures side by side may be resolved or possibly three or more at the same time (multiple pictures). If this is the case it indicates that the timebase is not running at its correct speed and some experiments with the values of the components in the timebase will have to be undertaken. The actual components which may require different values will, of course, depend on the type of timebase being used, and whether it is for an electrostatic or electromagnetic tube.

The same principles hold good for the frame timebase where difficulty is experienced in locking the picture vertically, or in obtaining correct interlace. One point to bear in mind is that with some circuits line hold and width controls interact with one another and adjustment of the line hold control to its correct operating position may alter the width of the picture.

If (b) is received it generally indicates that one or more stages in the vision receiver is unstable—a valve is oscillating. To find the faulty valve check the anode currents of each valve in turn and note if there is a change when the grid is short-circuited to earth. If it does change then it is that valve which is causing the oscillation. Having found the valve then the stage should be checked carefully to ascertain the reason for the instability. Points to look for are stray anode-to-grid capacity and undecoupled dropping resistors.

The hash on the screen indicated in (c) is generally due to valve noise and indicates that the video receiver itself is functioning though no video signal is being received. Before doing anything desperate remember that the transmitters occasionally have troubles of their own and it may be that the signal is temporarily off the air. However, if nothing happens within a reasonable time the trouble is either that the tuning circuits are tuned very far from the signal frequency, or that the trouble is in the aerial or associated circuits. The latter is more likely.

The result in (d) represents the biggest problem as it is the symptom of so many different faults. It is worth while trying a few short cuts before getting down to serious business.

With the contrast control fully extended (in a semi-darkened room) increase the brilliance control until the raster just appears. If the raster shows traces of moving black lines across it then the signal is there though very weak, and can be resolved by adjustment of line hold and frame hold controls in the manner indicated in earlier paragraphs. The picture can then be made stronger by adjustment of the tuning coils. If no result is obtained by using this method then the following points should be checked:

Is the connection between the video output valve and the tube O.K.?

Is the aerial connected to the video receiver? (Check this point carefully as it is possible for the aerial to be connected by one side only and still provide a good sound signal.) Examine the plugs with care, especially if a coaxial transmission line is used; it is so easy to get a short-circuit at this point.

Is the aerial connection to the transmission line O.K.? If a folded dipole is used it will present a short-circuit (so far as D.C. is concerned) at the receiver end of the cable, and thus forms a convenient method of checking to see if the transmission line is disconnected; the fold will, however, mask a short-circuit in the line.

Having run through these items a simple check can now be made. Turn up the brilliance control until the raster appears on the screen. Now tap an earthed

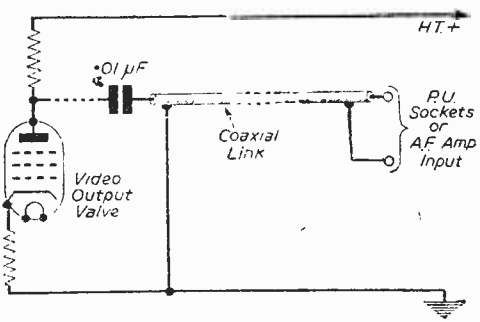


Fig. 1.—Using a radio receiver to check the video section.

wire on the aerial input socket. (By "earthed wire" is meant a wire which is connected to the common earth line of the receiver.) Tapping the wire on the non-earthy side of the aerial input socket should cause the raster to "jump" in sympathy.

Second Stage

We have now reached the stage where we have one of two conditions :

A. The raster "jumps" when the earthed wire is tapped on to the aerial input socket.

B. The raster does not "jump" under the above conditions.

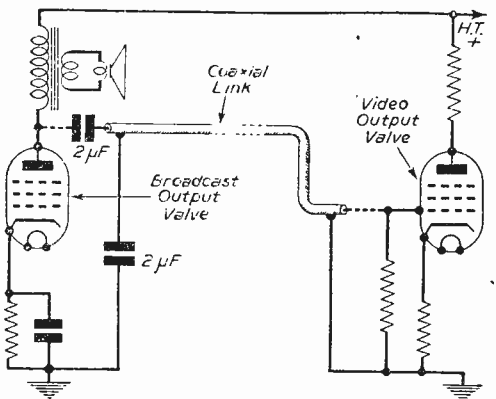


Fig. 2.—Testing the video and tube stages by coupling radio output into them.

Now from this point pertinent sections will be individually numbered so that easy reference can be made to them.

1. If condition *A* results from the test then the fault will come under one or more of the following categories :

(i) The aerial is faulty.

(ii) The oscillator is not functioning correctly.

(iii) The tuning circuits are very badly out of alignment.

(iv) The vision receiver is not working at full capacity.

2. If condition *B* results from the tests then the fault will come under one or more of the following :

(v) Common H.T. or L.T. line in the video receiver is disconnected at some point.

(vi) There is a disconnection between the video valve and the C.R.T.

(vii) One or more of the valve circuits is faulty.

3. With regard to the first fault (i) here are a few points to check : The transmission line to the aerial is either disconnected at some point or is short-circuited. If the aerial is a folded dipole a check can be made for disconnection in the line by the method indicated previously. A battery and voltmeter connected across the end of the line should give a reading. This reading will only indicate that the line is not disconnected ; it will not reveal that the line is short-circuited. The only sure method of checking the aerial is to take it down and inspect it. It is wise to open up the junction box and examine the connections carefully.

If the connections are in order, make certain that the aerial is pointing in the right direction. The shortest element in an H or Yagi array should point in the direction of the transmitter.

This advice may seem superfluous but one enthusiast who called in the writer's aid had struggled for three months to pick up the TV signal without success. The reason was obvious ; he was using a home-made wire contraption as an aerial and poking it out of the back bedroom window every night. The window faced south but the transmitter was 80 miles to the north of him !

In view of the foregoing ensure that there are no obstructions between you and the transmitter, and do use a proper aerial, not a couple of pieces of conduit separated by a marble. If you are at, or beyond, the fringe area have a good multi-element array (Yagi).

4. Fault (ii). The oscillator valve can be checked for oscillation by putting a milliammeter in its anode circuit and then short-circuiting the grid to earth. The anode current will fall if the valve is oscillating.

If a multi-grid valve is being used as combined mixer and oscillator then the appropriate grids corresponding to the above should be checked.

If a separate oscillator valve is used it should be checked to verify that the connections between it and the mixer valve are in order.

Should there be no change in anode current when the above test is made then it indicates that the valve is not oscillating, and the associated circuit should be checked.

5. Fault (iii). The tuning circuits in the video receiver cover a broad band of frequencies, but if the signal is very weak it is possible for them to be sufficiently off-tune to prevent the signal from operating the C.R.T.

The first thing to do is to check the coils to verify that the number of turns is correct ; if this is the case then the following procedure can be adopted.

Connect the output from the video valve to the input of an amplifier as shown in Fig. 1. The A.F. portion of the sound receiver can be used, or the pick-up terminals of a broadcast receiver. The leads must be screened and an odd piece of coaxial cable can be used for the job.

It may be possible that the video signal will be heard immediately though it may not be strong enough to operate the C.R.T. The signal sounds something like a mixture of 50-cycle hum and motor-boating. If the signal is heard, adjust the tuning coils, starting with the detector stage until as loud a signal as possible is obtained. Now change over to the C.R.T. and the signal should be seen on the screen.

Quite a loud volume of signal is required to operate the tube. Having once obtained the picture the procedure outlined in sections 9 and 10 can be followed.

6. Fault (iv). This fault is one of the most difficult to trace and may need some patience. First check all the anode, screen and cathode voltages, and verify that each valve is receiving its full filament supply. Next verify that each valve is well home in its socket—some EF50 valveholders are notorious for poor contacts between valve pins and holders.

7. Having checked the points mentioned in the above paragraph, check the video valve circuit by connecting a source of A.F. to its input side. This can be done conveniently by using the output from a broadcast receiver tuned to any station which is radiating a programme. Fig. 2 shows the method. Keep the volume at a reasonable level to avoid

overloading the video valve. A varying pattern should appear on the screen of the C.R.T.

If this is not the case connect a pair of headphones between the anode of the video valve and its resistor. The sound should be heard. If this is the case then the fault lies from this point to the C.R.T. grid or cathode according to the scheme used. If the sound is not heard, or is very weak, then the fault is in the video output valve or associated circuit.

8. If the above test is O.K. then the detector circuit must be checked. A rough test can be made by disconnecting the tuning coil, and injecting a source of modulated R.F. This can be done by using the broadcast receiver in a similar manner to section 7, but this time a tap is taken from the grid of the last I.F. valve (this point is chosen for simplicity), and

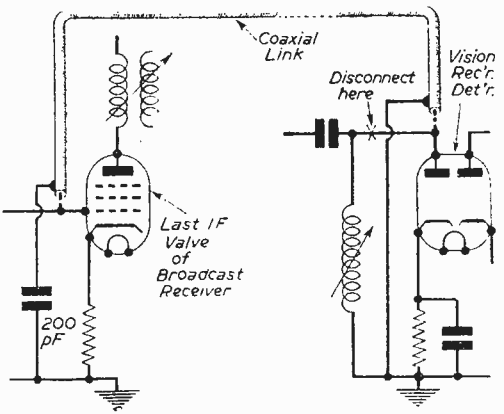


Fig. 3.—How to couple the I.F. stages of a video receiver to a radio set.

inject it into the input of the detector valve. The connection between the two units should be made with coaxial cable. Fig. 3 shows the scheme. The sound of the station being received should be heard in the 'phones.

All the above tests being O.K. then the next step is decided by the type of receiver being used. If it is a superhet the following procedure can be adopted.

9. The whole of the I.F. stages can be checked by tapping a long length of wire on to the grid of the first I.F. valve. Morse and/or telephony stations will be heard in the 'phones if the I.F. stages are functioning. If nothing is heard, or if the signals are very weak, then using the long wire trace the faulty stage by tapping the wire on the grid of each I.F. valve in turn, working from the last I.F. to the first. The signals should increase in volume progressively as more and more stages are included. A deviation from the step-by-step increase indicates a faulty stage.

Should the above test be O.K. then the fault is confined to the mixer valve and/or R.F. stage.

10. Condition *B* fault is when the raster does not jump when an earthed wire is tapped on to the live side of the aerial input socket. This may be due to :

11. Fault (v). The method of checking this will be fairly obvious. Of course it is assumed that preliminary " short cut " tests have been made. Check the voltages right on the valve pins and also check the voltages across the cathode resistor to ensure that each valve is taking its correct current.

12. Fault (vi). This should have been checked in the preliminary stages. The type of fault will largely depend on the system of coupling to the C.R.T. For example if directly-coupled cathode modulation is used then a disconnection to the cathode from the anode circuit of the video valve will cause the screen to glow brilliantly white all over.

13. Fault (vii). The methods given in sections 7, 8, 9, and 10 should be used after the tests indicated in section 12 have been made.

Employment of the foregoing procedures should enable a fault to be tracked to a particular stage. Owing to the multiplicity of circuit designs it is not possible to give a detailed analysis of all possible faults, when the faulty stage has been located it is merely a matter of checking the wiring and components in that particular stage. Condensers are the trickiest, and the best method is to substitute them with others which are known to be in good order.

Latest R.C.A. Tube

THE picture tube type 17CDP4 is the latest addition to RCA's line of picture tubes having 110 deg. diagonal deflection angle. It is designed with a 450-milliampere/8.4 volt heater having a controlled warm-up time to ensure dependable performance in television receivers employing a single, series-connected heater string.

Rectangular in shape, this glass picture tube has a 16-9/16in. envelope diagonal, an overall length o 12-9/16in., and a weight of only 10 lb. In comparison with types having the same size faceplate and 90 deg. deflection, the 17CDP4 has an overall length approximately 3in. shorter and a weight 5 lb. lighter.

In addition to its wide deflection angle and very short length, the 17CDP4 features a neck diameter of only 1¼in. This small neck diameter not only makes possible the use of a deflecting yoke having high deflection sensitivity, but also permits deflection of the beam through the wide deflection angle with only slightly more power than is required to scan a tube with 90 deg. deflection angle.

Another design feature of the 17CDP4 is its completely new electron gun of the " straight " type having improved focus and a unique pre-focus lens system to maintain image sharpness over the entire screen area. The new electron gun eliminates the need for an ion-trap magnet.

The 17CDP4 is of the low-voltage electrostatic-focus and magnetic-deflection type. It has a spherical filterglass faceplate, an aluminised screen 14⅜in. x 11-11/16in. with slightly curved sides and rounded corners, and a projected screen area of 155 square inches. In addition, the 17CDP4 has an external conductive bulb coating which with the internal conductive coating forms a supplementary filter capacitor, and utilises an integral glass-button base which eliminates any possibility of loose base-pin connections.

More About Col

A SIMPLE EXPLANATION OF THE MAKE-UP O COLOUR PICTURE

MANY viewers are under the impression that to transmit a picture in colour three cameras (or the equivalent) are used and three transmissions are made in the three primary colours. At the receiving end they think these three transmissions are picked up and separately treated and finally applied to a picture tube to re-create the original scene. If such a scheme were used it would certainly simplify matters from one point of view, but would necessitate a terrific bandwidth which would result in the transmitter having to occupy many more bands than are now used. The problem is very much greater than this and the transmitter has to make use of the same bandwidth as is now used and, furthermore, the signal must be capable of being picked up on a black-and-white set. Unfortunately, to explain and understand the process which is used one needs a very wide knowledge of mathematics and it is rather difficult to explain without the use of maths. However, from queries which have been submitted and from general discussion with viewers it is quite clear that some of the most interesting points of modern colour are not understood, and some attempt will here be made to simplify the explanation without going too deeply into figures.

