Practical TELEVISION

JULY 1961

1/6

A Nuvistor Band III Pre-amplifier

EQUALISING BBC AND ITV

A BASIC TV OSCILLOSCOPE

USING COAXIAL STUBS

Practical Television

AND TELEVISION TIMES

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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 the 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, London, W.C.2.

Owing to the rapid progress in the design of radio and television 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.

Colour TV and Line Standards Discussed at Scottish Conference

REPRESENTATIVES in many fields of the radio and television industry attended the Scottish Radio Congress, which was held recently at Rothesay, Isle of Bute. It is interesting to note that, although the meeting consisted of many short addresses on subjects affecting all sides of the industry, the main theme of most of the speeches was the television line and colour controversy.

Once again this important subject has been a major topic for discussion at a meeting dealing with radio and television, as it has done at so many recent conferences of similar nature. At this congress, however, several speakers emphasised the confusing and unsettling effects which this controversy has had on the public, rather than pointing out difficulties and complications involved in providing either colour or 625 line TV in this country; most of which everyone already knows.

The opinion of J. M. Weir, president of the Congress, and of many other speakers, was that repeated reference to these two problems, in the National Press and elsewhere, has confused so many people that sales of television receivers had suffered.

S. E. Allchurch, director of B.R.E.M.A., was of the opinion that a quick decision in this matter is called for if the industry is to benefit from these possible changes. Mr. Allchurch considered that the public were naturally more interested in colour than in line definition.

At this point it is interesting to note the views of the Brit. I.R.E. on the subject of colour and line standards, which it made in a memorandum submitted to the Pilkington Committee. The Institute would favour a final decision on the line system to be adopted in this country, before any actions are taken to provide colour TV transmissions.

CONTRIBUTIONS

THOSE of our readers who wish to submit articles should send them direct to the Editor at the address given on this page. Manuscripts should be typewritten with double spacing although legible hand-written articles are also acceptable. Articles should be between 1,000 and 2,000 words in length, be written on one side of the paper only, and deal with the home construction of equipment to do with television. We do not require articles of a theoretical nature unless these are written expressly for the amateur constructor. Clear drawings of the apparatus should be included with the article and need only be sufficient for our draughtsmen to prepare suitable illustrations. We also like to include with articles photographic illustrations. Large clear prints, or preferably negatives, should be sent if possible but we are prepared to take the necessary photographs ourselves if the apparatus can be sent to us for inspection. An illustrated article is always of more appeal as the methods of construction are shown more clearly.

Our next issue, dated August, 1961, will be published on July 21st.

Telenews

Television Receiving Licences

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

Region	Total
London Postal	1,918,464
Home Counties	1,567,863
Midland	1,699,136
North Eastern	1,827,182
North Western	1,484,504
South Western	961,083
Wales and Border Counties	683,709
Total England and Wales	10,141,941
Scotland	1,015,144
Northern Ireland	163,428
Grand Total	11,320,513

Electronic Guns from new Irish Factory

A MODERN new factory manufacturing American-designed magnetic and electrostatic electronic guns, for television cathode ray tubes, has gone into production at Bray, County Wicklow, on the east coast of Eire. It is the only one of its type in the country and aims at supplying a wide range of markets in the United Kingdom, Europe and the British Commonwealth.

Griffiths Electronic Guns, Ltd., Ireland, is the newest of the Sam Carpenter Group of Companies, which has its headquarters in Birmingham.

Initial production capacity is at the rate of 10,000 guns per week, but swift expansion is contemplated to meet the demand anticipated from the Continent, Scandinavia and a number of Commonwealth countries. Sample orders have already been despatched to West Germany, Belgium, Italy and Denmark and many other overseas inquiries are receiving attention.

O.B. Unit Drives to Moscow

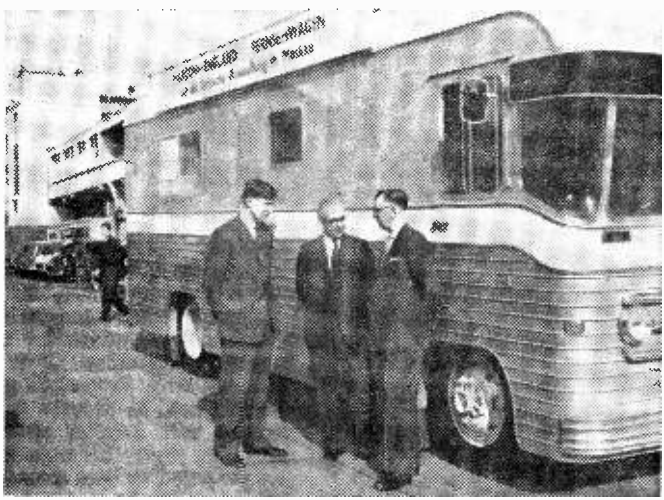
A TELEVISION outside broadcast vehicle recently travelled across Europe to the Russian border to join a convoy making its way to the British Trade Fair in Moscow, which was held from May 19th to June 4th. The O.B. unit started out from the Chelmsford works of the Marconi company on April 26th on its 1,750-mile journey to Moscow's Sokolniki Park.

Post Office Links to New Television Stations

WHEN the Independent Television service was extended to the South West of England, in April, five new Post Office vision links came into operation.

The first link connects London and Bristol by coaxial cable, and the second connects Bristol and Plymouth by line-of-sight radio link. Two shorter links, using line-of-sight radio transmission, connect Plymouth with the new ITA broadcasting stations at Stockland Hill in Devon, and Caradon Hill in Cornwall. Finally, the studios of the programme company, "Westward Television Ltd.", are connected by coaxial cable to the national television network at Plymouth.

The radio equipment used on these links operates on frequencies of about 4,000Mc/s. Each radio link is provided with protection equipment which will be automatically switched into service in the event of a breakdown.



This television outside broadcast vehicle recently travelled across Europe to the Russian border to join a convoy making its way to the British Trade Fair in Moscow. The O.B. unit started out from the Chelmsford works of the Marconi company on April 26th on its 1,750-mile journey to Moscow's Sokolniki Park, and arrived on Saturday, May 6th.

At each end of the main radio link, vision signals are extended distances of approximately four miles from the radio terminals into the Post Office television centres in Bristol and Plymouth by means of coaxial cables equipped for unbalanced vision transmission.

625-Line TV from Crystal Palace

THE British Broadcasting Corporation plans to transmit further experimental television pictures from the Crystal Palace station on the 625-line standard in Band V. These transmissions will include colour pictures.

For this purpose, the Corporation has placed an order with EMI Electronics Ltd. for carrying out the necessary modifications to the ten kilowatt ultra high frequency transmitter which was used at Crystal Palace for the BBC's experimental 405-line and 625-line monochrome transmissions in Band V during 1957 and 1958.

Queen Mother at Aldermary House Ceremony

WHEN the Queen Mother laid the foundation stone of the British Insurance Association's new building, Aldermary House, on May 4th, closed-circuit television, installed and operated by Rank Precision Industries Ltd., enabled more than 500 guests at the Guildhall a mile away to watch the ceremony.

Fourteen 21in. Bush television receivers were installed in the Guildhall to ensure optimum viewing conditions for all the guests. Special lines were provided by the G.P.O. to relay picture and sound from the television cameras and microphones covering the ceremony at Aldermary House.

Colour TV Display System

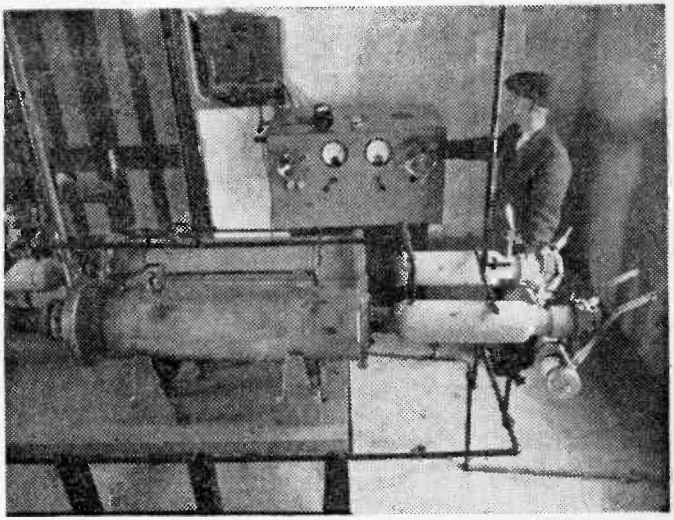
SCIENTISTS of the Mullard Research Laboratories presented a series of papers on a novel colour television display system, at a meeting of the Electronics and Communication Section of the Institution of Electrical Engineers on May 15th. The display system has been given the code name "Banana", because of the shape of the cathode ray tube.

The inventor of the Banana Tube system, Dr. P. Schagen, set out some years ago to overcome the major disadvantages of present display devices. Some success has been achieved, but the system has fundamental drawbacks of its own. The meeting on the 15th was a scientific meeting and in no way an announcement of a new product.

The advantages of the Banana Tube system are:—a relatively cheap and simple cathode ray tube, high picture contrast, and shallow cabinet.

Its disadvantages are a narrow viewing angle and the incorporation of optical and moving parts.

The authors emphasise, in their papers, that the system in the form that it is demonstrated, is not a practical proposition for a domestic receiver.



In this furnace at the new Griffiths Electronic Guns, Ltd. factory in Eire, all the stainless steel parts of the electronic guns are hydrogen fired.

Acquisition of TV and Radio Firm

AN announcement by Thorn Electrical Industries Ltd. states that they have acquired from Ultra (Holdings) Ltd. the entire share capital of Ultra Radio and Television Ltd. and Pilot Radio and Television Ltd. and their subsidiaries. The transaction is for cash and includes Ultra's factory at Gosport and other premises at Ruislip, Eastcote and Park Royal.

It is intended to preserve the separate identities of Ultra and Pilot as working and marketing units, and the management will remain substantially unchanged. This acquisition of Ultra and Pilot by the Thorn Group further consolidates their position as the largest group in the industry.

Queen's Portrait on Colour TV at Moscow Fair

COLOUR television was the highlight of EMI Electronics Ltd's display at the British Trade Fair recently held in Moscow.

A colour TV camera housed in a special viewing room on the Company's stand—C8—showed a varied programme, including a portrait of the Queen in the Robes of the Order of the Bath, Yuri Gagarin the Russian astronaut, and a working display of electric model trains set in a typical British countryside scene.

Monochrome TV equipment on show included 4½in. Image Orthicon cameras in an EMI Outside Broadcast Vehicle sited on an outside stand. This is the first time that an EMI O.B. unit has been sent to the U.S.S.R.

The EMI television cameras also televised a special Russian language film showing some of the varied uses for which EMIDEC computers are being supplied to leading British Industrial organisations.

Equalising BBC and ITV

By G. J. King

WHEN switching from a BBC programme to an ITA programme, it is necessary in many areas to increase the setting of the contrast or sensitivity control in order to obtain a Band III picture of the same contrast as the Band I picture. There are several reasons for this. One is that most sets have a greater sensitivity on Band I channels than they have on Band III channels, for it usually follows that the sensitivity of a receiver falls slightly with increase in frequency.

Another reason is that the Band III sensitivity of early multi-channel sets is usually three to five times below the Band I sensitivity. This may not necessarily mean that the Band III signal has to be three to five times greater than Band I signal to provide comparable pictures. Provided the aerial signal of the Band III transmission is relatively high (in the region of 500μV) and the receiver features vision AGC, then it really does not matter if the Band I signal is two or three times higher than this, for the receiver's AGC system will iron-out the difference and balance the pictures.

Problems arise, however, when the Band III signal is below about 500μV, for, then, when the set is switched from BBC to ITA, a distinct deterioration in picture brightness, and possibly quality, is seen. In some cases the ITA picture is covered with grain due to first stage valve and frequency changer noise.

Various Factors

There are other various factors which contribute to the unbalance of the two signals. One is the greater fall-off in local Band III signal strength with distance, as compared with Band I. Moreover, there may not be a "local" Band III station and, whilst the local BBC station may provide a millivolt or so of aerial signal, the distant ITA station may give only a few microvolts. These

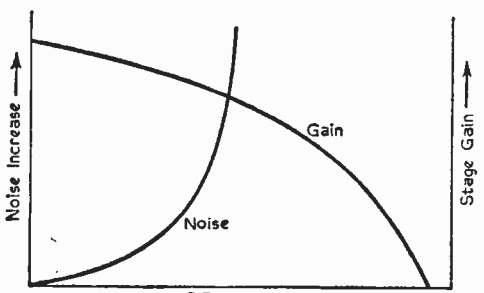


Fig. 1.—Noise from the R.F. valve rises steeply with increase in bias, while the stage gain follows a gentle decline, as illustrated by the two curves above.

factors can only be equalised adequately by the use of a high-gain Band III aerial system. As it would be wrong to reduce the signal strength and quality of the Band I picture to equal a relatively poor Band III picture, the first move under these conditions, therefore, should be to try and improve the ITA reception. When this is accomplished, then the BBC picture can be equalised to give a better match to the ITA picture.

Aerial Signal Balance

With co-sited BBC and ITA transmitters of approximately equal effective radiated power, the signal pick-up on a Band III four-to-six element aerial is approximately equal to the signal pick-up on a Band I two-to-three element aerial within the service area of the stations. Outside the service area, conditions may alter—local screening may affect the ITA signal more than the BBC signal—and a double-six or a twelve element array may be required on Band III and a three or four element on Band I.

Feeder loss is also important. With an average run of, say, 50ft of good quality cable, a loss of something like 1dB may be introduced on Band I, but this will rise to 2dB on Band III, owing to the higher frequency. Although 2dB may not sound very much, in a weak signal area, it could make the difference between a poor picture and a reasonable picture. Assuming equal aerial signals and a common downlead, 2dB would mean that, at the set, the Band III signal is approximately 13per cent below the Band I signal.

If a combined aerial results in severe unbalance between the two signals, it would be desirable to employ a separate high-gain aerial for Band III. This aerial should be mounted as high as possible and carefully orientated for maximum signal pick-up. By the use of such an array with low-loss feeder an extra 6dB of signal can invariably be secured.

In shielded areas, where standing-waves are troublesome, the labour of probing for the best signal is often well rewarded. There remains the difficulty of finding somewhere to secure the aerial after the best pick-up position has been established. The chimney stack is not always the best site now that it is called upon to support so many arrays. Proximity effects between the aerials often detract from the pick-up efficiency, and this is one of the reasons why R.F. television relay systems are becoming so popular.

Improving Band III at the set

It can thus be seen that signal equalisation should start first at the aerial system by giving due attention to the aerial and its positioning, to the downlead and also to the diplexer or triplexer which may be used to combine the signals to a common lead for connecting to the receiver.

When all possible has been done to improve the Band III aerial signal, and the ITA picture is still poor, some improvement is possible at the receiver. Most multi-channel sets employ AGC on the R.F. cascode valve in the tuner. This is usually fed to the tuner on a green lead from the receiver's AGC line, and even on a very weak signal some bias is produced which decreases the R.F. gain. This is of no consequence so far as the I.F. stages are concerned, since these are working at a fairly high signal level, but on the R.F. stage, even a very small bias tends to impair its noise factor, and give rise to gain on the picture. This effect is shown in Fig. 1. It will be seen that the noise rises steeply

Fig. 2.—The circuit of a Band I equaliser. (Coil L may be tuned by a dust-core.)

with increase in bias while the stage gain follows a gentle decline. As a normal standing bias is provided on the cascode R.F. stage by its cathode resistor, the bias produced by the AGC can be removed without causing any damage, but with a considerable improvement in performance. The AGC wire to the tuner should simply be disconnected and the vacated tag connected direct to chassis. The AGC feed wire itself should either be removed or well insulated so as to avoid shorting to other parts of the set.

It should be noted, however, that on some sets a delay is given to the bias on the R.F. valve, so that a bias is not produced until the aerial signal reaches a certain pre-determined value. On sets of this nature the alteration detailed above would not assist as much as on sets with no delay.

The need for R.F. stage AGC arises when the aerial signal is very strong. It removes overloading troubles which cause sound-on-vision and vision-on-sound. Should it be found that overloading of this kind occurs after removing the R.F. AGC bias—this would, of course, occur only on Band I —the process of Band I equalisation, described later in this article, would eliminate it.

Tuner adjustments

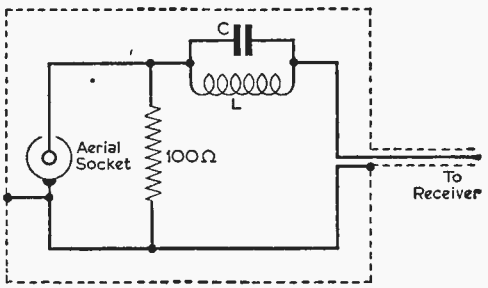
Further improvement in the performance on Band III is often possible by adjusting the core in the output transformer of the tuner unit or turret in the set. The Band III picture and sound should first be tuned in by the fine tuning control for the best possible picture, and then the tuner I.F. core should be very carefully adjusted to improve the picture. It will be found that a compromise will be necessary to maintain sound and vision balance on the channel. Nevertheless, a worthwhile improvement is often possible, which will have virtually no effect on the stronger BBC signal.

Fig. 3.—The response curve given by the equaliser in Fig. 2.

In modern receivers, the sensitivity difference between the two bands has been reduced by circuit improvements and by the use of frame-grid valves, which provide in the region of a 5dB gain increase and a 2dB reduction in noise over the older type of tuner valves. It should be clearly noted, however, that this improvement is not possible simply by replacing the old type of valves with frame-grid specimens. In addition to valve changes, alteration to the circuit of the tuner is usually required.

Signal Balancing at the set

Where the set features separate aerial sockets for the Band I and Band III aerials, it is simply necessary to interpose a line-type attenuator between the Band I downlead and the Band I aerial socket. There are also variable attenuators which can be



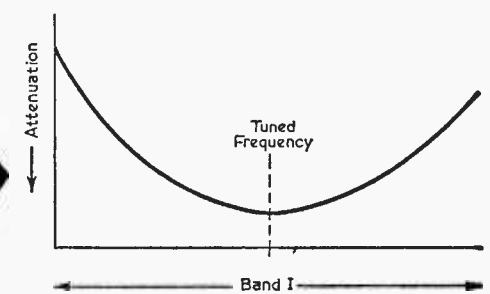
adjusted to provide the correct degree of balance.

If the installation uses a diplexer near to the set, then, again, the Band I signal, as applied to the diplexer, can be suitably attenuated. If a combined aerial is in use or if the diplexer is mounted close to the aerial, which in both cases demand the use of a common downlead carrying both signals, some other means is usually necessary to produce the requisite signal balance.