First, it is essential to correct the idea that three separate colour pictures are transmitted. In effect, only two are sent out, the third being obtained by adding one of these to the other. However, the following is a simplified explanation of what takes place.

The Importance of Y

The amount of detail in the actual scene is in effect the same as in a black-and-white picture, and therefore the detail is taken separately and is known as the Y signal. It is made up of varying portions of the green, red and blue pictures. The proportions which are taken are those which are found in the colour sensitivity of the average human eye and are

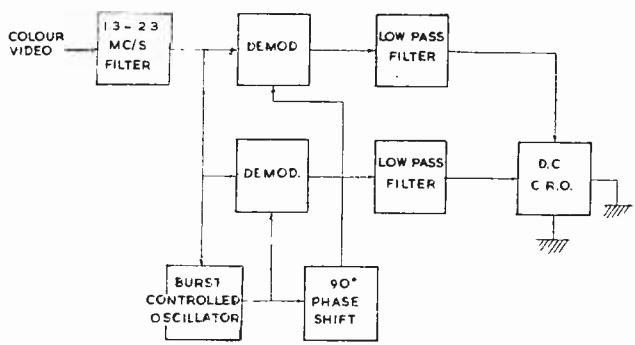


Fig. 1.—A simplified diagram of the Vectorscope described at the end of this article.

green 59 per cent., red 30 per cent. and blue 11 per cent. This signal is spread over the available bandwidth of the transmitter. This signal is also known as the luminance or brightness signal, as its purpose is to vary the signal on the end of the tube in different degrees of brightness, or in other words, light and shade. The colour signal (chrominance) is interleaved in this luminance signal, and itself consists of a carrier and sidebands. It is here that the mathematical calculations come in. Normally, for a three-colour picture, three colours would have to be used to modulate the signal, but by a clever mathematical arrangement it is possible to use only two. Here is how this is done.

The three colour signals from the three colour cameras or its equivalent are combined with a portion of the Y signal just referred to. The portion which is used is actually reversed in phase after passing it through circuits to remove all but the larger details. (It is found that fine detail is not necessary when colour is used as the colour makes up for the absence of the finer details.) Unfortunately, here we must use a small amount of arithmetic to show what happens. When the Y signal has been inverted it becomes negative, or $-Y$. As already stated, the three colours are added to this, which gives us $R-Y$, $G-Y$ and $B-Y$ (the letters R, G and B standing, of course, for red, green and blue).

Owing to the fact that the Y signal contains varying proportions of R, G and B, it is now found that we only need $R-Y$ and $B-Y$ to obtain at the receiver the three quantities, or in other words, we only need the red and blue signal, and can from these two obtain the green.

Mathematical Proof

Here is where the little bit of arithmetic comes in. We saw that originally the Y signal consisted of 59 per cent. green, 30 per cent. red and 11 per cent. blue. This is the same as saying that $Y=.59G+.30R+.11B$. Now we have just seen that the colour signals are added to the Y signal after the latter has been reversed in phase and made $-Y$.

Therefore $R-Y=R-(.59G+.30R+.11B)$ or

$R-Y=.70R-.59G-.11B$.

The blue signal on the same basis becomes $B-Y=B-(.59G+.30R+.11B)$ or $B-Y=.89B-.59G-.30R$

The green signal becomes $G-Y=G-(.59G+.30R+.11B)$ or: $G-Y=.41G-.30R-.11B$.

Now this is where the mathematical trickery comes in. If we take .51 $(R-Y)$, add it to .19 $(B-Y)$ and then invert the final signal, we find we have $G-Y$.

Proof:

$.51(R-Y)=.51(.70R-.59G-.11B)$

$=.36R-.30G-.056B$.

$.19(B-Y)=.19(.89B-.30R-.59G)$

$=.17B-.057R-.11G$.

Adding the two together we have $.36R-.30G-.056B+.17B-.057R-.11G$, and by combining like terms we have $.30R-.41G+.11B$.

As shown by the equation above, this is equal to $-(G-Y)$, and then if we invert the equation we have $.41G-.30R-.11B$, which is $G-Y$.

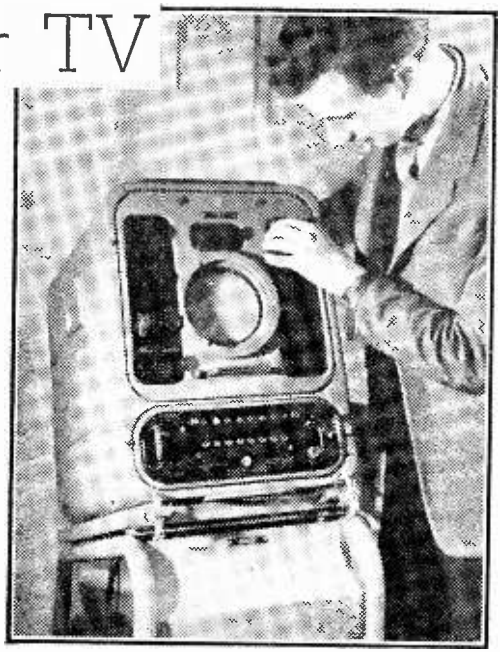
I and Q

The other two signals mentioned are I and Q and these are defined as follows:

$I=-.27(B-Y)+.74(R-Y)$

and $Q=.41(B-Y)+.48(R-Y)$.

our TV



Adjusting the Vectorscope.

These are also present in certain proportions in the received signal and it is obvious that all these factors need very careful balancing if our finally received picture is to have the correct balance of the three colours.

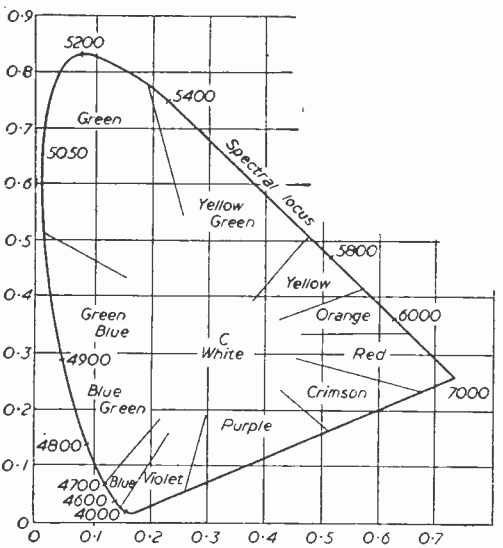


Fig. 4.—The C.I.E. Chromaticity Diagram.

A Colour Vectorscope

The extensive amount of research work which is taking place into colour television techniques has underlined the need for specialist test equipment for use in that field.

To this end, Marconi's Wireless Telegraph Company Ltd. have produced a new test instrument known as a Vectorscope, which is specially designed to display the chrominance component of the type of colour television signal just described.

The Vectorscope has proved to be of considerable value, not only for the correct setting up of coding systems of the N.T.S.C. type, but also for measurements of amplitude and phase relationship in a colour signal at any point in a television distribution system. A further application lies in the monitoring of actual colour camera signals, since its display gives an objective indication of the hue and saturation of the colour components. It can thus help in matching the characteristics of colour cameras and prove useful as an aid to programme directors in choosing colours for costumes and backgrounds.

The chrominance information is carried on a subcarrier which is modulated in amplitude, representing the colour saturation, and in phase, representing the hue. The display is presented on a cathode-ray tube, the radial distance of the spot from the centre indicating the amplitude modulation or saturation, while the phase or hue is displayed as the angle subtended from a fixed phase reference on the screen.

A simplified block diagram is shown in Fig. 1. The Vectorscope employs a pair of quadrature demodulators similar to those used in colour monitors and receivers, and a burst-controlled oscillator for deriving the reference sub-carrier from the colour synchronising bursts contained in the signal under test. The outputs of the two demodulators are applied after suitable filtering and amplification to the horizontal and vertical plates of the cathode-ray tube.

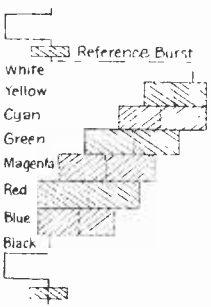


Fig. 2.—Colour signal showing composition when transmitting a colour bar test pattern.

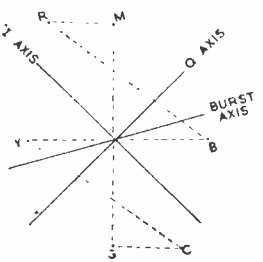


Fig. 3.—The Vector display given by the colour bar test signal.

When used in conjunction with the colour bar test signal, the Vectorscope produces a pattern of bright dots corresponding to the tips of the various colour vectors and a pattern of lines corresponding to the transitions between the colours. "Boxes" indicating phase and amplitude tolerance limits are drawn on a transparent scale to provide a very convenient indication of the quality of the signal, although it must be remembered that these tolerances refer only to the sub-carrier information, since the luminance information has been removed by the 1.3-3.3 Mc/s filter shown in the block diagram.

The use of the Vectorscope in colour television, is, in fact, analogous to that of a normal oscilloscope employed as a waveform monitor on black-and-white television.

A Popular Surplus Valve

HOW TO MAKE THE MOST OF THE EF54 V.H.F. PENTODE, AND A PRE-AMPLIFIER USING IT

ONE of the most popular of the ex-Government valves, after the EF50, is a development of that particular type, the EF54. It is still widely available either in equipment which is sold with valves, or as a separate component, and in view of the fact that it was specially designed for V.H.F. working, readers are continually asking us for details of apparatus making use of it. We did publish some data a few years back, but as all issues so far back are now out of print, and in view of the apparent popularity of the valve we are reprinting the following details on using this particular valve. As a voltage amplifier at television frequencies the EF54 (surplus equivalent VR136) is surpassed by very few valves.

Characteristics

First, its relevant characteristics as a voltage amplifier. These can be obtained from most valve data manuals, but are reproduced here for convenience at Table I.

When used in a pre-amplifier, or first R.F. stage of a complete receiver, the important factors are low noise, low input and output capacitance, high slope and high input resistance. The input-tuned circuit is heavily damped by the aerial and feeder, thus, any extra damping imposed by the valve, whose input resistance is connected across this coil, results in the response curve being unnecessarily broad. To maintain a high input resistance, mainly attributable to cathode lead inductance, four cathode leads have been brought out, each to a separate pin, and to take advantage of this feature a de-coupling capacitor should be connected between each cathode pin and chassis. The circuit at Fig. 1 makes this point clear.

Incidentally, this circuit is that of the pre-amplifier to be described later.

Noise is largely a function of the ratio of anode to screen-grid current. In this valve this is kept high by careful alignment of the control and screen-grids, and the resulting value of equivalent noise resistance (Req), of 700Ω is better than even the more modern miniature pentodes.

TABLE I

Characteristics of EF54.

Va	250
Vg2	250
Vg1	1.7
gm	7.7 mA/V.
Req	700 Ω.
Input resistance at 50 Mc/s	10,000 Ω.
Input capacitance	6.3 pF.
Output capacitance	4.9 pF.

Disadvantage

It was not until the author attempted to use the EF54 throughout in a video receiver that its great disadvantage was encountered.

The circuit was to consist of two stages of R.F. amplification, mixer and two I.F. stages before the detector. Band-pass coupling was used between each stage with the exception of the detector, as owing to the great distance of some 120 miles from Sutton Coldfield the maximum possible gain was essential. Also, this form of coupling enables a response curve closely approaching the ideal to be obtained.

Clearly, some form of gain control had to be fitted and the usual circuit (shown at Fig. 2) was tried. In the R.F. section it was found to be completely unworkable. Internal screening in the EF54 is connected to the cathode instead of being brought out to a pin, thus

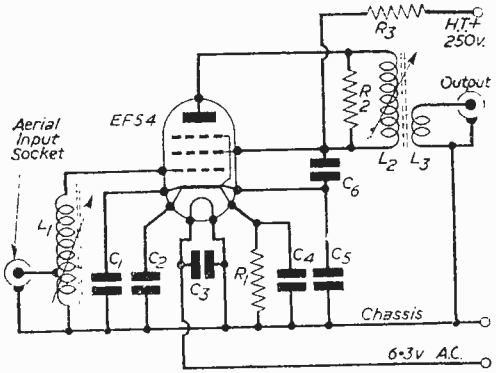


Fig. 1.—Circuit of the pre-amplifier.

the 33Ω resistor in Fig. 2 prevents effective earthing of this screening and allows a small amount of capacitive coupling between input and output circuits. With the comparatively light damping of the tuning inductors, needed with band-pass tuning, stage gain is high, and with the control near maximum setting the coupling is sufficient to allow the valve to burst into continuous self-oscillation. Grid and anode stoppers were tried but with little effect.

When single-stagger-tuned circuits are used and heavy damping thereby needed, stability can be achieved with this circuit, even without stopper resistors, but the presence of a tendency to regeneration has a detrimental effect on the noise factor, especially when it is allowed to occur in early R.F. stages.

Another possible form of contrast control circuit is shown in Fig. 3. Here the control grid bias is maintained constant at −1.7 volts irrespective of anode or screen currents by using the volts dropped across a resistor in the H.T. negative line of the power supply. Control is then effected by varying the voltage on G2 by means of VR1.

At the I.F. used for the vision channel (10.5 to 13.5 Mc/s) the degree of capacitive coupling due to inefficient screening is correspondingly smaller, and here stopper resistors were found to be completely effective. Fig. 4 shows the circuit subsequently used for the first I.F. stage. At these frequencies it is unnecessary to provide a separate cathode capacitor for each pin. Since the input resistance of the valve is inversely proportional to the frequency squared—at 12.5 Mc/s it is some 250 KΩ—damping resistors must be pro-

vided to give a smooth overall response curve. The slight reduction of input resistance, resulting from connecting all cathode pins together and using only one decoupling capacitor, can thus be more than tolerated.

Unlike the EF50, which has its suppressor grid brought out to a pin, the EF54 has this grid connected internally to cathode. This makes impracticable the circuit at Fig. 5, one commonly employed by constructors, which enables both the control and suppressor grids to be biased. In this circuit it will be seen that the internal screening is earthed to R.F. through the cathode decoupling capacitor, thus reducing feed-back within the valve to a minimum.

Readers will be aware that these somewhat complex biasing arrangements are necessary in order that the input capacitance and resistance of the valve should not change as the contrast control is rotated throughout its range. The associated tuning coil relies on these valves to tune it to the correct operating frequency, thus any variation will lead to a distortion of the overall response curve with accompanying degrading of picture definition.

A Pre-amplifier

The construction of the pre-amplifier should be found to be quite straightforward, although a few points need particular attention if the maximum performance is to be obtained.

A chassis, bent from 22 s.w.g. aluminium, the dimensions of which are 3in. × 4in. × 1in. deep, will be found sufficiently large to accommodate all the components. A screen must be fitted across the valveholder, in the position shown in Fig. 6, and bolted to the sides of the chassis. The length of all connections must be kept at a minimum, taking particular care with the grid and anode leads, and cathode by-pass capacitors. It is essential that the capacitors, C1 and C2, be earthed at the same point as L1, otherwise chassis currents will be set up with a risk of positive feed-back. The anode decoupling capacitor, C6, is connected to cathode instead of earthed to chassis in order to separate more effectively the grid and anode R.F. circuits. To reduce the possibility of aerial mis-match and loss of signal caused by the lead to the tapping on L1 forming a loop with the earthed lead, these should be run together through a short length of sleeving.

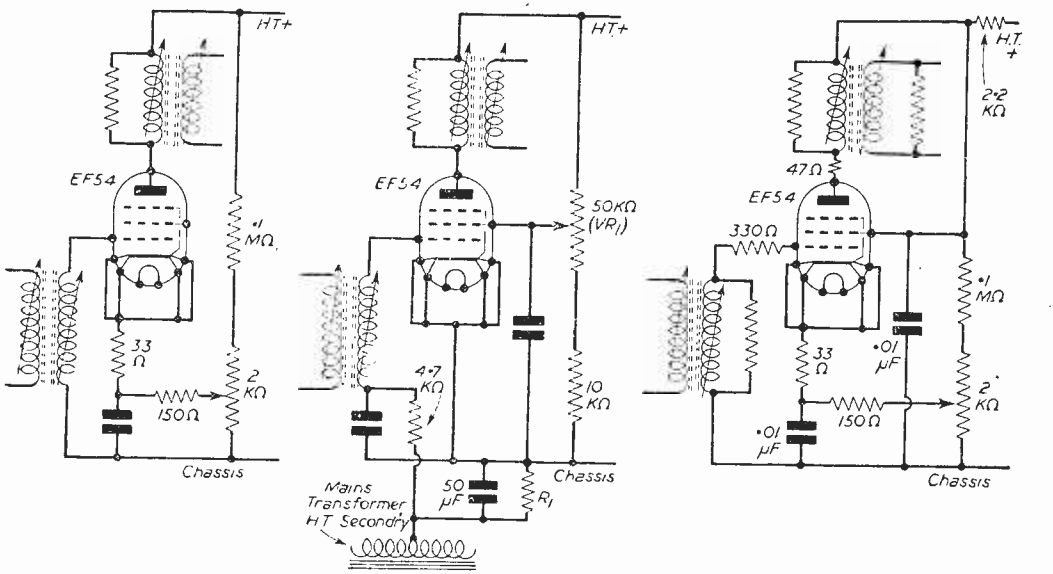
The coil-formers are the small Aladdin type, approximately ¼in. diameter, wound to the specifications found in Table 2, which gives the number of turns required for all five channels. A hard wax such as beeswax can be used to fix the wire in position after winding.

The 4.7 KΩ resistor, connected across the anode coil, is needed to give the amplifier a sufficiently wide response curve. It will be appreciated by most readers that as the receiver with which the pre-amplifier is to be used, whether commercial or amateur built, will have a response curve of the

TABLE 2

Channel	Number of Turns			
	L1	Tapping	L2	L3
1	11	2	10	2
2	10	2	9½	2
3	9	2	9	2
4	8	1½	8	1½
5	7½	1½	7½	1½

L3 is interwound with earthy end of L2.
All windings of 32 s.w.g. s.s.e. wire.



Figs. 2, 3 and 4.—Various gain controls as described in this article.

desired form the response of the pre-amplifier should be flat over the 3.5 Mc/s needed for the sound and vision channels. This cannot be obtained from two stagger-tuned circuits without embracing unwanted frequencies outside the required passband. The result is not as good as could be obtained from a receiver using similar valves and designed to have the sensitivity required with the minimum of amplification of unwanted side-bands. Nevertheless, in spite of the broad response curve the circuit at Fig. 1, when used in conjunction with many commercial receivers, it will be found to improve the signal-to-noise ratio considerably.

It is hoped that constructors and experimenters who have encountered similar difficulties and have hitherto unwittingly condemned the valve will find this article helpful, and enable them to obtain the best results from this excellent pentode.

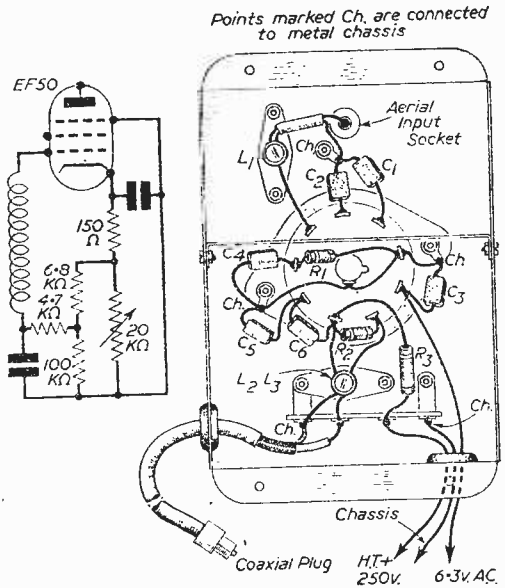


Fig. 5 (left).—Contrast control circuit suitable for EF50, EF91, SP61. Fig 6 (right).—Underside of pre-amplifier.

LIST OF COMPONENTS FOR PRE-AMPLIFIER

C1, C2, C3, C4, C5, C6 500 pF.
R1 - 150Ω (.25 watt).
R2 - 4.7 KΩ (.1 watt).
R3 - 2 KΩ (.25 watt).
Chassis - See text.
2 Aladdin coil formers ⅜in. diameter.
1 B9G ceramic valve-holder.
1 retaining clip.
2 rubber grommets.
Co-axial plug and socket.
Length of co-axial to requirements.
Nuts, bolts, wire, etc.
1 valve - EF54.

New TV Control Signal System

A PAPER was read before the I.R.E. National Convention recently describing a number of test signals to be transmitted at all times (including programmes) by television broadcast facilities. These test signals would be added to the composite programme signal near the end of vertical blanking and occupy two or three lines in each field. Addition of the test signal does not degrade programme transmission in any way. The home viewer would not normally be aware of its presence because the signal insertion time and the signal structure are selected to cause a minimal display on the home receiver picture tube.

The test signals would be either manually or automatically sequentially selected from the four available signals listed below.

1. Multiburst: permits instantaneous frequency response display: also determines frequency selective distortion.

2. Stairstep with 3.58 Mc/s permits precise measurement of colour subcarrier differential phase and gain: stairstep alone permits grey scale check.

3. Sine²-square wave: permits sensitive check of phase delay, transient and frequency response.

4. Colour Bar: provides a number of colour references to permit a vectorscope or chromascope presentation to be obtained even during a colour programme. Checks colour phase at different programme origination points.

Each signal, in addition to its other characteristics, contains a Peak White reference for level setting and alternatively a 50 per cent. Peak White reference to serve should white compression exist.

There are many powerful advantages to a test signal sent continuously during programming:

1. Deterioration or potential deterioration of video facilities instantly indicated and corrective measures may be undertaken during programme time.

2. Behaviour of video facilities under dynamic signal changes and all operating conditions is constantly shown.

3. Uniform conditions for video transmission may be established in terms of these test signals.

4. Permits colour or monochrome signals from different studios, cameras, or encoders to be adjusted for the same operating conditions. This will minimise disturbances caused when scenes are switched and levels have not been closely adjusted.

5. A peak white reference is *always* present. This permits a very important level of a video signal to be determined. Black level changes are apparently less important as shown by the success of receivers which do not use D.C. restorers.

6. These test signals may be used in the future to provide automatic level control, automatic frequency equalisation, automatic chroma level control, automatic differential phase and gain equalisation and automatic programme switching.

7. Permits the FCC to check condition of TV facilities in accordance with established standards.

The test signals should be inserted early in the programme signal chain so that as much of the system as possible can be monitored. The programme signal enters an input jack of the test signal generator and is directly conducted to an output jack. Generally, only one connection is made to the signal line inside the unit. This connection is from a vacuum tube adder which inserts the test signals during the end of vertical blanking. In this manner, the picture signal remains unaffected.

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Type A. Low leakage windings. Ratio 1 : 1.25 giving a 25% boost on secondary.
2 v., 10/6 ; 4 v., 10,6 ; 6.3 v., 10 6 ; 10.8 v., 10/6 ; 13.5 v., 10 6.
Ditto with mains primaries. 12 6 each.
Type B. Mains input 220-240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50%, respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel. 21 - each.
Type C. Low capacity wound transformer for use with 2 volt Tubes with rolling emission. Input 220-240 volts. Output 2-2½-2½ volts at 2 amps. With Tag Panel. 17 6 each.
NOTE.—It is essential to use mains primary types with T.V. receivers having series connected heaters.

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HIGH STABILITY. ½ w., 1%, 2 -. Preferred values 100 ohms to 10 meg.
5 watt } 10 watt } 25 ohms—10,000 ohms..... { 1 3 / 1 6
15 watt } 15,000 ohms—50,000 ohms, 5 w., 1/9 ; 10 w., 2 3. { 2 -

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6BE6	7/6	12AH8	10 6	EF41	10 6
6BH6	10/6	12AT7	10/6	EF50	5 6
6BW6	8/6	12AU7	10 6	Equip.	
6BW7	8/6	12AX7	10 6	EF50	8.6
6C4	10/6	12BE6	10/6	Sylv.	
6C6	7/6	12BH7	10 6	EF80	10 6
6F6	7/6	12K7	8 6	EF92	5 6
6H6	3/6	12Q7	8/6	EL32	5 6
6J5	6/6	3/521	10/6	EL84	10 6
6J6	7/6	80	8/6	EL91	10 6
6J7	8/6	954	1/6	EY51	11 6
6K6	6/6	EA50	1/6	EZ40	10 6
6K7	5/6	EABC80	8 6	EZ81	11 6

6/6	ET14	1 6	
8,6	HABC80		
10 6		12 6	
8/6	HVR2A	7 6	
12/6	MU14	10 6	
10 6	PCC84	12 6	
10 6	PCF80	10 6	
10 6	PCF82	10 6	
8 6	PCL82	10 6	
12-6	PL81	11 6	
7 6	PL82	10 6	
10 6	PY80	10 6	
5 6	PY81	10 6	
	PY82	10 6	
8.6	SP61	5 6	
	UBC41	8 6	
10 6	UCH42	8 6	
5 6	UF41	8 6	
5 6	UL41	8 6	
10 6	UY41	8 6	
11 6	U22	10 6	
10 6	4-25	11 6	
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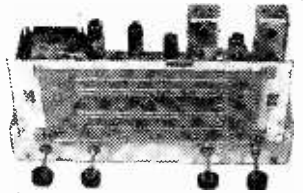

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8/500 v.	2/6	CAN TYPES		32+32/450 v.	6 6
16/450 v.	3/6	Clips	3d.	50+50/350 v.	5/-
16/500 v.	4/-	16/450 v.	2/6	60+100/350 v.	11 6
32/450 v.	5/6	32/350 v.	4/-	100+200/275 v.	12 6
25/25 v.	1/9	64/350 v.	5/6	100+1,000,6 v.	12 6
50/25 v.	1/9	500/12 v.	3/-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

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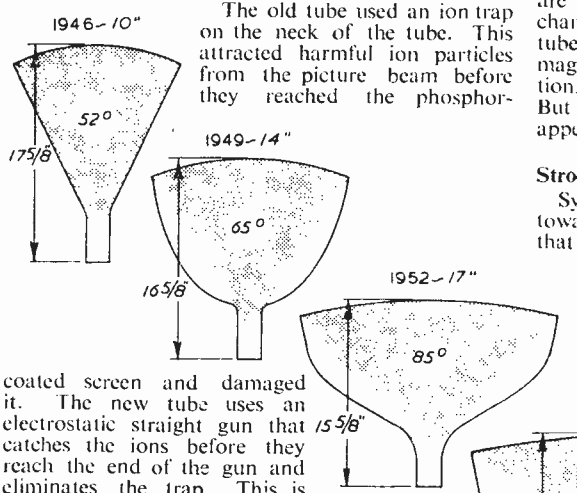
Smaller Picture Tubes

A SHORT ACCOUNT OF THE DEVELOPMENT OF THE C.R.T. AND POINTERS TO THE FUTURE

WHEN the television service first began in this country the picture tube which was used was of the 9in. type. There were one or two which were only 7in. in diameter, but the standard was a 9in. round tube. The overall length of this tube was about 15in. To-day there are 21in. tubes in use, but in spite of the much larger face, the length has been reduced, and these tubes may be obtained with an overall length less than the old 9in. tube. R.C.A. were first to introduce the new tube last October, and it has been able to cut the tube length of its 21in. sets from 20in. to 14 11/16in.