One way is to use a low-Q rejector circuit after the style of that shown in Fig. 2. Here L and C are arranged to resonate in Band I, and the core adjustment of L should allow the circuit to tune over the whole of Band I. This will produce a response curve as shown in Fig. 3 with sides which do not rise very sharply.

Variable attenuation

When the circuit is adjusted to tune to the frequency corresponding to the local Band I channel, the signal passed from the downlead to the set is very heavily attenuated, and only in districts very close to a powerful station would such great attenuation be required. However, when the circuit is tuned either side of resonance, the whole



response curve is shifted in relation to the Band I frequency and the signal then falls on the sloping side of the curve, which corresponds to a smaller value of attenuation.

(Continued on page 504)

A Capacitance-Resistance Bridge

THIS INSTRUMENT WORKS WITH THE AID OF AN AUDIO OSCILLATOR AND AN AMPLIFIER

By G. L. Kermez

A VERY simple way to measure an unknown resistor is to use a Wheatstone bridge, and compare the unknown resistor with a standard. The basic arrangement, which will be familiar to many, is the use of a metre bridge, i.e. a metre of resistance wire mounted on a scale, a sensitive centre-zero galvanometer, and a battery of small voltage, as shown in Fig. 1.

Let R1 be the unknown resistance, R2 the known standard, and point Z on the wire at which no deflection is obtained on the galvanometer, then as the resistance of wire is proportional to the length,

$$\frac{R1}{R2} = \frac{L1}{L2}$$

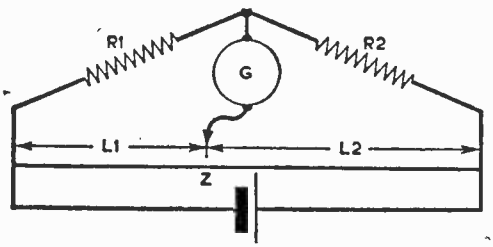


Fig. 1.—The basis of this instrument is the well-known metre bridge.

From this, the value of R1 can be found. In a similar bridge for capacitors, called the De Sauty bridge, R1 and R2 can be substituted for the unknown and known capacitors respectively, then again at balance point—

$$\frac{C1}{C2} = \frac{L1}{L2}$$

—if an A.C. source is used instead of the battery.

Hence, given the instruments, standards, and patience, any capacitor or resistor can be measured. The accurate manipulation of a metre bridge is both laborious and difficult, so a 10k wire-wound linear potentiometer is used as the bridge wire, an audio tone as the battery and any reasonable amplifier as the zero point detector. A 6-way, 2-pole switch is used to bring into the network different standards, so that the complete instrument measures from 1·0Ω to 10M to 1per cent accuracy, and from 10pF to 10μF, to within 2per cent approximately. Moreover, a useful indication can be obtained from 0·01 to 100 times the value of the standard for each range. Provision is also made for matching two resistors, capacitors, or even coils, by substituting a 2-pin socket for a capacitance standard. The full circuit is shown in Fig. 2.

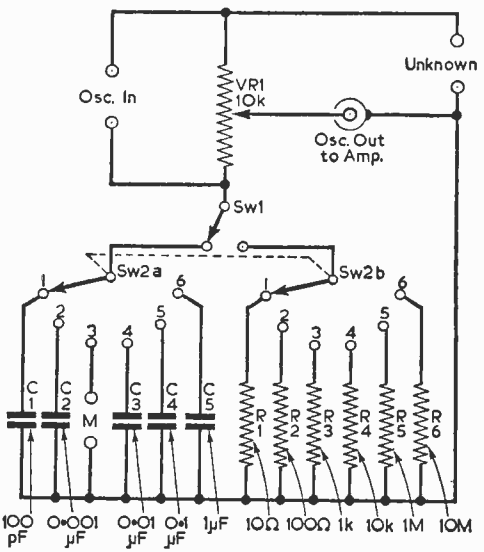


Fig. 2.—The complete circuit diagram.

The audio oscillator, working at about 500c/s, can be any good quality instrument, the phase shift oscillator as described in the June 1960 issue of PRACTICAL WIRELESS being very suitable. As far as the amplifier is concerned, any reasonable 2-valver will give perfect results, because hi-fi response is

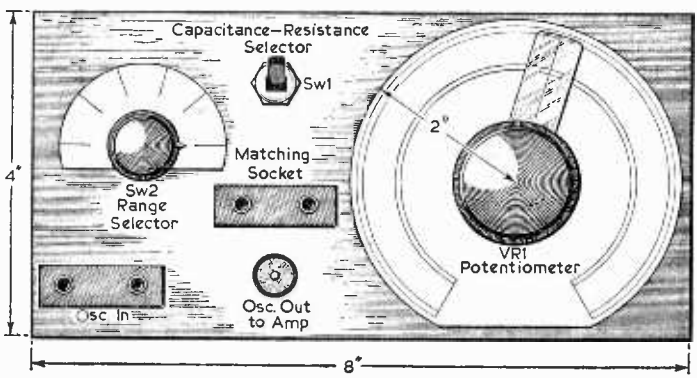


Fig. 3.—The layout of controls on the front panel.

not required, and even a little ripple on the H.T. line can be ignored. If the oscillator is to be built, it could be made an integral part of the bridge, hence making the whole self-contained.

Construction

All controls and input-output sockets, except the screw terminals for the unknown input, are grouped on a front panel 8in. x 4in. made of ⅛in. ply, as shown in Fig. 3. This is then built into any convenient box, either with, or without, the oscillator. The original box shape was as shown in Fig. 4, the front panel being glued to a base 8in. x 4in. of ½in. wood, and the sides, of ½in. ply, being cut to give a rake of 30° to the front so as to make it easier to read the dials when used at bench level.

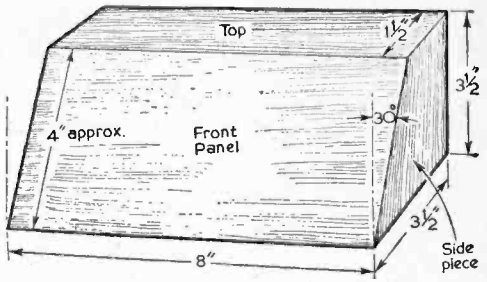


Fig. 4.—The dimensions of the cabinet.

The "unknown" input terminals are mounted at the top of the box, which is covered with Rexine or painted a suitable colour. The potentiometer and range switch dials are cut from white card, and can be of any shape or size, to suit the knobs in use. The dial knob for the potentiometer should be of 1½in. x 2in. diameter variety and have a hairline fitted; if one cannot be bought, it is an easy matter to stick a strip of $\frac{1}{16}$in. Perspex, on which a straight line has been scored, on the back of the knob. Careful use of black and red Indian inks can make the dials very impressive and, perhaps more important, easy to read.

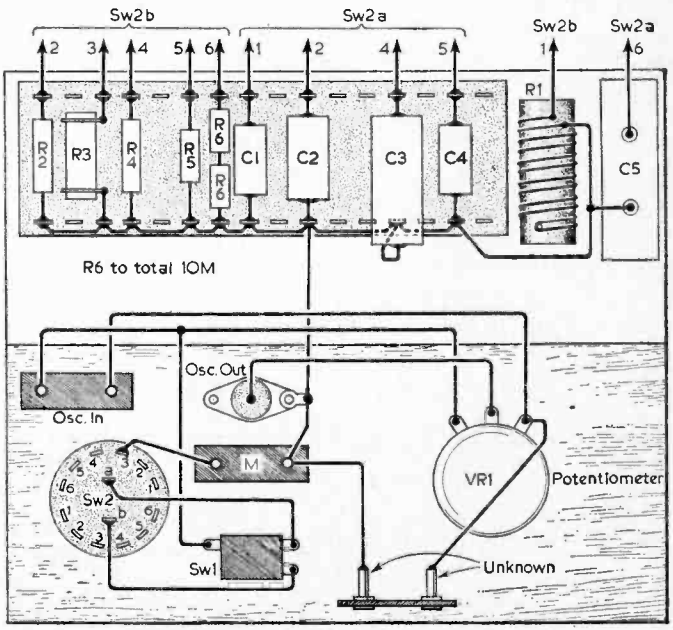


Fig. 5.—The layout of components and wiring diagram.

Assembly

The wiring up of the circuit follows normal practice. For convenience, all the standards, except the 10Ω and 1μF components, are mounted, printed circuit fashion, on to a bakelite sheet. For neatness in wiring up, these should be positioned in the order shown in the circuit. The two standards mentioned are wired loose because the 10Ω resistor is home made and bulky, and 1μF capacitor, a paper component, again bulky.

To wind the 10Ω resistor, a 56½in. length of 31s.w.g. insulated Eureka or Constantan wire is wound on a bakelite former (non-inductively), and then mounted, together with the other components as shown in Fig. 5.

(Non-inductive winding of the resistor is achieved by doubling the 56½in. length of resistance wire to 28¼in. and winding this double wire on to the bakelite former—see Fig. 5.)