The New Design

Redesign of the electron gun that projects the picture beams from the neck of the tube on to the picture screen and a greater deflection angle are the major features of the new tube in the U.S.A.



The old tube used an ion trap on the neck of the tube. This attracted harmful ion particles from the picture beam before they reached the phosphor-coated screen and damaged it. The new tube uses an electrostatic straight gun that catches the ions before they reach the end of the gun and eliminates the trap. This is what makes the tube lighter. The new design also makes the tube easier to service.

By using a deflection angle (which will be explained later) of 110 deg., it has been possible to make a flatter triangle for the area between the tube neck and the screen. This shortens the tube length. It also allows the manufacturers to reduce the chassis size of their sets by a considerable amount for the first time since the days of the smaller tube.

Production Problems

But the shorter tube is not an unmixed blessing. It also poses some headaches for the manufacturer. Up until now, the need for a deep case to house the picture tube has left plenty of room for the circuitry. But, to take advantage of the shorter tube, the new chassis will be hardly more than half the size of the old ones in most cases. That means valves will have to be placed closer together. And to keep the wiring uncongested more printed circuits will have to be used. Retooling for this is going to cost much in time and money. One manufacturer had to adjust and retool his entire assembly line to wash the glass, settle the phosphor screen, create a vacuum in the tube, seal it, and install the new straight gun.

More Power Needed

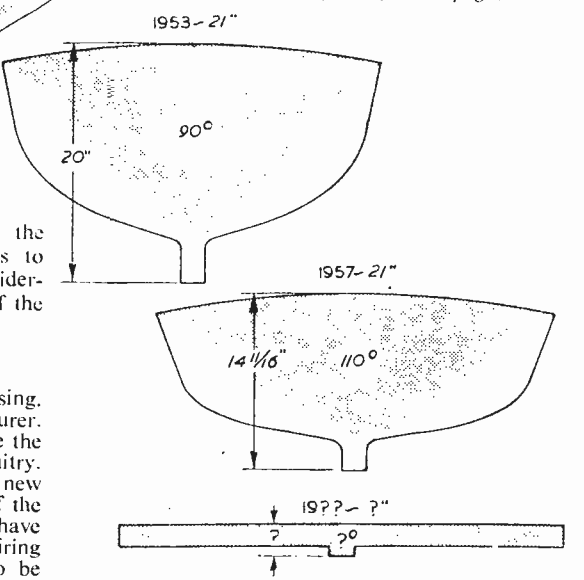
On top of that, the new tube itself carries a disadvantage. In most cases it takes more electrical power to deflect the beam to the far corners of the screen of the increased angle tube than for those now commonly in use. That is why manufacturers hesitate to credit the new tube with cost saving. Instead, they enthuse about space-saving possibilities.

Nearly all manufacturers in the U.S.A. are planning to include some 110-deg. angle tubes in their sets this year. Most are keeping quiet about what models will feature the tube innovation until the new lines are introduced in the summer and they've had a chance to whittle down the inventories of 90-deg. tube sets. According to a survey by the American magazine "Electronics," a McGraw-Hill publication, valve sales are off 6.4 per cent. against last year. But it is fairly safe to assume that 110-deg. tubes will appear in most of the so-called portable lines.

Strong Advocate

Sylvania feels so strongly that the trend today is toward smaller sets, that it already has announced that its entire 1958 line will feature the 110-deg. tube. The company has had some experience with the 110-deg. tube. It introduced a 17in. 110-deg. portable last December. And sales for the first two months of 1957 are running better than two-to-one ahead of a similar period last year.

(*Concluded at foot of next page*)



From the tube of yesterday to the tube of tomorrow.

CORRESPONDENCE

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

COLOUR TV

SIR,—I have read the editorial column in your June issue, and whilst I am glad to see that you have given as much importance to what is obviously Mr. C. O. Stanley's report on American colour TV as it deserves you have omitted reference to the incorrect handling of the marketing of portable TV sets which, as he says, "started the rot."

The situation is not without parallel in this country where the credit sale terms on small portable TV sets are comparable with the instalments on the domestic models, but without the 50 per cent. deposit. I know of many instances where families view five or more hours a day on receivers designed in the first place as "second sets."

Your correspondent, G. Goodson ("Valve Design," p. 539) is not alone in his valveholder sufferings, but may like to know that the individual pins in this particular breed of holder can be lifted out and nipped up, or replaced.

Another annoying source of trouble is caused by the valve manufacturer who so kindly fits a plastic button over the pins for transit protection, but fails to tuck all nine inside its slot.—H. PETERS (Norfolk).

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.

THE DOOR-KNOB KILOVOLTER

SIR,—The kilo-voltmeter described in the June issue of PRACTICAL TELEVISION is certainly a very useful instrument, but surely there is a certain amount of risk involved in using it. If the crocodile clip should spring off the chassis whenever a spark is occurring across the gap it would cause the operator some discomfort, particularly if the EHT was anywhere near 20 kV.

I think it would be worth a little extra trouble to make the rod holding the moving sphere from a piece of fibre or similar material and connect the "earth" lead direct to the sphere.

Many thanks for a most interesting and useful article.—A. WILSON (Co. Antrim).

INTERMITTENT FAULTS

SIR,—Having read the letter of Mr. H. Wells (Edgware) on "Intermittent Faults," as a service engineer I have been in the same difficulty many times, and the number of hours that I have wasted!

I wonder how many readers would agree with my "idea" of servicing "intermittent faults." Why not have a TV made up of five plug-in units: (1) Tuner unit; (2) vision and sound I.F. strip; (3) frame timebase and sync. sep.; (4) line timebase; (5) power unit, and even the E.O.T. could be a plug-in component.

How many hours have been paid for by the customer for replacing a E.O.T. on a TV? Surely some parts of a TV can be plug-in units, and so ease the job for a service engineer.

The idea of plug-in components would solve the problem of "intermittent faults." The faulty unit could be despatched to makers for servicing, who have all the latest instruments for the job. Thank you.—H. D. WILLIAMS (N. Wales).

COMMERCIAL SERVICE SHEETS

SIR,—Would you please explain why many English radio firms do not supply a circuit diagram with their sets? When one writes asking for one, the reply is that they are distributed only to their authorised dealers. German manufacturers provide them, why cannot ours?

If the idea behind it is to protect the public in some way, then I cannot understand how.

What of the serviceman who is asked to repair a make of set of which he is not an agent? He will fiddle with it, perhaps causing some damage, the cost of which the customer probably has to bear.

Why, also, should the "technical type," who would not dream of sending his set to a repairer be unnecessarily handicapped?

Surely, in this "do-it-yourself" age, this is a major selling point? Perhaps some manufacturer would explain.—R. N. PARKHOUSE (Cpl., Signals, 2nd T.A.F., Germany).

A D.C. PROBLEM

SIR,—As I am on D.C. mains I wondered if any of your readers could assist me with the following problem: I have a D.C. to A.C. rotary converter, delivering approximately 70 watts output. As I recently came into possession of an A.C. television set, I wondered if it is possible by any means to boost this output up to about 150 watts to drive this TV. I would appreciate any suggestions from readers. It will light up all the valves but I cannot get enough EHT for the tube.—A. ELLIOTT (Notts).

SMALLER PICTURE TUBES

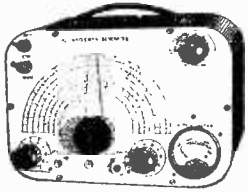
(Concluded from page 579)

In May, Sylvania plans to bring out a 21in. set using the new tube, and then a 24in. model a little later on.

How Flat?

And while the manufacturers are trying to work out their new production problems, their tube designers will be trying to go one better and produce a flat tube. It is not likely that the picture tube's angle of deflection will continue to increase in small jumps as it has in the past until it reaches the impossible ideal of 180 deg. The power required to spread the electrons across the screen at wide angles is too much to be commercially practical. And the electron gun would be too close to the phosphor screen. Rather, the flat tube probably will be the result of an entirely new approach to tube making. For that reason, no one in the industry is predicting that the flat tube will make its debut before five years at the very earliest.

SIGNAL GENERATOR



Coverage 120 Kc/s-230 Kc/s, 230 Kc/s-900 Kc/s, 900 Kc/s-2.75 Mc/s, 2.75 Mc/s-8.5 Mc/s, 8.6 Mc/s-28 Mc/s, 16 Mc/s-56 Mc/s, 24 Mc/s-84 Mc/s. Metal case 10in. x 6¼in. x 4¼in. Size of scale, 6¼ x 3¼in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F. output continuously variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%. **£4.19.6** or **34**/- deposit and 8 monthly payments **25**/-. P. & P. 4/6 extra.

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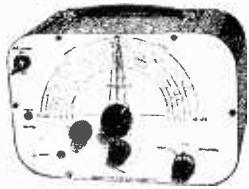

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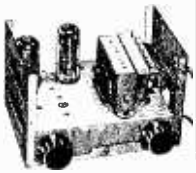

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6C8	5/6	6V6M	6/6	EB34	1/6	EF92	5/6	SP61	2/6
6D6	5/-	6X4	6/-	EBC33	7/-	EF95	8/6	SP21)	3/6
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6J5M	5/-	7C5	7/6	ECC81	8/-	EL91	4/-	U52	6/6
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1R5	7/6	7C5	7/11	955	3/11	EF89	9/6
1S5	7/3	7C6	7/11	956	2/11	EL32	5/11
1T4	7/3	7S7	8/11	958	3/11	EL84	10/3
3S4	7/6	7Y4	7/11	39/44	8/6	EY51	9/11
3Q4	8/11	12AH8	10/3	41MP	11/6	EY86	10/6
3V4	8/5	12AT6	10/3	DAF96	9/6	EZ80	8/3
5U4G	7/11	12J7GT	9/6	DF96	9/6	PCC84	9/6
5Y3GT	7/6	12K7GT	8/11	DK96	9/6	PCF80	10/11
5Z4G	8/3	12K8GT	12/6	DL96	9/6	PCL83	12/3
6AT6	7/6	12Q7GT	9/3	DM70	7/11	PL82	8/11
6BA6	7/3	1457	13/6	EABC80	7/6	PL83	11/3
6BJ6	7/6	19AQ5	11/6	EB91	6/11	PY81	8/3
6J5M	2/11	25L6GT	8/6	ECC81	8/3	PY82	8/3
6K7G	2/11	25Z4G	8/11	ECC82	7/6	UBC41	8/11
6K8GT	9/6	35A5	10/11	ECC83	8/3	UL41	9/6
6Q7GT	8/3	35L6GT	8/11	ECC84		UL84	9/6
6SN7GT	7/11	35Z4GT	7/11		10/11	UY41	7/11
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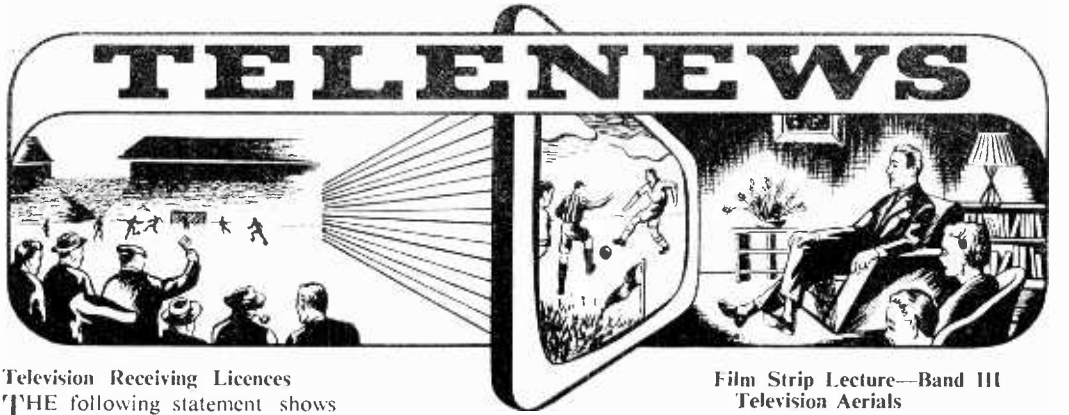
No Lists

In Stock at Present: Not Working TV's, from **39/6**; Working TV's, from **£5/19/6**. *All carriage extra.*



Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of April, 1957, in respect of receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,474,341
Home Counties	836,460
Midland	1,167,818
North Eastern	1,105,164
North Western	1,005,673
South Western	515,504
Wales and Border Counties ...	394,406
Total England and Wales ...	6,499,366
Scotland	485,896
Northern Ireland	65,046
Grand Total	7,050,308

Television Passes 7 Million

DURING April the number of television licences increased by 84,052.