Calibration

When the circuit has been checked, the bridge should be connected up to its auxiliaries, and, with the volume control on the amplifier held ready for adjustment, allowed to warm up. The range switch is then turned to the 1k range, and, using a 1k standard resistor, the potentiometer rotated until the tone volume level decreases to zero, or as near to zero as possible (the null point). It is usually found that the fundamental note does disappear, but the harmonics, if present, can still be heard. This point, when located, is then marked 1, and corresponds to the centre of the potentiometer track. This procedure is then repeated, using the appropriate standards, to mark off the main points from 0·01 to 100. As a matter of interest, the values of resistors required to do this are 1k, 2k, 2k, 5k, 10k, 20k, 20k, 50k, using these in various parallel-series arrangements. All the main points can be marked: e.g., for the 9 point, the 2k and 2k and 5k resistors would be used in series, and for the 0·5 mark, the 1k, 2k and 2k resistors would be used in parallel, etc., etc. If the calibration procedure has been accurately carried out, all the resistance ranges should now be calibrated.

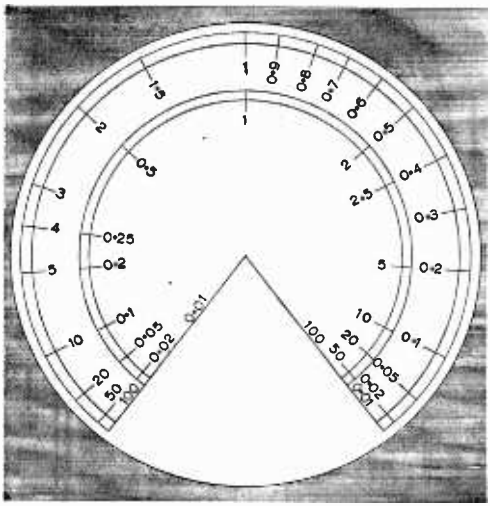


Fig. 6.—Assuming that the potentiometer, VR1, is linear, the calibrations on the scale should be similar to this.

Now, a second scale is drawn on the inside of the resistance scale (different coloured background paper could be used here to good advantage) and the main points transferred to it. This is the capacitor scale, which does not require calibration, as the marking points on it are the reciprocals of the points on the resistance scale; i.e., 0·5 on the resistance scale would correspond to 2 (1/0·5) on the capacitor scale and so on.

The calibration is now complete and the scales should look like Fig. 6. If the standards cannot be obtained, then the internal standards could be connected in turn across the unknown terminals, all, of course, except the 1k, and the 100, 10, 0·1 and 0·01 points found. For the other points assuming the potentiometer is linear, Fig. 6 should be a very good approximation of the scale, and can be used ready marked. If this is done, the 100 and 10 points should match when tried with the internal standards; if they do not, the scale should be rotated until they do.

The matching socket can be used with the potentiometer set at 1, to match any two components. It can be very useful in matching, say, the two grid leak resistors on a push-pull output circuit, and if a coil of known inductance, i.e. an M.W. frame aerial, is placed across the unknown input, another coil can be wound to the same inductance, at any multiple or sub-multiple thereof. For convenience, two lengths of flexible wire, fitted at one end with crocodile clips, and at the other with wander plugs, should be made up for the matching socket. ■

CROYDON TV TOWER

MR. HENRY BROOKE, Minister of Housing and Local Government, has given the Independent Television Authority planning permission to build a 500ft television tower at Beaulieu Heights, South Norwood Hill, Croydon. The consent is for a period of five years only.

The Minister directed that the application be referred to him for decision, and a public inquiry was held on 10th January.

In this report to the Minister, the inspector who held the inquiry wrote that there was substantial agreement on the design of the tower, but there was some difference on its setting, its proximity to other buildings and its suitability to the neighbourhood. He did not consider it would be practicable or reasonable to insist on a non-residential area when the choice of site was so restricted.

He considered that it was a matter of opinion whether such a structure should be free-standing or have a podium or "foil" of buildings at its base. The tower should be set back as far as possible on the site. A question of principle was raised by the use for a purpose of this kind of land acquired for public open space but the undertaking was of a very special, if not unique, kind, and in his view the loss of potential open space would be negligible. He did not consider that a proposed block of flats off South Northwood Hill would be adversely affected. The need for the tower could be accepted, but the Authority's recognition that uncertainty about the needs of a permanent station must continue for several years convinced him that the proper course was to give permission for five years only, during which period future television needs in general would have been determined.

The Minister agreed. He gave planning permission subject to the conditions that the tower be set back as far as possible within the site, that the site be laid out as a garden on open lines, and that the tower be removed from the site not later than 30th April, 1966.

Equalising BBC and ITV

(Continued from page 501)

The circuit will not offer a great deal of attenuation to the Band III signals, which are well removed in frequency from Band I. Adjustment should be effected by first tuning the set to the Band I station with the circuit connected. The dust slug should then be adjusted until the reception on Band I is comparable to that on Band III. As the unit is frequency-selective, it will discriminate between sound and vision on Band I, but a compromise setting can quickly be established on the core.

For experimenters wishing to construct such a unit, the coil should be 1μH and the capacitor 10pF. The coil can be made up of 8 turns, close wound, of 22s.w.g. enamelled-covered wire on an Aladdin Type PP5892 former, which contains an adjustable dust-iron slug.

The components should be mounted in a small screened can with the coaxial connecting leads, suitably terminated, brought out at each end. ■

Television Interference

RECOGNITION, CAUSES AND CURE

By L. E. Higgs

(Continued from page 474 of the June issue)

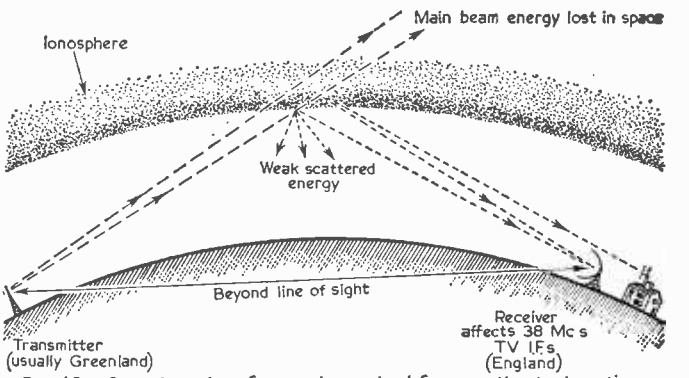


Fig. 13.—Sometimes interference is received from scatter propagation transmitters in remote countries.

Pulling

THIS is a side effect of negative images. The inverted picture can upset the clean front edge of the horizontal sync pulse causing early triggering of the line—only in certain sections of the raster depending on the picture content at the extreme right-hand side of the raster. The result is sections of the picture slithering and wobbling horizontally by ¼in. or so as the scene varies. The aerial needs adjusting here.

Patterning

Herringbone patterns of criss-crossing lines over the picture silently changing direction similar to patterns from moiré silk as one moves it (Fig. 10)

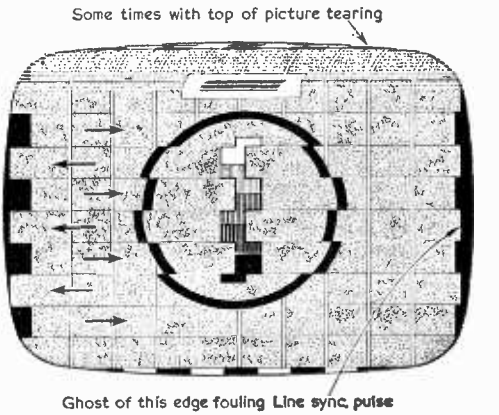


Fig. 14 (above).—Line "pulling"; this is a series of horizontal displacements of various sections of the picture.

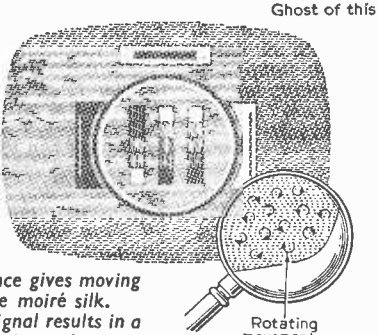


Fig. 10. (above left).—R.F. interference gives moving patterns on the screen rather like moiré silk.

Fig. 11. (above right).—Insufficient signal results in a decreased signal-to-noise ratio—the picture becomes grainy and weak.

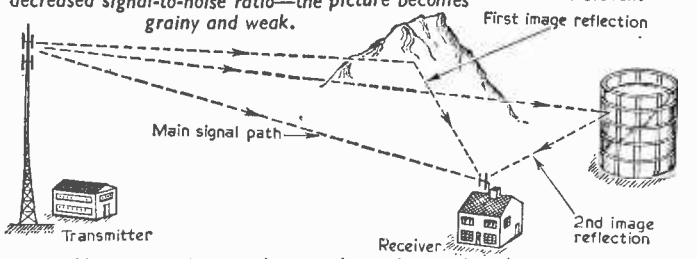


Fig. 12.—When the signal proceeds to the receiver by two or more different paths, the result is a succession of images on the screen—see Figs. 8 and 9, last month.

is the symptom of radio frequency interference from a transmitter, oscillator or a local Band III converter. If the announcer apologises, then it is abnormal reception of distant radio stations. If a trace of Band III sound can be heard, then, probably, an incorrectly installed Band III converter is radiating some Band III on a Band I frequency—this will only occur when the offender is viewing on Band III. Thus, there is freedom from this trouble when popular programmes are on Band I.

The local oscillator in some nearby short wave radios and hospital diathermy R.F. apparatus can also give this effect.

(Continued on page 510)

ADD-ON COLOUR TESTS

(1)—TWO-COLOUR ANALYSIS

By A. O. Hopkins

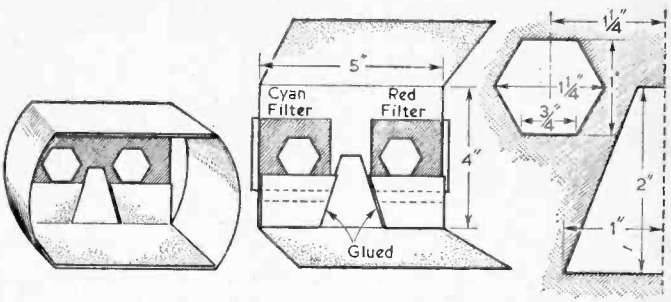


Fig. 1.—A binocular-type viewer with two colour filters—dimensions of the apertures are given on the right.

THE system of colour television, "Add-On Colour", which I described in the June, 1960, edition of PRACTICAL TELEVISION, should appeal to readers who have experimented with closed-circuit scanning, since it offers an easy way to convert from the familiar "monochrome". Briefly, my method is to scan the focused image or coloured slide through a cyan (blue-green) filter. Although red components are missing, the picture signals are suitable for monochrome receivers because we are used to red being represented by a darker grey than blue or green of similar brightness.

Foundation Picture

This cyan-filtered "foundation picture" looks well in black-and-white because all such pictures, printed or screened, depend entirely upon contrast, only possible when all colours are converted to numerous shades of grey in order to register. I instanced a strongly contrasting pattern of green and red of similar "luminance" which disappears completely if given "panchromatic" treatment. A cyan filter handles this and other "freak" colour problems, generally improving the contrast.

Colour Receivers

The foundation picture would also be received and traced in full cyan by colour receivers, which would receive an extra transmission (of narrower bandwidth) of a red-filtered scan of the same scene for them to "add-on". The two traced pictures, in cyan and red, would be optically combined to present a picture in colour from the two scans sharing one screen or traced on two tube faces. Coloured filters could be used with an ordinary "white" screen, or two separate phosphors, fluorescing in cyan and red, could be employed.

Change-over to colour would only mean adding to your existing receiver—converting it, not scrapping it for a colour set at perhaps treble the price. No interference between "plain and coloured" could occur, because no fancy electronics are necessary in this dual system. Were there a demand for a colour system easy to instal, inexpensive to transmit and receive, reliable and free from complication, I believe the "add-on" principle would satisfy it.

Were three-colour analysis insisted upon, the green scan would be excellent for the monochrome-foundation picture, with narrow-band blue and red add-on scans for colour. Colour quality would equal the N.T.S.C. standard, without the complicated circuitry and high cost of the R.C.A. shadow-mask phosphor-dot screen system.

Colour Standards

Comparison between two- and three-colour analysis can be made by anyone who can spare a quarter hour to construct a colour-viewer from inexpensive materials. How much (or little) is lost by combining blue and green should be judged by everyone who expects to buy a colour receiver in the future. Apart from its scientific value, non-technical friends will want to see how their screens would look in two colours. The actual scene they look at can be considered as three-coloured, so comparison is easy. When colour does eventually arrive we cannot know too much about it.

Simple Construction

The colour-viewer is very easy to make, as Fig. 1 shows. A piece of stiff cardboard, about 14in. by 5in., is cut and bent as illustrated. A strip of thinner card, about 20in. by 5in., is bent and glued to the stiff top and bottom to form the "binocular" case. Each eye-aperture is then covered by a coloured filter. If this material is flimsy such as Cellophane, these coloured "windows" should be stuck along the edges by adhesive strip. An improved viewer could have slots beneath each eye-aperture to receive pieces of glass (red and "peacock blue"), stiff "gelatin" (colour-photography filter), or "nitrate" filter (used in studio and stage-lighting effects), allowing a range of colour combinations to be tried.

If one of the two-colour cardboard spectacles used for "3D picture" anaglyphs is available, the job becomes even simpler. If cyan is unobtainable, two layers—one blue, one green—in not too strongly coloured material can give the blue-green to balance the red. If the cyan is too blue, place a light yellow over it. Light yellow will also correct the red if it is too near crimson or magenta.

Using the Viewer

In daylight or by artificial illumination, the viewer provides quite an exciting look into a two-colour world. Scenery, faces, clothes, furniture all appear in attractive tones, sometimes differing but

very acceptable if your screen could reproduce them instead of the monotonous monochrome. Facial tints are of primary importance, especially in close-up. Through these filters they glow quite attractively, flattering the person "viewed". Similarly the whole range of hair-colouring appears surprisingly true to life. Brightly reflecting objects (with "highlights" furnished chiefly by the "foundation" colour) appear exactly as they are.

The subjects for this two-colour test (which also tests whether the add-on principle is practical) are as limitless as those appearing on your monochrome screen. The loss suffered by colourless television is only realised if the televised scene in the studio or outdoors, often glowing with colour, could be seen for comparison.

Colour Balance

The two filters chosen for colour analysis must together cause the superposed light from two sources of equal brilliance to appear as nearly white as possible. This second test can also be made with simple apparatus. If two lenses, say the two parts (plano-convex) of a condenser lens, are available with an "opal" lamp behind each and a filter in front they form a double projector for testing colour balance.

A single lens is enough for this experiment if the two filters are arranged as in Fig. 2, which shows them covering opposite halves of the lens face. A cardboard mask in front of the lens carries two strips, partly glued on, which act as a slip-in frame for the colour filters. At a distance of a few feet the two-coloured light should blend as white.

Picture Tests

Your two-colour projection lamp can now analyse pictures printed in three colours, to find what chromatic changes can occur. The large well-coloured close-up portraits and figures on the covers of several magazines are excellent for this test.

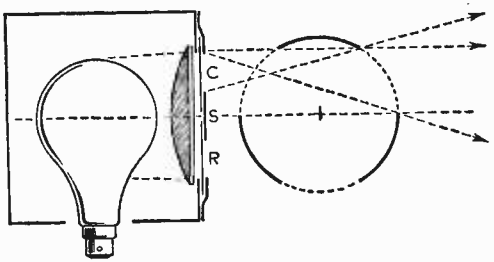


Fig. 3.—A two-colour projector with filters (C: cyan; R: red) in a frame with a strip S and a rotary shutter. Each colour is exposed separately.

Having compared the projection effects with ordinary room lighting, cover each half-lens in turn. With cyan filter obscured, strongly lit with red, the picture seems very bright, but the darker parts are obviously in the wrong places. It almost seems like a negative, quite unsuitable for the foundation-monochrome picture.

Lit strongly in cyan its suitability for presentation in monochrome will be obvious. Now uncover the obscured red filter and you have "added on" red, showing your picture in full colour!

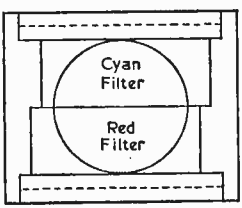


Fig. 2 (left).—A mask for a lens, with a slip-in frame for colour-filter experiments.

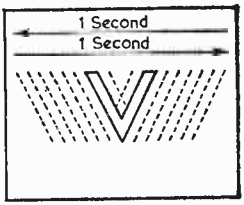


Fig. 5 (right).—An illuminated figure on a moving screen to test picture flicker.

Flicker

All scanning generates flicker. Two different kinds of flicker can occur in monochrome scanning, and three kinds in colour TV. The three can be called "picture", "frame" and "colour" flicker. Each inflicts discomfort on the eye in a different way, and each can be remedied by increasing the repetition rate of either interlaced picture, scanning frames or colour fields. Since repetition costs channel bandwidth, it is important to know what minimum frequency will smooth out each kind of flicker. Readers will know that the current controversies about increasing our line total for higher definition, and also introducing colour, arise from the expenditure of bandwidth involved.

Fair questions could be:—

Is monochrome scanning using its channels economically (just enough pictures and frames to suppress its two kinds of flicker)?

If not, could colour occupy the hitherto wasted space (with colour flicker suppressed)?

Rotary Shutter

The divided lens arrangement can be used to test the three flicker speeds, and both questions can be answered.

Artificial flicker can be generated by a rotary shutter, usually with radial blades. A more useful shutter, with abrupt light switching, can be used with your lens and colour filters as shown in Fig. 3. It is an apertured drum, with three openings separated by their own height. The diameter of the drum should be slightly larger than that of the lens. I cut my drum from a cardboard-sided custard "tin" (without the lid), and this shutter is easily driven by a small model motor. Fig. 4 shows the apertured drum attached to the motor shaft. A strip of cardboard 1in. wide is fixed across the lens centre.

During rotation, two apertures become level with each part of the lens above and below the strip in turn, releasing a flash. The boundary rays of the cyan flash are indicated. Each rotation releases six flashes, the two colours alternating, with short dark periods between. This is a severe flicker test. Scanning is more smoothly illuminated, but brilliance can be greater on modern screens, so these flicker tests form a useful guide.

Each type of flicker can be tested by means of an easily prepared screen. This is a white card, about 6 by 8 inches, at the centre of which a figure, say a "V", is cut, as shown in Fig. 5. Thin tracing paper is stuck behind the "V", and a touch of grease makes the figure translucent.

Colour Flicker

Cyan and red are complementary colours, their light exciting different receptors (rods and cones) of the retina, according to optical theory. In practice, violent colour contrast occurs, and persistence of vision cannot smooth out the light pulsations and blend them if these two colours alternate at too low a frequency. Colour flicker will not cease until the succession is fast enough for the retina to accept the two colours as occurring simultaneously. Five or six rotations of the shutter per second, giving at least 15 flashes in each colour, will be found to illuminate the screen as from a white light source. The total flicker frequency is then at least 30.