14,559,316 broadcast receiving licences, including 7,050,308 for television and 308,296 for sets fitted in cars, were current in Great Britain and Northern Ireland at the end of April, 1957.

Pye TV Station for Bangkok

PYE LIMITED announce that they have sold [a complete high-power television station for Bangkok for £170,000. It is expected to be completed towards the end of the year.

In 1955 Pye sold a complete television station for Baghdad to the Iraq Government, and have also secured contracts for transmission equipment in many other parts of the world.

Marconi Equipment for Cyprus Television Station

THE island of Cyprus is soon to have its own television service. The Governor, Field-Marshal Sir John Harding, has approved plans for a station, to be situated near Nicosia, adjoining the existing sound broadcasting station.

In common with the sound service, the new television service will be entirely Marconi equipped. Equipment to a total value of £38,000 will be supplied and installed by Marconi's Wireless Telegraph Company Ltd. for the Cyprus Broadcasting Service. This will include studio equipment to a value of £23,000, a 500-watt vision transmitter, a 125-watt sound transmitter and associated transmitting equipment.

Technicians from Cyprus who will operate the new station are at present being trained in the Marconi works, while the BBC has undertaken the training of programme producers.

Film Strip Lecture—Band III Television Aerials

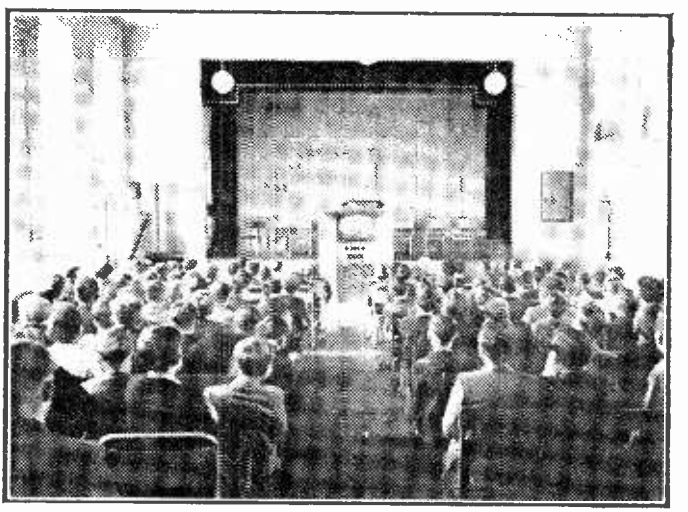
A FILM strip has been produced in colour telling the story of Band III reception. It is proposed to show this primarily to Scottish dealers participating in the exhibitions being organised by Scottish Television Ltd.

Four centres have been chosen, Edinburgh, Stirling, Glasgow and Dundee.

The run-through will occupy about 45 minutes when there will be a tea break before question time. A senior representative of the company and an engineer will be in attendance to answer technical questions.

The purpose of the film is to help dealers exhibiting to answer the inevitable questions put by their customers as to which of many types of aerial will be required in any particular location.

The first showing will be in Edin-

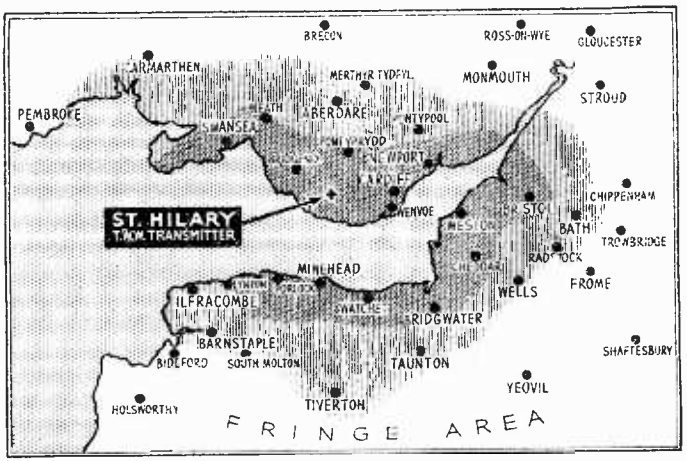


A 27in. receiver installed by High Definition TV Ltd. at a Cambridge boys' school.

burgh, before the first exhibition, which is being held in Portobello. Admittance by ticket, obtainable from Belling and Lee Ltd., Great Cambridge Road, Enfield, Middlesex.

16-stack high-gain quadrant aerial. The effective radiated (vision) power will be of the order of 200 kW.

The studio equipment includes one complete two-camera studio,



The projected areas of reception of the I.T.A. transmitter for Wales and the West.

Colour Set-backs

GENERAL SARNOFF of the R.C.A., at the annual stockholders' meeting recently said, amongst other things, "... Having pioneered and developed compatible colour television, we have the utmost faith in its ultimate success. We are fully aware from past experience that the introduction of a new product or service as significant as colour television faces many obstacles; some are natural and others are man-made. Indeed, it was that way with wireless telegraphy, radio broadcasting, and black-and-white television. Now, colour TV is meeting such obstacles and is overcoming them one by one and day by day.

"To the great services offered by black-and-white television, colour adds a new and thrilling dimension. Nothing can stop the continued progress of colour television. . . ."

Poland Orders Television Station

AN order to the approximate value of £200,000 has been received by Marconi's for the supply of a complete television station to Poland. It will be the biggest in that country.

The transmitting equipment included in the contract comprises two 7½ kW. vision transmitters, two 2 kW. sound transmitters, two combining units and one a master control room, two vidicon telecine channels, and a considerable quantity of test-gear and spares.

The outputs of one vision and one sound transmitter will be combined to feed into eight stacks of the aerial array; the remaining pair will be treated in like manner, feeding into the other half of the array. By this means the two vision transmitters are effectively in parallel "on the air" as also are their sound counterparts.

The station will operate on Band III, to O.I.R. standards—that is, 625 lines 50 fields with a video bandwidth of 6 Mc/s. This is the same as the standards adopted by the U.S.S.R. The station will be built at Katowice in southern Poland and will serve that densely populated mining area.

Biggest-ever Export Bid

THE first concentrated export drive in Eastern Europe by any television manufacturer in the world is to be launched by Pye Limited, of Cambridge, at the Leipzig Fair.

This export drive will be on the largest scale ever undertaken by Pye in an overseas market. It will involve demonstrations of underwater, industrial and studio television cameras as well as a complete outside broadcast vehicle.

During out-of-service hours, when the East German Television Service is off the air, TV pictures from the Fair will be offered to the authorities for re-transmission.

In all, nearly a quarter of a million pounds-worth of the most advanced British television transmission equipment and other electronic apparatus will be taken to Leipzig by the Pye Group of Companies. Included in the exhibits on the Pye stand will be telecommunications and scientific instruments, electronic components, such as transistors and quartz crystals, and domestic radio, television and sound reproducing equipment.

Television and the "Under Sixteens"

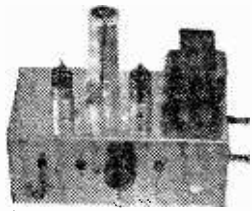
WHAT effect is the lifting of the ban on 6 p.m. to 7 p.m. television broadcasting likely to have on the size of the "under sixteen" element in I.T.A. audiences during evening time segments?

Programming during the 6 p.m. to 7 p.m. period is obviously likely to be the major determining factor. Nielsen Television Index examination of "under sixteen" viewing, shows a definite and consistent pattern under present circumstances. Between 5 p.m. and 6 p.m. the average daily "under sixteen" percentage of total I.T.A. audience to Croydon is 48 per cent., between 7 p.m. and 8 p.m. 22 per cent.; to Lichfield 52 per cent. and 33 per cent.; to the Northern transmitters 51 per cent. and 30 per cent.; showing a fall-off of between 26 (Croydon) and 19 (Lichfield) percentage points.

As a background to speculation it is worth bearing in mind that the latest Nielsen surveys show that 46 per cent. of I.T.A. homes have no children (on the average of all areas), while 43 per cent. have one or two children, 11 per cent. three or more.

Television Set Innovation

A NEW idea is reported from America where "modular" construction is now taking the field. One 17in. receiver now on the market has a printed-circuit chassis into which are plugged 17 modular plates which contain the equivalent of 127 conventional components. Other chassis have a horizontal deflection circuit composed of 4 modules which replace some 40 components.



T.V. CONVERTER £2.5.0. post free

Suitable for all Band 3 I.T.V. channels. Method W.World circuit. Highly successful for S.Het. and I.F. S.Band T.R.F. receivers. Complete kit of parts, non mains, **£2.5.0.** post free. Ready built and aligned, non mains, **£2.19.6.** carr. and ins. 3/6; ditto, mains operated, **£3.19.6.** carr. and ins. 3/6.

T.V. ACCESSORIES: Adaptors from **7/6** per set. Indoor or outdoor Band 3 dipoles with 5 yds. cable, **13/9.** 3 Element array, **27/6.** etc. Band I-Band 3 cross over filter unit, **7/6.** Variable attenuators 0 db 26 db, **6/9.** BBC break-through filter, suitable for BBC pattern rejection, **8/6.**

Volume Controls

Log. ratios. 10,000 ohms – 2 Megohms. Long spindles. 1 year guarantee. Midget Edis-wan type.

No. Sw. S.P. Sw. D.P. Sw.
3/- 4/- 4/9

Linear Ratio, 10,000 ohms – 2 Megohms. Less switch, 4/- each.

Coax plugs, 1/2. Coax sockets 1/-. Couplers 1/3. Outlet boxes, 4/6.

80 ohm CABLE COAX

STANDARD ¼in. diam. Polythene insulated.

GRADE "A" ONLY

8d. yd.

SPECIAL - - Semi-air spaced polythene. 80 ohm. **Coax** ¼in. diam. Stranded core. Losses cut 50%.

9d. yd.

TWIN FEEDER. 80 ohms, **8d.** yd.; 300 ohms, **8d.** yd.

TWIN SCREEN FEEDER, 80 ohms, **1/3** yd.

50 OHM CABLE 8d. per yd. ¼in. dia.

TRIMMERS, Ceramic. 1 pf.—70 pf., **9d.** 100 pf., 450 pf., **1/3**; 250 pf., **1/6**; 600 pf., **1/9. PHILIPS** Bee-hive Type—2 to 8 pf. or 5 to 30 pf., **1/3** each.

RESISTORS.—Pref. values 10 ohms 10 megohms.

CARBON		WIRE WOUND	
20%, Type, ¼ w., **3d.**; ½ w., **5d.**; 1 w., **6d.**; 2 w., **9d.**		5w. 25 ohms 10w. 10,000 15w. ohms	**1/3** **1/6** **2/-**
10%, Type. ½ w., **9d.**; **5%, Type.** ½ w., **1/-**; **1%, Hi-Stab.** ¼ w., **2/-.**		5w. 15,000 – 33,000 10w. ohms	**1/9** **2/3**

WIRE-WOUND POTS. Pre-Set Min. T.V. Type Knurled Slotted Knob. All values 25 ohms to 30 K., **3/-** ea. 50 K., **4/-.** Ditto Carbon Track. 50 K. to 2 Meg., **3/-.**

3w. LAB. COLVERN, etc. Standard Size Pots. 2¼in. Spindle. High Grade. All Values. 100 ohms to 30 K., **5/6**; 100 K., **6.6.**

W/W EXT. SPEAKER CONTROL 10Ω. **3/-.**

CONDENSERS.—Mica or S. Mica. All pref. values. 3 pf. to 680 pf., **6d.** ea. Ceramic types, 2.2 pf.-5,000 pf. as available, **9d.** each. **Tubulars,** 450 v., Hunts and T.C.C. .0005, .001, .005, .01 and .1, 350 v., **9d.** .02, .05, .1.500v. Hunts. TCC. **1/-.** .25 Hunts. **1/6.** .5 Hunts, **1/9.** .1, 1,500 v. T.C.C. (S.Simplex). **3/6.** .001 6 kV. T.C.C., **5/6.** .001 20 kV. T.C.C., **£ 6.**

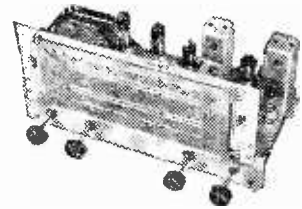
SILVER MICA CONDENSERS—10% 5 pf. to 500 pf., **1/-.** 600 pf. to 3,000 pf., **1/3.** 1% 1.5 pf. to 500 pf., **1/9.** 515 pf. to 5,000 pf., **2/-.**

ALUMINIUM CHASSIS.—**18 s.w.g. Plain, undrilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2¼in. sides. 7in. x 4in., 4/6; 9in. x 6in., 5/9; 11in. x 7in., 6/9; 13in. x 9in., 8/6; 14in. x 11in., 10/6.**

SOLON SOLDERING IRONS (200-250v. or 230-250 v.), 25 watt Instrument type, **21/6**; 65 watt Pencil Bit Type, **26/8**; 65 watt Oval Bit Type, **25/-.** Comprehensive stock of spares available.