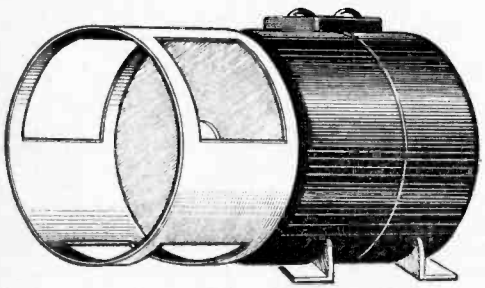


Fig. 4.—A rotary shutter driven by a small motor.

A second unwanted colour effect called "fringing" can be treated as flicker and tested. "Fringing" is the visible separation of colours at the edges of fast-moving close pictorial objects. Observe the "V" from the back of the screen, where it should glow brightly. The screen card should then be moved nearly its own width from side to side at about one traversal per second. The "V" then simulates a close white object moving quickly across a dark background, the most severe test possible. At a shutter speed lower than 5 rotations per second, with 15 flashes in each colour, "fringing" will be clearly seen along the sides of the "V". This is represented in Fig. 5 by dotted lines, with arrows showing the horizontal movement and timing. Normally such fast-moving close objects are avoided by film and TV technicians, even in monochrome. Ordinary movement gives no "fringing" trouble.

Picture Flicker

Monochrome scanning is based on current film technique, the 25 interlaced pictures being copied from the 24 film frames, chiefly for telecine purposes. All that must really be satisfied is persistence of vision, the visual blending of a succession of superposed images upon the retina.

It was established years ago that bright images for film and similar purposes need the highest repetition rate, about 16, whereas dull intermittent pictures are free from "jerkiness" with fewer exposures. The perfected "silent" films used 16 frames per second, and were only speeded up to 24 to accommodate the early "talkie" sound-track. This film expenditure gave no visual benefit, but film technicians have never restored the economical picture speed, 16.

To test this, remove the two colour filters from the frame. Each rotation of the shutter now releases 6 flashes of white light. Watch the "V" from the back of the screen as before, moving the card in the same way at the same speed. The "V" moves jerkily until about 3 shutter rotations are reached, when more than 16 exposures of the "moving object" are found to smooth its progress. Every cine enthusiast uses this economical "pull-down" speed.

Frame Flicker

If the projected light is strong, the front of your card will seem white with 16 or so flashes, yet an overall flicker will continue. This form of flicker has nothing to do with visual persistence, and takes about three times the repetition to suppress. Slow flicker on the whole screen is painful because the iris muscles of the eye try to contract and expand the pupil in an effort to convert the fluctuating light to a steady value. This function of the iris protects the retina from excessive light which would violently stimulate the perceptive system, and could even damage the delicate network of the optic nerve. At a suitable speed the iris cannot follow the fluctations, so settles down with "fixed aperture" for the average illumination.

This problem was solved for the cinema when the 16 frame projections were "light chopped" into 48 by means of a three-bladed shutter before the lens. When "sound" frames were increased to 24, these were "chopped" into 48 by a two-bladed shutter. Interlaced scanning then matched the televised films with 50 frames, also chosen because they permit locking with the mains.

In our test this frame flicker disappears when the shutter rotations reach 7 or 8, when the flash frequency is between 40 and 50. Our screen then appears lit with steady white light, although actually lit by flashes in the same way as the cinema screen.

Space for Colour

Had 35mm film technique restored the scientific 16-frame speed, "triple-interlacing", which has been demonstrated as practical, would doubtless have been adopted for television in order to match it. The 50 interlacing frames would form $16\frac{2}{3}$ pictures of 3 frames each, saving $\frac{1}{3}$ of the video sideband by reducing it from 3 to 2Mc/s for our 405-line standard. The whole megacycle freed on every channel by this economy would have made colour experiments possible on simple, inexpensive lines. Is it not probable that colour television would have become standard practice by now, enjoyed by the millions who must instead be content with monochrome?

Three-Colour Analysis

Keen experimenters who have made the two-colour viewer, and have tested the surprising coverage possible with cyan (blue-green) and red, will want to compare the limitless range which the three primary colours, blue, green and red, can attain.

The BBC's experimental transmission of the adapted N.T.S.C. system has been tailored to suit the R.C.A. phosphor-dot tube, which complicates reception for display on simpler (and cheaper) colour tubes. Demonstration of colour TV will

be the special attraction at the Radio Show this year, and should stimulate the interest of every home constructor and experimenter in monochrome. Sale of this "compatible" system dragged in the USA, which our own manufacturers have noted. Hard economics have put colour TV back to the pioneer stage, giving a chance for a simpler system to be developed in time for colour to be enjoyed in Britain in a less distant future.

Colour Principles

To advance from monochrome to colour a few basic principles and theories of coloured light will be found valuable. Newton's spectroscope splits white light into the whole "rainbow" of colours, which explains why rays from a white source can penetrate any coloured filter. Six distinct hues can be seen in the visible spectrum; violet, blue, green, yellow, orange, red. These gradually merge with their neighbours, forming five more hues. Red is widely separated from blue and violet, but is found in nature combined with them in purples, magenta and crimson. All these hues are found also in "pale" or pastel tones (such as pink, cream, mauve), in browns, in greys (which contain all three primaries), and in dark shades (which contain little light).

Young and Helmholtz discovered that three colours, now called "primary", were sufficient in combination to stimulate the eye to see the whole range of colours. The perceptors of the retina, the "rods" and "cones", were considered to respond individually to only one primary, which divided them into three groups. Their response is represented as being in bands which span the whole visible spectrum but which peak strongly in one of the three primary regions. Fig. 6 illustrates this theory, and shows the approximate wavelengths, in milli-microns, of the seven most easily separated colours. Cyan, between blue and green, seems right, but yellow as a blend of green and red is unexpected when first met. Near the centre, green takes command, peaking symmetrically, whereas blue and red weaken rapidly to the extremes of the range.

Colour Problems

One criticism of these response curves is that no pure primary could be separately perceived owing to the overlap of the other two primary regions. Yet how otherwise might be filled in the range of colours between the primaries? Cyan light from a single source, for example, has the same visual effect as blue and green from two sources. This requires the curves to sustain smooth transition in both colour change and light value, free from "dips".

Another snag is that every colour would contain some white (blue+green+red) preventing saturation. My idea is that the blue and red curves do not overlap, but reach their inner zero near green peak frequency, freeing all colours from unwanted white. I would also reduce the spread of the green curve, allowing it to reach its two zero frequencies near peak blue and peak red, purifying these two colours. Theory would then match experimental fact.

Green Foundation Picture

The overall sensitivity of the eye is greatest in the green-yellow region, as shown by the broken line curve in Fig. 6, and reaches zero at the extreme frequencies of violet and red. The proximity of the green and sensitivity peaks is doubtless responsible for the fact that the eye can accept a green-filtered image as natural when presented in monochrome, that is in brightness or "luminance" only. This is the principle of "add-on" colour (with three-colour analysis), in which monochrome receivers could trace the green "foundation" picture in "black and white". Colour receivers would reproduce this in green, and would also receive two other colour signals, for the blue- and red-filtered images, combining the three optically to form a picture in full colour.

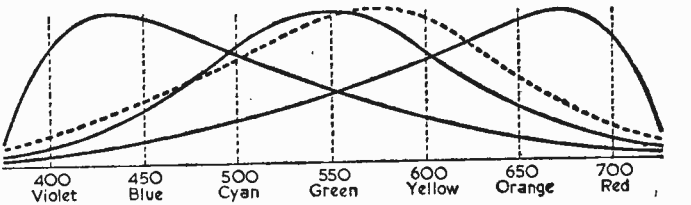


Fig. 6.—The colour response of the eye (Young-Helmholtz Theory). The three primary colours curves peak at blue, green and red. The chief spectrum colours are shown with approximate wavelengths in milli-microns. The sensitivity curve is shown dotted.

White Light

Another colour perception theory should be mentioned, that of Hering, who considered that blue and yellow light excite one set of perceptors, while green and red excite another set. These form two overlapping curves, and a third curve spans them both, similar in shape to the sensitivity curve. Hering's third curve represents a group of perceptors which are sensitive to white light only—almost a built-in "compatibility" system for the eye. This theory does not help analysis and synthesis by the accepted three primary colours, although experiment has proved that yellow is a separate visual sensation, not depending upon the presence of green and red.

Modern Optical Theory

According to modern optical theory only the retinal cones are sensitive to colour. The part of the retina which gives detail vision, the centre of focus or "fixation point" (the foveal pit of the macula) contains only cones. Rods become more numerous further from the centre, and are sensitive only to brightness, to the "luminance" of light what ever its colour. This accounts for changes in light patterns, such as are caused by movement, being easily detected from the corner of the eye, as we all know. The rods seem to be related to the "sensitivity" and "white" curves, perhaps in a "compatible" arrangement far simpler than N.T.S.C. circuitry.