8" P.M. SPEAKER

Ex Mfrs'. Units: Rola, Elac, Celestion, etc. All reconditioned and guaranteed. Ideal Ext. Unit. Bargain, **7/6.** Carr. 1/6.



ALL WAVE RADIOGRAM CHASSIS

3 WAVEBANDS	5 VALVES
S.W. 16 m. –50 m.	LATEST MIDGET
M.W. 200 m. 550 m.	BVA
L.W. 800 m. 2,000 m.	SERIES

Brand new and guar. A.C. 200/250 v. 4 pos. W.C. sw. Short-Medium-Long-Gram. P.U. socket. High Q dust core coils. Latest circuit technique, delayed AVC and neg. feedback. O/P 4 watts. Chassis size, 13½ x 5¼ x 2¼in. Dial 10in. x 4¼in. Hor. or vert. station names. Walnut or ivory knobs to choice. Aligned and calibrated ready for use. **Sensitivity and Quality at Low Cost.**

Double wound mains trans. **BARGAIN PRICE 9½ Gns.** Carr. and ins., **4/6.**

8 or 10in. speaker to match, **20/-** and **25/-.**

7 Valve De Luxe, push-pull version, 7 watt output, **£12.10.0.** Carr. & ins. 5/-.

RECORD PLAYER BARGAINS

SINGLE PLAYERS: 3-SPEED BSR.—Model T.U.S., consisting of motor turntable and duo xtal. turnover head, **£4.12.6.** carr. and ins. 3/-. Cut mounting board for T.U.S., 5/-, carr. and ins. 1/-. **3-SPEED COLLARO.**—Model 3/554 with studio type P.U., **£6.19.6.** carr. and ins. 3/6. **4-SPEED COLLARO** and **GARRARD** units as available, from **£7.10.0.** carr. and ins. 3/6.

AUTOCHANGERS 4-SPEED BSR U.A.8, £3.15.0. carr. and ins. 4/6. **4-SPEED COLLARO** and **GARRARD** units, as available, from **£4 gns.**, carr. and ins. 4/6.

RECORD PLAYER CABINETS

Contemporary style rexine covered cabinet in mottled red with cream interior. Size 18½ x 13½ x ht. 8¼in., fitted with all accessories, including speaker baffle board and plastic fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14 x 13in. Cut mounting boards available.

Cabinet Price, £3.3.0. carr. and ins. 5/6.

2 VALVE AMPLIFIER (to fit above cabinet), modern circuit with EL84 output, ready built, with 6in. speaker and output transformer, **£3.12.6,** carr. and ins. 2/6.

TRANSISTORS

Mfr's. surplus PNP Junction type.

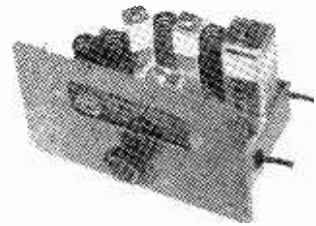
Audio Type, 800 Kc/s, 250 m.w., **9/6.**

I.F. and Mixer Type, 1.6 Mc/s, **14/6.**

R.F. and L.O. Mixer Type, 2.5 Mc/s, **19 6.**

All tested and guaranteed.

Transistor Components.—Midget I.F. transf. 315 kc/s, **5/-**; Ferrite Slab Aerial (final range), **13 6**; M. and L.W. Osc. and 1st I.F., **11 6**; Push Pull inter-stage transf., **8 6**; Push Pull output transf., **8 -.**



JASON F.M. TUNER UNIT (87 mc s-105 m c s). As described in Radio Constructor. Designer Approved Kit of parts to build this modern highly successful unit, drilled chassis and J.B. dial, coils and cans. 4 BVA miniature valves and all components, etc., for only **£6/10/0** post free. **SUPERIOR TYPE GLASS DIAL** (as illustrated).—Calibrated in Mc s and edge lit by 2 pilot lamps, **12/6** extra. Illustrated handbook with full details, **2/-** post free.

NEW BOXED VALVES ALL GUARANTEED

1R5, 1T4	7/6	DAF96	9/-	ECL80	10/6
1S5, 1S4	7/6	DF96	9/-	EF41	10/6
3S4, 3V4	8/-	DK96	9/-	EF80	10/6
5Z4	9/6	DL96	9/-	EF86	12/6
6AT6	8/6	35L8	10/6	EF91	8/6
6K7	6/6	EABC80	9/6	EL41	10/6
6K8	8/6	EB91	6/6	EL84	11/6
6Q7	8/6	EBC41	10/6	EY51	10/6
6SN7	8/6	EBC33	8/6	EZ40	8/6
6V6	7/6	ECC82	12/6	EZ80	8/6
6X4	7/6	ECF80	12/6	EZ81	8/6
6X5	7/6	ECF82	12/6	PCC84	10/6
7C5	9/-	ECH42	10/6	PCF80	10/6
7Y4	8/6	ECH81	10/6	PCF82	10/6

PCL83	12	6	
PL81	11	6	
PL82	10	-	
PL83	11	6	
PY80	9	6	
PY81	9	6	
PY82	8	6	
U22	8	6	
U25	11	6	
UBC41	9	6	
UCH42	10	6	
UF41	10	-	
UL41	10	6	
UY41	8	6	

SPECIAL PRICE PER SET

1R5, 1T4, 1S5, 1S4 or 3S4, or 3V4	...	...	27/6
DK96, DF96, DAF96, DL96	...	...	35 -
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5	...	...	35/-

ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire Ends		Can. Types, Clips. 3d. ea.	
25/25 v., 50/12 v.	1/9	8/450 v.	2/6
50/50 v., 4 500 v.	2/-	8+8/450 v. T.C.C.	4/6
100/25 v., 2/450 v.	2/-	8+16/450 v. Hunts	5/-
8/450 v. B.E.C.	2/3	16+16/450 v. T.C.C.	5 6
8/500 v. Dub.	2/9	32/350 v.	4/-
8+8 500 v. Dub.	4/6	32+32/275 v. Hunts	4/6
8+16 450 v. T.C.C.	5/-	32+32/450 v. T.C.C.	6/6
16/450 v. B.E.C.	3/6	250/350 v. B.E.C.	8/6
16/500 v. Dub.	4/-	60/350 v. T.C.C.	6/6
16 - 16/450 v. T.C.C.	5/6	60+100/350 v.	11 6
32/350 v. Dub.	4/-	60+250/275 v.	12/6
32/500 v. Dub.	5/-	100+200/275 v.	12/6
50+50/350 v. B.E.C.	6/6	3,000 mfd. 6 v.	3 6
32+32/350 v. B.E.C.	5/6		

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES.—K3/25 2 kV., **5/-**; K3/40 3/2 kV., **6/9**; K3/45 3.6 kV., **7/3**; K3/50 4 kV., **7/9**; K3/100 8 kV., **12/9**, etc.

MAINS TYPES. - RM1 125 v., 60 mA., **4/6**; RM2 125 v. 100 mA., **4/9**; RM3 125 v. 120 mA., **6/9**; RM4 250 v., 250 mA., **16/-.**

ENGRAVED CONTROL KNOBS for ¼in. spindle. 1¼in. diam. Walnut or ivory. Gold filled. 16 standard engravings, **1/6** ea. Plain knobs to match above, 1¼in., **10d.** each.; 1¼in. diam., **8d.** ea. Superior walnut or ivory with gold rings, 1¼in., **1/-** ea.; 1in., **9d.** ea. Pointer knobs, black with white line, **9d.**

WEARITE "P" TYPE COILS.—All ranges 1 to 7, **2/6** ea. Osmor Q series coils. Slug tuned. All ranges from **3/6.** Med. & L.W. dual range coil with reaction, type DRR2 with circuits, **4/-.**

MAINS TRANSFORMERS.—Made in our own Workshops to Top Grade spec. Fully interleaved and impregnated. **RADIO AND AMPLIFIER TYPE.**—250 v., 60 mA. F.W. rec. 5 v. or 6.3 v. 1 a. rect. 6.3 v. 2.5 a. set Htrs., **21/-**, etc., **C.R.T. HTR. ISOLATION TYPE.** -Low leakage with or without 25% sec. boost voltage. Ratio 1 : 1 or 1.25, 2 v., **10/6**; 4 v., **10/6**; 6.3 v., **10/6**; 13.3 v.; **10/6.** Ditto with mains primaries 200/250 v., **12 6.** Specials to order.

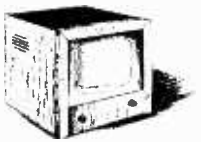
I.F. TRANSFORMER –465 kc/s

Brand new ex-manufacturer's midget I.F.T. size 2¼in. x 1in. x ¾in. dust core tuning. Litz wound coils, High Q. Bargain offer, **7 6** pair.

SUMMER SALE!

Finest Battery Portable

Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C., ready-built and aligned chassis, if required, beautiful two-tone cabinet covered with L.C.I. Rexine and Tygan. Guaranteed results on long and medium waves anywhere. All parts, including speaker and cabinet. Price is **£7.15.0** complete or **£1.15.0** deposit and 7 monthly payments of **£1**, post and ins. **3 6**. ready-built chassis **30 -** extra. Data **1 6**.



14" T.V. Cabinet

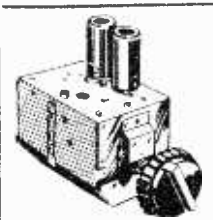
14in. T.V. cabinet of the latest styling —beautifully veneered and polished— limited quantity—sale price **17 6** each. Carriage and packing 3/6 extra.

Transistor Receiver 19/6

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

Crystal Microphone

Miniature crystal type has high gain and is suitable for all purposes — tape recorders—amplifiers. Price **4/9**, post and ins. 9d.



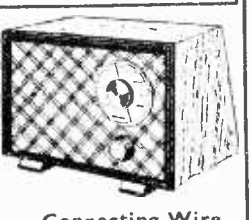
THIS MONTH'S SNIP

Turret Tuner

Brand new stock, not surplus, with coils for Band I and III complete with valves PCC84 and PCF80—I.F. Output 33/38 Mcs with instructions and circuit diagram, **79 6**. With knobs **3 6** extra, post and insurance 2/6.

The Skysearcher

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



Save £2 - 10 - 0

The Cleveland Band III converter is one of the best on the market and literally thousands are in use all over Britain. Original price, **£7.10.0**. Sale price **£4.19.6**, carriage and insurance 5/-.

Connecting Wire

PVC covered copper wire in 100ft. coils most colours. Sale price **2 6** per coil or 5 coils **10 -**, post free.

Electric Blanket Element 15/-

We are offering an out-of-season bargain- 14 yards of waterproof electric blanket element, enough to make a full size blanket. Normally we sell at 20/-. Sale price is only **15 -**, post free, complete with Illustrated data.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders, Dept. 5, Sutton Road, Eastbourne

266, London Road, Croydon. Phone : CRO 6558
42-46, Windmill Hill, Ruislip, Middx. Phone : RUISLIP 5780
152-3, Fleet Street, E.C.4. Phone : FLEet 2833
29 Stroud Green Rd., Finsbury Pk., N.4. Phone : ARChway 1049
249, Kilburn High Road, Kilburn. Phone : MAIda Vale 4921

COMMERCIAL TV

DON'T GIVE UP BEFORE YOU HAVE TRIED OUR BAND III PRE-AMP

Separate coaxial inputs for Band I and III Aerial Downleads. No changing of Aerial leads. No Diplexor required. Attractive black crackle finished case fitted with non-scratch rubber feet. Easily installed—just plug in mains and aerial leads.

A sensitive unit complete with built-in power supply specially designed for use in ultra-fringe areas. High signal to noise ratio. Will produce excellent results in localities where the signal is normally unusable.

Dimensions 6in. x 4in. x 2¼in. Will fit inside most receiver cabinets. 200-50 v. A.C.

PRICE £6.6.8. C.W.O. OR C.O.D.
(Fly Lead 3'6 extra.)

"AIRVISION"

(Electronic Equipment Manufacturers),
14, Boulton Road, SOUTHSEA.

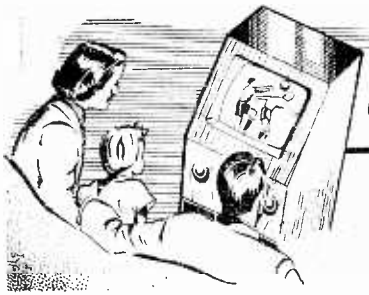
GUARANTEED VALVES

CV6	1 -	EL33	15 -	VR116	6 -	6R7	8,6
DET19	1 6	EL41	10 -	VR150/30	7 6	6SA7	8 -
DET25	5 -	EL42	10 -	VU111	2 -	6SH7	5 -
DF91	7 6	EL84	10 6	X66	10 -	6SJ7	7 6
DF92	7 6	EL90	7 -	07A4	6 6	6SK7	7 6
DL92	7 6	EL91	8 6	1L4	7 6	6SL7	6 6
DL93	7 6	EM80	13 -	1T4	7 6	6SN7	7 6
DL95	7 6	EN91	7 6	1U5	8 6	6SS7	5 -
EA50	1 -	EY51	11 6	1U5	7 6	6T8	9 -
EABC80	9 -	EZ35	8 -	2C34	3 6	6V6	7 6
EB34	2 6	EZ40	8 -	2D21	7 6	6X4	7 6
EB91	6 -	EZ80	8 6	2X2	4 -	8D2	4 6
EBC33	8 -	FC13C	4 6	3A4	7 6	9D2	4 6
EBF80	9 -	HL13C	4 6	3Q4	7 6	12A6	7 6
ECC32	7 6	H63	7 6	4D1	4 6	12AH8	10 -
ECC35	7 6	KT33C	8 6	5U4	8 -	12AT7	7 6
ECC81	7 6	KT44	10 -	5Z4	8 6	12AU7	9 -
ECC82	9 -	KTW61	7 6	6AG5	6 6	12AX7	9 -
ECC83	9 -	KTW63	7 6	6AK5	6 6	12H6	2 6
ECC84	11 -	PL36	20 -	6AL5	6 6	12J5	5 -
ECH35	10 -	PL81	10 6	6AM6	7 9	12J7	7 6
ECH81	9 -	PL82	10 6	6AQ5	7 -	12K7	7 6
ECH42	10 -	PY80	9 -	6AT6	8 -	12K8	17 6
ECF82	11 -	PY81	8 6	6AU6	7 -	12Q7	7 6
ECL80	9 -	PY82	8 6	6BE6	8 -	12SC7	7 6
EC52	5 -	PCF80	9 6	6BA6	8 6	12SG7	5 -
EC54	5 -	PCF82	10 -	6BC5	6 6	12SH7	5 -
EC90	6 -	PCC84	10 -	6BH6	7 6	12SJ7	5 -
EF36	6 -	PCC84	11 6	6BR7	8 6	12SK7	5 -
EF37A	10 -	PCL82	10 -	6BS7	8 6	15D2	5 -
EF39	6 -	PEN16	8 6	6BW6	8 6	35L6	9 -
EF41	10 -	P61	5 -	6BX6	8 6	35Z4	8 6
EF42	10 -	PZ30	15 -	6B8	5 -	45	6 6
EF50	5 -	RK34	3 6	6C4	6 -	50	5 -
EF54	7 6	R17	5 -	6F32	5 -	76	5 -
EF55	9 -	SP13C	4 6	6F33	7 6	85A2	9 -
EF80	8 6	SP41	5 -	6C6	5 -	90C1	8 -
EF85	10 6	SP61	5 -	6H6	2 6	807	7 6
EF91	7 6	U301	20 -	6J5	5 -	829	40 -
EF92	5 6	TT11	4 -	6J7	7 6	832	30 -
EF94	7 -	CBC41	10 -	6K7	5 6	954	5 -
EF95	6 6	UF41	10 -	6K8	8 6	955	5 -
EF96	6 6	U8	20 -	6L6	10 -	7193	3 -
EK32	8 6	CL4C	10 -	6N7	7 6	8012	6 6
EK90	8 -	U24	8 -	6P28	20 -	9001	5 -
EL32	6 6	VP13C	4 6	6Q7	8 6	9003	5 -

Post & Packing 6d. Free over £1. C.O.D. 2'6 extra.

LAWRENCE ELECTRONICS

15B, CHIPSTEAD VALLEY ROAD, COULSDON, SURREY. UPlands 9075. Personal callers preferably on Saturdays.



UNDERNEATH THE DIPOLE

TELEVISION PICK-UPS AND REFLECTIONS

By Iconos

IN the earliest days of 2LO, training schemes were held in high esteem by the then managing director of the BBC, Mr. J. C. W. Reith (now Lord Reith); the Controller, Admiral Carpendale, and the Chief Engineer, Capt. P. P. Eckersley. In conjunction with Marconi's, a course was held at Chelmsford in 1923, attended by many young and enthusiastic engineers who are now in the "top brass" of the BBC Engineering Division. Since that time, educational activities have broadened in their scope and training and refresher courses have been extended to cover almost every possible aspect of the broadcasting world, dealing with production and organisation subjects as well as technical.

BBC TV COURSES

TELEVISION has resulted in a further crop of training courses, which have increased in number since the loss of a number of experienced personnel to the I.T.A. programme contractors. These training schemes include special entrance courses for would-be television and film cameramen, assistant producers, editors, film recordists, projectionists and make-up assistants. The courses are held from time to time in accordance with staff shortages in different departments. There are, as might be expected, hundreds of applications for positions in specialist departments with the BBC, quite apart from those which are specifically advertised for in the daily and technical Press. These applications are carefully scrutinised and persons with reasonably promising qualifications are given interviews. Finally, a selected few are given the opportunity of taking a course on the particular job they fancy—with the full knowledge that for some occupations only about 50 per cent. of those taking the course succeed. At the moment, a practical course on make-up is in progress at the BBC-TV Film Studios, Ealing. Under the supervision of Miss Bradnock and Miss Rose, 12 charming girls are being coached in the mysteries of grease paint, foundation creams, eye shadowing, character lining, hair styles and false moustaches. I must say that the group of young ladies that I saw at the Ealing make-up course seemed to be a capable and earnest little class; I hope that every one of them succeeds. The BBC are able to do this kind of thing much better than the feature film world, where the entry of new make-up assistants is severely restricted by the branch of the trade union concerned.

RECORDED TV FEATURES

I HAVE often wondered why so many of the feature series programmes on both BBC and I.T.A. are sent out live instead of being filmed. Practically all the popular weekly American shows, such as *I Love Lucy*, *The Burns and Allen Show*, etc., are filmed and edited, thus achieving the maximum of slickness and timing in the end product. From the edited 35 mm. negative can be struck off prints in 16 mm. or 35 mm. for showing at various times of the day in different parts of the U.S.A. and for exporting abroad. It was the difference in the time between the East and West coasts of America together with the high cost of land line TV networking which brought about the necessity for the use of film and justified the high cost. Export of TV films abroad came along later and opened up an enormous and rapidly expanding market. There is no special necessity for TV filming in Britain, since live networking can be carried out simultaneously to all British transmitters and, if required, to a few Continental ones as well. Nevertheless, both the BBC and the I.T.A. companies would like to increase the amount of filming, to gain a bigger share of the world market in TV films. The cost of film stock, processing and editing, however, is relatively high—adding at least £1,000 to the budget of a half-hour feature, if telerecording is carried out, or more if film in the conventional film studio manner. There are exceptions, of course. *Robin Hood* is one British feature series which has justified the extra costs of filming, but this was initially made for the American market before it appeared on British television. The same applies to the highly successful Douglas Fairbanks films. If the quality of telerecording could be improved and the costs reduced, Britain could put on film a large proportion of live TV features for export. I.T.A. companies are hoping that magnetic telerecording will make this possible.

S.S.W.

IN the meantime, Marconi's have disclosed to the Television Division of the British Kinematograph Society a number of improvements in telerecording included in their newest TV studio equipment. By providing spot-wobble to the scanning of their image orthicon cameras and synchronising it with similar spot-wobble on the receiver tube of the telerecorder, there is an astonishing improvement in quality and definition of the recorded result. It does, in fact, enable 405 lines to achieve the definition of 600 to 800 lines. Synchronised spot-wobble—commonly known amongst Marconi engineers as "S.S.W."—will become a familiar term in the next few months. The paper on the subject, with demonstration films, film clips and slides, was given by Messrs. Jesty and Sarson and was followed by a lengthy but lively discussion in which several leading television engineers took part. If the system could be made compatible with the present British standard, then a tremendous improvement in home reception

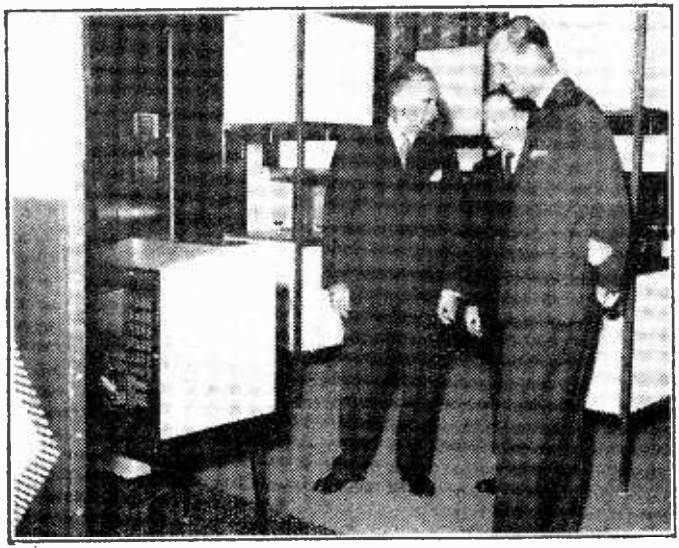
would be possible on receivers fitted with synchronised spot-wobble. However, the immediate objective is to improve telerecording quality on live TV transmissions.

TOP COMICS

THE Charing Cross Road fraternity of music publishers have a traditional appreciation for the circulation figures of their sheet music and the records sold of their published "numbers." They have a special fondness for the "top ten" returns in one of the musical weekly papers of the current popular songs. A "pop" number arrives, catches on, is whistled by errand-boys, and duly registers higher and higher on the "top ten" list—until it falls, like a spent rocket, right off the list. The life of a popular song number is almost as ephemeral as the mayfly. If it wasn't for the script writers, the TV lives of the comics would be equally short. However talented a comedian is, he must rely to a large extent on the material supplied to him. Forging to the front at the moment are Tony Hancock, Arthur Haynes and Flanagan and Allen, with Harry Secombe maintaining his position, while several comics who were in the top ten a year ago have now disappeared from the list. *Hancock's Half Hour* scored heavily with the episode which had a repertory theatre as its setting, and Tony Hancock, Warren Mitchell, Hattie Jaques and Kenneth Williams all made the best of a hilarious script, excellently produced by Duncan Wood.

"REQUIEM FOR A HEAVYWEIGHT"

THE versatile Warren Mitchell, appearing lately in so many TV revues and goon shows, was also seen recently in a dramatic role in *Requiem for a Heavyweight* on BBC-TV, in which he played the part of the seedy trainer of a heavyweight who had passed his prime.



H.R.H. Prince Philip inspecting one of the 12 products which received an award for outstanding design at the Design Centre. It is the CS17 Television receiver in Japanese sen veneer made by Pye, Ltd.

He turned in a first-rate character performance. "Mountain" McClintock, the heavyweight with a simple soul, was most movingly portrayed by Sean Connery, a young actor new to me. The story of the ageing boxer who was too ashamed to become a stooge in faked wrestling matches, but whose inarticulateness and lack of education fitted him for little else, was well told in a taut script by the American TV playwright, Rod Sterling. Other players who did well in this excellent play were George Margo, as the boxer's manager, and Jacqueline Hill as a girl at an employment bureau. Alvin Rakoff was the producer.

T.W.W.

I WAS not at all surprised to hear the "Television Wales and West" announcement of a link-up with the Granada Television Network. Up to now, the tendency has been for the provincial programme contractors to take a high proportion of network programmes from A-TV and AR-TV in London. The idea of mutual exchanges of programme between provincial stations has achieved quite a measure of success in America, as a variation of the conventional networking from New York City. There is no reason why the policy should not succeed here, especially as regards the types of material most likely to succeed in the lighter programmes. The major part in the tie-up will be taken by Granada, whose excellent facilities in Manchester are likely to expand rapidly. In my report of a visit to Granada's TV Centre, Manchester, a few months ago, I remarked upon the space available for expansion. Another provincial expansion of studio space will be in Glasgow, where the BBC have taken over the Black Cat Cinema in Springfield Road and are now converting it into a TV studio.

TOIL AND TROUBLE!

"DOUBLE bubble toil and trouble!" said an I.T.V. production executive to me. "That describes the daily grind required to turn out six or seven hours of live programmes per week." I sympathised with him in a suitable manner, but he was not listening. His eyes glinted—a new idea for a TV feature had just occurred to him: maybe it was something to do with the opening scenes with the witches in Shakespeare's *Macbeth*.

I waited patiently while the brain-child was born, wondering whether the words "double bubble" merely referred to overtime payments. I was never to know; for he returned to earth without referring to either witches or cauldrons, and continued to describe the trials and tribulations which have to be overcome in producing elaborate I.T.V. plays under severely restricted facilities, with budgeting, casting, readings, art and wardrobe treatment, preliminary and final camera rehearsals all rushed through at a breathless rate. It was hard work all right—but I could see from his expression that he was enjoying it, nevertheless.

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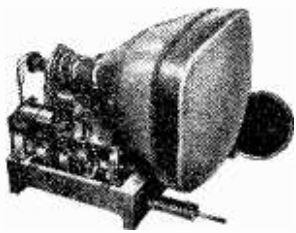

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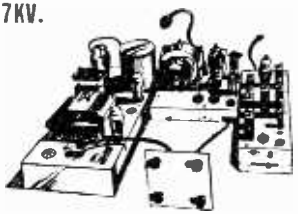

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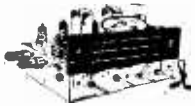

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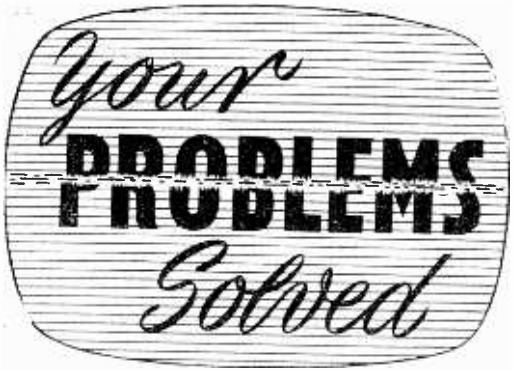

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 595 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

LV/30, C.F. PYE

I cannot seem to focus the picture very well.