(To be continued)

A Basic TV Oscilloscope

TESTING THE COMPLETED INSTRUMENT

By H. Peters

(*Continued from page 474 of the June issue*)

FURTHER saving of space is possible by dismantling the contact-cooled type of rectifier and stacking the discs on a well insulated 2B.A. rod. The writer uses a 14RA1283, which, if carefully dismantled, will disclose a bakelite honeycomb of 12 sections. In each section are seven washers. The top one is bronze and curved, and is only used to compress the others. The second one and the bottom one are plain steel washers. Between these two are the stack of four rectifying washers, each washer having a bright metallic upper side (the positive) which is bevelled, and a rather rusty and dull underside, which is the negative. Each disc will handle 15V so that the total of 48 is suitable for a 720V A.C. input, which if adequately smoothed will give a negative H.T. line of approximately 900V.

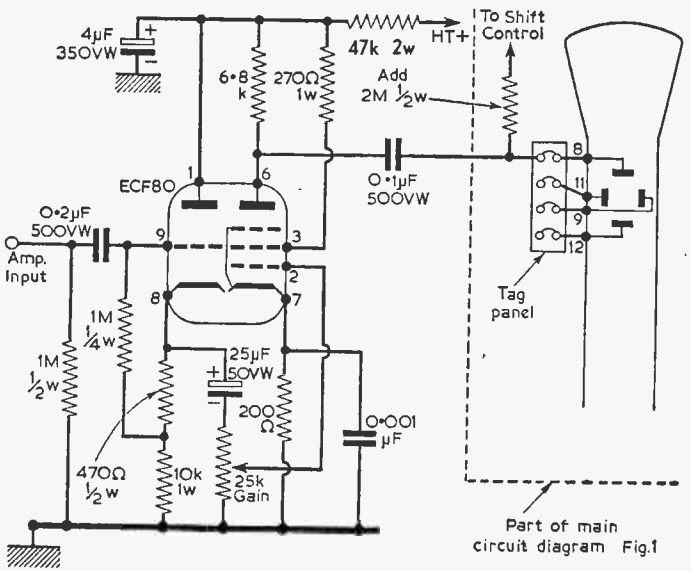


Fig. 4.—The circuit of a suitable Y-amplifier.

Test Leads

These can be made up to suit individual needs, but three basic leads about a yard long are adequate for most purposes. Terminate the oscilloscope end appropriately with wander plug or spade terminals, and fit crocodile clips to the other end of two of them, and a probe to the third. A spent ball-pen makes an ideal probe. Remove the refill and pass the flex down the empty case from the top. Solder the lower end to the brass turning which holds the ball and refit to the case. With a little skill a working ball-pen can be adapted and this will provide a test prod which both reads and writes.

Testing

Before switching on check for shorts on the H.T. lines. A resistance reading should give about ½M from H.T. positive to chassis and 2½M from H.T. negative to chassis. Set the two shift controls, the fine frequency control, focus, sync and sweep to midway, and the brightness to maximum. A bright green line should appear, and the two shift controls should be used to bring this line into the centre of the screen. Connect a suitable lead from the input terminal to the 6·3V calibrating voltage.

This will produce a rectangular patch of light the height of which will correspond to 20V peak to peak. Switch the coarse frequency switch S1 to a slow position and by rotating fine frequency control VR2 a 50c/s sine wave trace should be produced. Adjust sync and sweep until it is locked and the correct size. It will be found that sync and sweep affect the speed of the scanned trace and that it may be necessary to readjust the fine frequency control once more. The 'scope is now ready for use. ■

Television Interference

(*Continued from page 505*)

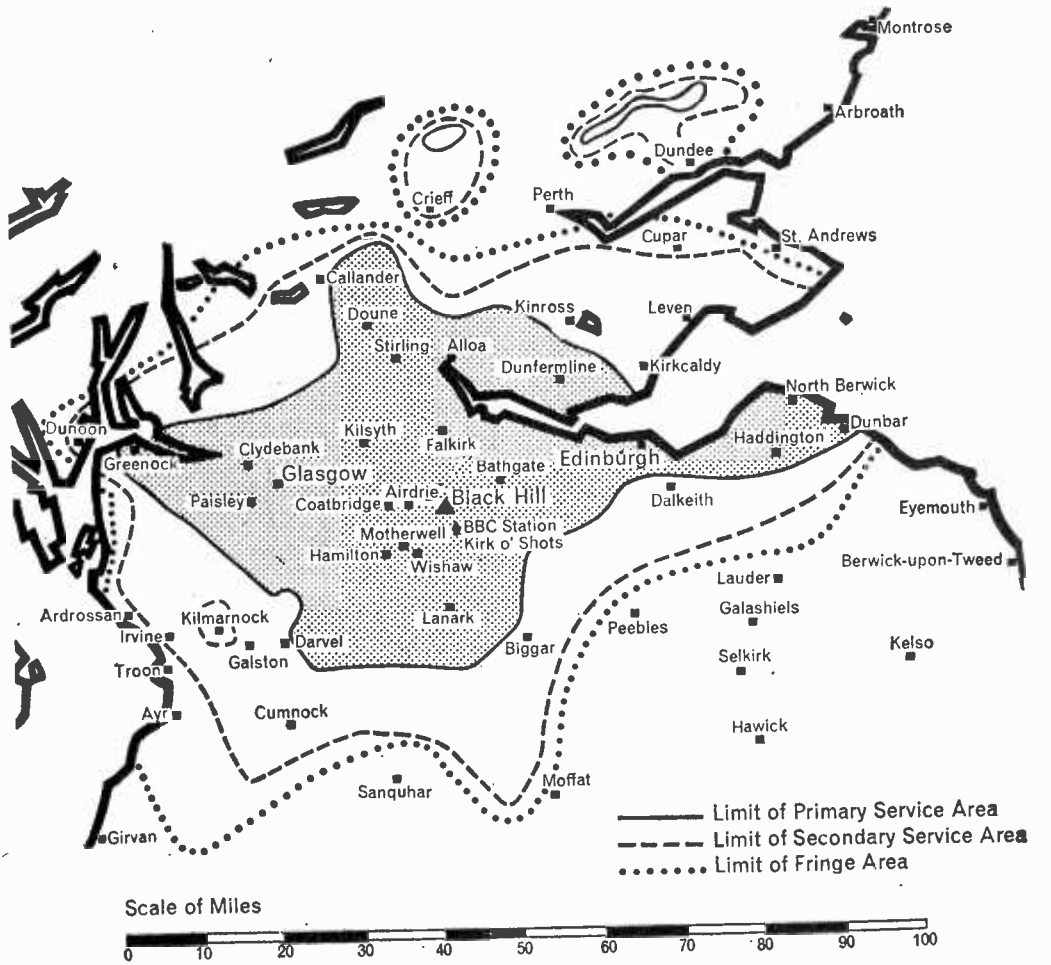
Scatter Interference (see Fig. 13)

This is characterised by patterning, as above, fading spasmodically, with a pulsating "brr, brr, brr" in the sound rising and falling in volume and it occurs mostly in the afternoons during daylight, and on Band I. Thirteen channel receivers with 38Mc/s I.F. circuits are most affected. The best cure is to fit a commercial 38Mc/s rejector filter in the aerial input lead or cut a 38Mc/s rejector stub from a length of coaxial cable and connect it in parallel with the aerial input.

Grain

A moving background to the picture (Fig. 11) may fairly be described as "interference" as it was not broadcast with the picture, but originates mainly from the noise in the frequency-changer valve. If the input signal is weak, then the picture is seen against a background of noise or "snow". The remedy is to increase the input signal to the frequency changer. If in an area of good signal strength, the aerial, feeder, or, more likely, the cascode R.F. valve is at fault. ■

A New Mast at the ITA's Black Hill Station in Scotland



The estimated coverage of the new mast.

This month programme transmissions from the Independent Television Authority's Black Hill station, in Scotland, will come from a new 1,000ft mast and directional aerial, which replaces the old 750ft mast and aerial.

The effect of the new mast will be to increase the overall coverage of the station and to improve reception in many parts of the present service area.

Nearly four million people will now be able to receive ITA programmes from the Black Hill station, on channel 10.

Owing to the fact that the signal in some parts of the area, notably Ayrshire, has so far been, in part, horizontally polarised, some receiving aerials have been installed in a horizontal position. The new transmitting aerial will radiate in the vertical plane with no significant horizontal component, and so horizontal receiving aerials will have to be re-aligned to pick up the vertical signal. The removal of the horizontal signal component is necessary in order to conform to national and international technical agreements.

The effective radiated power of the new directional aerial is 475kW to the North East; 250kW to the South West; and 150kW to the North West and South East. The vision frequency is 199·7305Mc/s, and the sound frequency is 196·2395Mc/s.

USING COAXIAL STUBS

TUNED LINE FILTERS FOR REJECTING UNWANTED SIGNALS

By P. Rules

WHEN coaxial cable is used in unmatched conditions, it can perform some remarkable functions because of its unusual behaviour at radio frequencies. The three electrical parts of a uniform coaxial cable are: a cylindrical tube (which may be considered "electrically solid"); and a centre conductor coaxial with it (see Fig. 1). Thus, for each unit length of cable, there will be a uniform capacity between the inner and outer conductor and a uniform inductance from the combined effect of the length of the two conductors. All good coaxial cables have uniform physical dimensions and hence uniform electrical characteristics along their length; so uniform, in fact, that the cable makers quote their various cable types as having so much capacity in picrofarads and so much inductance in microhenries to the yard. As inductance and capacity lumped together form tuned circuits, we can cut off to order tuned circuits "by the yard".