Only by decreasing the size of the picture can I get it reasonably sharp. The raster is only visible by turning the gain on contrast control towards minimum, but by doing this the picture diminishes also.

I have tried the focus magnet in different positions, but this does not help.

The sound seems to be a little distorted, but whether there is any relationship between these two faults I don't know.—B. A. Gale (Ipswich).

Since you do not mention the effect of the brilliance control, we would advise you try the effect of this. It is at the rear of the chassis.

If upon advancing this the picture becomes larger and more blurred until it fails completely, you should replace the EY51 EHT rectifier.

If, however, upon inspection of this, when the set is working, the heater is very dim, first have the PL38 and P230 valves tested.

Also have the sound A.F. and output ECL80 valve tested and if these are good, check the resistors associated with the sound noise limiter EB91.

FERGUSON 992T

When the set is switched on no picture appears at all for about 10 minutes, and when it does appear it is elongated and badly out of focus, with white blurred lines running across the screen. At this stage the brilliance control is ineffective, and when the contrast is turned up the picture fades out entirely, returning if the contrast is reduced.

After about 15 minutes in this condition the picture suddenly shrinks to normal size and comes into clear focus, although sometimes the white lines, now thin and sharp, are visible.

After about another 10 minutes the trouble begins again, and then clears, and so on all the time the set is switched on. Occasionally the picture fades out entirely for a minute or so.

The bad condition appears to worsen after two or three hours until the picture does not appear clear at all. —Peter W. Reid (Leeds).

We would advise you to rewire the tube base socket as follows. Remove any connection from pin No. 7, pins being counted clockwise from locating slot, spaces being counted if pins are not actually fitted. Remove lead from pin 10 and connect to pin 7 or leave unconnected. Remove lead from pin 2 and solder to pin 10. Place a short length of lead from pin 2 across to pin 11. The set will now have to be operated at an increased brilliance level and the ion trap magnet on the rear of the tube neck should be readjusted to obtain maximum brilliance.

FERGUSON 941T

Just recently I have suffered with uncontrollable brilliance. I checked through the circuit and could find nothing to indicate a fault. About 2 hours after I lost picture, raster, everything. I checked EHT and found none. The line oscillator still appeared to oscillate but not as well as it used. I assumed that the EHT section of the line transformer had burned out. I checked the impedance and it was a dead short instead of 400Ω, the specified figure. Would you agree with my assumption ? If this is the case can you advise me of a suitable transformer to replace the line transformer, where it can be obtained from and as to the price, though this is not a necessity as I expect they would send it C.O.D.—H. Leeves (Hants).

Short-circuited turns in the line output transformer are almost certainly responsible for the eventual lack of EHT, but the former symptom mentioned is probably caused by an inter-electrode short in the picture tube.

The correct replacement transformer should be obtained from T.E.I. Service, 141-145, Kentish Town Road, London, N.W.5.

MARCONI VT69DA

Can you advise me if I can use a Mullard C.R.T. MW43.64 as a substitute for the present C.R.T. which is an Emitron 4, 15 G, and modifications if any ?—D. C. Hughes (London, W.).

The circuit cannot easily be adapted to cater for the Mullard tube mentioned in your letter.

FREQUENCY OF INTERFERENCE

What is the average frequency range of the majority of car ignition TV interference, and what diameter coil, number of turns and associated capacity would respond to that range of frequencies only ?

Why cannot car ignition interference be effectively filtered out of the TV signal component altogether ?

What is the resistance of the usual car ignition suppressor and what is the technical explanation of its effectiveness in implementing suppression of the interference ?—E. F. Stiles (Notts).

Impulsive interference of the kind mentioned is of a transient nature and is thus composed of components occurring at all frequencies from very low ones determined by the repetition frequency of the spark to very high ones depending upon the shape of the current waveform due to the discharge. A filter of the tuned variety cannot be used to alleviate the effect, of course, and further, on receipt by the receiver of the interference along with the signal, the tuned circuits are promoted to " ring " or oscillate at their resonant frequencies and since this is the frequency to which the receiver is tuned the interference effects cannot be tuned out.

Resistances in the region of 100 K ohms in the ignition system tend to limit the large build-up of interference currents and thus modifies the current waveform and alleviates radiation.

INVICTA T120 TV

The frame hold control is almost at the maximum left hand (anti-clock) position, and I am often troubled with intermittent frame slip during which I find the top five or so flyback lines are visible. I have tried replacing the frame O/P valve, this improves the position of the frame hold control, but does not cure the fault.

May I say that I have tested the frame blocking osc. transformer and that this is O.K.

If you could advise on improving the frame lock I should be most grateful.—E. Gotterson (Hickling).

Replace the 560k resistor which is connected to the slider of the frame hold control. Check, by substitution, the ECL80 valve which is situated in the right-hand corner of the timebase chassis. Check, and replace if necessary, the Type M3 and Type WX6 rectifiers which are incorporated in the frame synchronising network.

H.M.V. 1829A

The picture has become so weak that it is almost invisible by daylight. Sometimes picture is well defined, but often not so good, and is inclined to roll up or down, being difficult to lock. EHT is well up. Line output valve has been replaced: sound perfect. There is no heater-to-cathode short in picture tube, at any rate not when set is switched off.—R. Clements (Norwich).

The trouble would apparently be due to a failing tube aggravated by weak synchronisation. In the first place, check the voltage selector panel at the rear to see that the arrangement is correctly set to agree with the actual applied mains voltage. Also make a general check on the Z152 valves. If you feel that ample contrast is in hand, check the small frame interlacing diode (metal rectifier), connected from the anode of the Z152 sync separator to the anode of the LN152 (triode section) frame oscillator and output valve.

If you require further information please let us have details of the operation of the contrast-sensitivity, brilliance and limiter controls: their effect upon the picture, etc.

If lack of sensitivity seems to be the main fault, check the tuner unit valves, especially the PCC84.

BAIRD T163

I wish to replace a cathode ray tube for a Baird T163 set. The original tube was a G.E.C. 6503, and later replaced with a G.E.C. 6505A. As I intend to get a reclaimed tube can I use any other make and number, or must I have either of the G.E.C. numbers only? I do not wish to make any modification to the set.—H. Payne (Perivale).

There is no direct equivalent tube which can be used in your receiver. Whatever other C.R.T. you may wish to employ will entail some alteration to the receiver.

BUSH T24

This is not a constant fault, it happens perhaps three or four times a week, or it could occur twice in the course of one evening's viewing. The picture slips in the vertical plane, sometimes rolling slowly, sometimes very quickly. At one time I could stop it by turning the vertical hold a little more anti-clockwise which would lock the picture, but this control no longer stops the slipping: it now just seems to go on rolling for about one or two minutes and then stops of its own accord.

Can you suggest a possible cause and a remedy? I have the circuit diagram and service instructions for above set, but no instruments.—Eric Burkett (Manchester).

If the control is at one end of its travel, replace the resistor in series with it, which has probably changed in value.

If this does not effect a cure change the ECL80 (left side as viewed from rear) frame oscillator output valve.

It is possible that the interlace Westector WX6 rectifier may be defective.

DEFIANT TR1250

Could you let me have the precise instructions for fitting the C.R.T. to my receiver, which is a Defiant (Regentone) TR1250 TM? Present C.R.T. is a CRM121 with two volts heating.—G. Corbett (Tadcaster).

To remove the C.R.T., first remove the rear cover, pull off the control knobs at the front and unscrew the chassis fixing screws from beneath the cabinet.

Remove the base socket from the tube, the scanning coils connecting plug from the top of the chassis and remove chassis completely.

Lay cabinet forward on its face, remove the four fixing screws from the batten which supports the focus magnet and remove the batten complete with magnet and scanning coils.

Release springs which secure the tube bulb retaining strap and lift out. When new tube has been placed in position, remember to replace the piece of plastic between the tube bulb and the scanning coils.

A CRM121B or CRM123 is a suitable replacement.

ULTRA V80W

I would like to know the values of the potentiometer and associated resistors of the brightness network.

There is a fault on the set. The picture is dark after a short while and on turning up brightness the tube becomes much too bright. If the brightness is now turned down it is too dark. I suspect that on turning up brightness an intermittent short occurs between first anode and grid. Would you please give me your opinion?—David Hopkins (Maesteg).

We do not suspect the tube to be at fault at all. There is no possibility of a first anode to grid short since there is no "first anode" in the tube in the sense you mean it. The tube is a triode.

We would advise you to check the brightness control itself.

This has a value of 50 KΩ and a 3.9 KΩ resistor is wired from one end to the H.T. line.

PHILLIPS 485U

I should like to mention that the set is now six years old with still the original tube, but I do not think the fault is due to the tube. The fault is "top of picture bent to left," and also this portion wobbles very badly. I have checked this sympton with your "Fault

(*Continued on page* 595)

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(Continued on page 594)

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PAD 5607

Symptoms," issue April, 1954, and have replaced sync sep. valve with no success. Also, I have noticed that during two or three hours' run I slowly lose focus until I hardly get a clear focus at the end of the evening. Would this be due to tube failing or E.H.T?—G. Lee (Northfleet).

We would advise you to check the 5 μF and 50 μF capacitors (electrolytic) associated with the video amplifier/detector UF42 mounted on the rear left side of the chassis.

Also check the UCH42 on the right side beneath the tube.

The cause of bent verticals is usually a fault in the video or sync stages, but if the hold control is at one end of its travel, it may well be that its series resistor requires replacement.

Gradually worsening focus is usually due to a failing UL41 sound output valve. The A.F. output circuit is in series (H.T. that is) with part of the focus coil.

FERGUSON 991T

Until a few months ago I was able to get a sharp picture by using the focus control knob near the tube base. Now, with the knob turned as far as it will go, the picture is diffused and out of focus.

Can you tell me if there is anything I can do to remedy this fault and enable me to get a sharp picture again?

I have the articles published in "Practical Television" on servicing the Ferguson 991T, but this particular fault is not mentioned.—J. S. Garner (Harrogate).

It will be necessary to make a few simple tests in order to ascertain the cause of the loss of focus. Quite often the EY51 EHT rectifier is responsible and in this case operation of the brilliance control will prove whether the valve is at fault. If upon advancing this, the focus becomes worse and the picture "blows out" before finally fading altogether, it is quite safe to assume the EY51 to be at fault.

If, however, the images just become more blurred and tend to turn negative, it may be assumed that the tube is at fault.

If no definite results are obtained, we would advise you to have the valves PY82, PL81 and PY81 tested.

MURPHY V204C

The set was up to a certain time working perfectly and giving a good picture, it was then switched off for an hour or so, and then I switched on. I received sound but no picture. I am unable to get EHT at anode of tube.

I cannot see how I can remove chassis so as to test out components.—H. Young (Neath).

To remove the V204C chassis, remove both backs, slacken off control panel (two nuts), lift and withdraw. Detach tube base and EHT cap and unplug focus and scan connecting plug. Disengage the two retaining plates from the two dowels at the bottom of the chassis, slacken two ¼in. chassis fixing nuts at rear of chassis and withdraw chassis.

It is normally not necessary to remove the chassis for service. Merely slacken off the two fixing nuts at the rear, lift the chassis out a little and swing it up or down as required on the front dowels.

A common cause of your failure is the U25 valve mounted on top of the line output transformer can. If this is so a spark can be drawn off the anode by an insulated screwdriver, but not from the cathode.

ENGLISH ELECTRIC 1650

When I use the brilliance and contrast adjustments the picture becomes large and out of focus. The same thing happens on its own. When viewing it occasionally goes out of focus on its own.

Could you supply me with a service and fault-finding book for my set and Rotomatic Tuner, C.O.D.?—C. Hewson (Birkenhead).

The symptoms are those of a failing SU25 EHT rectifier. This valve is mounted in the left side perforated screening box. The associated 185BT could be at fault if the SU25 proves good. If you find that a Cossor SU25 is difficult to obtain, a Mazda U24 may be used although this is a much smaller valve. We are unable to supply circuit diagrams or manuals. These are regularly advertised in PRACTICAL TELEVISION by various advertisers.

PYE BV.30/P

I have purchased a 9in. Pye tuned to the Sutton Coldfield station. Could you please advise me of the alterations to the set to enable same to be retuned to the London station.—A. Chesnell (Leyton).

There is no easy way of retuning this receiver since it is of the T.R.F. type, thus all coils must be altered. It will be necessary to add some three turns to each of the sound and vision R.F. coils, the slugs then being retuned individually. A signal generator, to enable each stage to be separately adjusted, is virtually a necessity and if you do not possess one of these instruments you would be well advised to borrow one if this is at all possible. Exact instructions cannot be supplied since these would be of such an extensive nature as to render them impossible to include in a reply of this nature.

MURPHY V180C

Two pictures appear side by side. Adjustment of the horizontal hold control will make the line run at half and twice normal speed, but will not correct above defect. (I have substituted EL38 line output valve with little effect). Distortion of sound.—D. J. Heasman (Horley).

The trouble almost certainly lies somewhere in proximity to the 6K25 line timebase oscillator circuit. First check the condition of the valve, preferably by substitution. If this appears to be in good order, investigate the components associated with the anode and control grid circuits of this valve. In particular, pay special attention to the capacitor and fixed resistor associated with the line hold control. Also ensure that the line hold control potentiometer possesses continuity over the whole of its track.

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