Just as tuned circuits can be connected in two basic forms—series and parallel—so coaxial cable

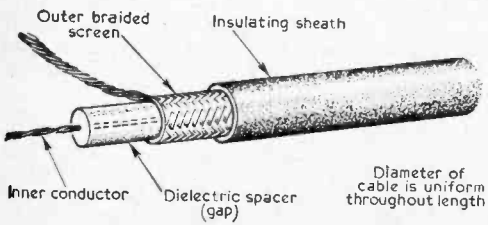


Fig. 1.—The construction of coaxial cable.

tuned circuit can be so connected. Just as a series tuned circuit acts as an acceptor to one particular frequency, so can a length of coaxial cable cut to one quarter of a given wavelength—if left open circuited at one end. By shorting this same length of cable at the end, the electrical characteristics reverse from an acceptor circuit to a rejector circuit. These tuned circuits are very efficient and conveniently short at TV frequencies and can be put to use in the following ways on domestic TV.

I.F. Interference rejection (single channel)

Interference breaking through directly to the I.F. stages of a single channel T.V. set (in the form of R.F. patterning) can best be dealt with in this way. The break through is usually from a harmonic of a powerful local radio transmitter and only affects TV receivers with a particular value of I.F. As the TV is only a single channel type, or if there is only one worthwhile channel in the district, then if a rejector circuit is connected directly across the input to the receiver and tuned to this required channel, then only signals from this channel can appear across the aerial socket. All other stations (and interference) will be absorbed in the "stub". The adjustment of the tuned stub is easy and it can be made from an old length of coaxial cable.

Take a length of coaxial cable 6ft long and neatly prepare the ends as shown Fig. 2. Solder the inner across the inner connection of the TV aerial socket (at the rear), and the outer of the cable across the outer of the TV aerial socket. Switch on the set and observe the type of picture obtained—the aerial must be plugged in. (The picture will be reduced in strength owing to the losses of the inserted length of cable.) The length suggested (6ft) is necessary to tune to Band I, Channel 1. For channels higher in frequency (and number), a shorter length can be used from the start, but 6ft covers any channel.

Now snip off 1in. lengths of cable from the remote end of the stub, carefully watching the screen. The picture should steadily deteriorate as each increment is clipped off. If there is no AGC on the receiver then it will be necessary to keep raising the gain, contrast or sensitivity control as the picture fades out. If there is AGC on the receiver then the background to the picture will become steadily more grainy until a point is reached where vision and sound disappear, with only a rushing sound and grain on the screen. This is what is required—maximum rejection of the

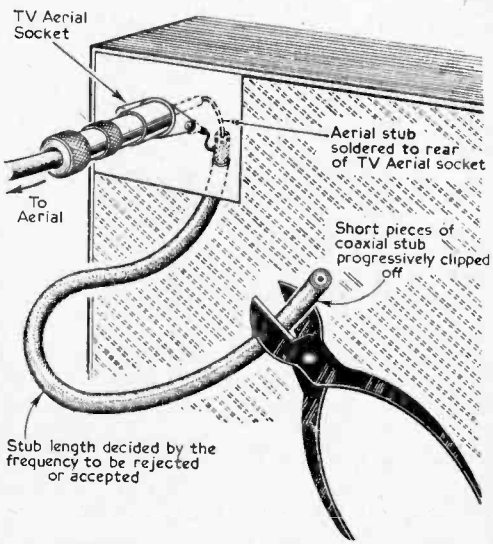


Fig. 2.—A method of adjusting an aerial stub.

channel; as the critical point is reached, make each piece of clipped off cable very small to avoid clipping past the point of maximum attenuation. If you do find the picture increasing as more is clipped of then it means the critical point has been passed and you must start again with another length.

Having reached minimum channel strength all

that is needed now is to strip back slightly the clipped end and twist the last ½in. together shorting out inner and outer of the cable and solder.

This action of short circuiting the end of the acceptor stub reverses its function and turns it into a rejector tuned circuit causing the signal to reappear with the picture at least as bright as it was without the stub. However, all frequencies on either side of the channel will be attenuated together with I.F. interference.

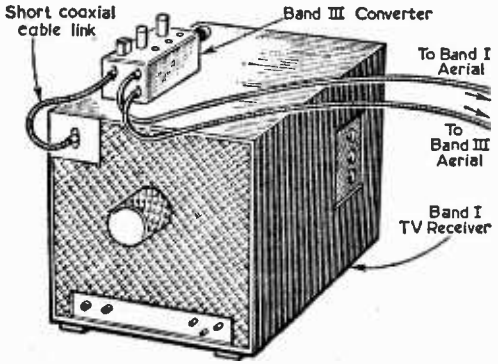
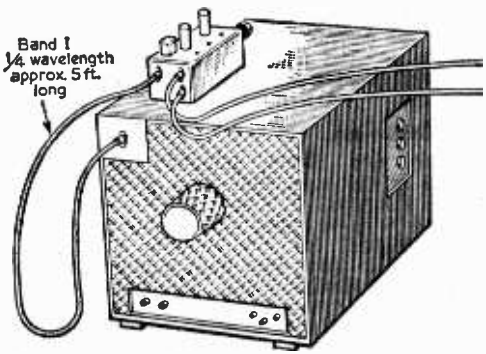


Fig. 3a. (above)— A normal Band III converter installation.

Fig. 3b. (below)—A converter installation with a Band I rejector coaxial link.



I.F. Interference rejection (multi-channel)

The above method allows only one frequency to reach the TV screen and is only suitable for single channel reception. When more than one station is to be received the following method can be employed. Follow the instructions given above, but adjust the length in the following way. The object here is to connect an acceptor circuit across the TV socket to accept and absorb the interfering frequency only, letting all other channels pass unaffected to the set. It must be known what frequency is causing the main interference. As the interference itself is usually too weak and unreliable through fading for direct reference in cutting the stub, it must be simulated by a signal generator. Wait for an occasion when the interference is prevalent and couple the signal generator loosely to the aerial cable inner wire via a high resistance, and adjust the output from the generator to produce a beat note in the sound, or stronger screen patterning identical to that given by the interference. Generally this frequency will be in the region of the TV I.F. or some sub-harmonic. Once found, pull out the external aerial and plug in the signal generator and feed in a strong signal. Now adjust the stub by clipping off pieces of cable to produce a minimum of interfering signal on the TV sound and vision—the input from the signal generator can be progressively raised as the minimum point is approached.

When a minimum has been found remove the signal generator and plug in the aerial—do not short out the end of the cable this time, in fact, make sure no whiskers of wire can bridge between the inner and outer. The stub should have little or no effect on the channels normally used but will absorb the frequency to which it was adjusted. Be prepared to start with up to ten feet of cable if the interference is from 30Mc/s upward.

Table 1

This table lists one quarter wavelength for a given frequency. Find the frequency to be tuned, and start with a stub 25 per cent longer.

Frequency	Quarter Wave-length
30 Mc/s	2.5 m
45 Mc/s	1.65 m
60 Mc/s	1.25 m
90 Mc/s	83 cm
120 Mc/s	62.5 cm
150 Mc/s	50 cm
180 Mc/s	35 cm
210 Mc/s	14.3 cm

Band III Converter Interference

Band I receivers using aerial lead converters are prone to patterning on Band III owing to breakthrough from the local Band I station. Very often, the lead (coaxial) from the converter to the TV aerial socket is kept short for tidiness and to reduce Band I pickup. If this is the case, try making the lead approximately one quarter of a wavelength (of the local Band I channel). In many cases the lead will act as a rejector circuit to the Band I breakthrough (Fig. 3). If it is found that there is an improvement, then experiment to find the length of connecting cable that cancels out the interference. Table 1 gives approximate lengths for various channels, but the final length for any particular installation will depend on the local receiver and converter—however, they should not vary much from the ¼-wavelength.

Optimum Aerial Matching

Weak reception is sometimes caused by incorrect aerial matching. This possibility can be checked by a matching stub tuned to the poorly received channel as described for single channel interference rejection. If the aerial is in order, with good matching, then there will be no improvement in results. But, if a considerable improvement is obtained when the stub is connected then the aerial system should be investigated. If the stub is left in position at the rear of the aerial socket then the alternative channels used will most likely be weakened. (The stub might be wired direct across the diplexer or aerial in some cases). ■

An under-chassis view.

A Nuvistor Band III Pre-amp

BY EMPLOYING A NEW LOW-NOISE-FACTOR VALVE, THIS PIECE OF EQUIPMENT WILL GIVE ALL THE AMPLIFICATION NECESSARY ON BAND III, IN AREAS OF POOR SIGNAL STRENGTH, WHERE RECEPTION WAS PREVIOUSLY OF NO ENTERTAINMENT VALUE.

By R. E. F. Street

ALTHOUGH there are many new TV transmitters, there are many areas where television is of poor entertainment value owing to weak signals, resulting in noise on both picture and sound. The obvious way to improve results in such areas is to pre-amplify the signal before it is fed into the receiver. However, a limit is set in the application of this method by the noise in the pre-amplifier. (The current flowing in the valve is not constant but continually varying and gives rise to a signal in the anode circuit.) Normally, this noise is insignificant compared with the signal being amplified by the valve, and is of no importance. In fringe areas, though, the signal received may be of the same order as the noise in the valve.

The noise in the pre-amplifier valve thus sets a limit to the useful amplification which may be obtained: the signal received must be sufficiently strong to override the noise in the input valve. With the introduction of new valve types, each with a reduced noise factor, the design of pre-amplifier circuits for more remote areas becomes possible.

The Noise Factor

With the above principle in mind, an article in the June 1960 issue of Practical Television described a Two-band Pre-amp using a PCC89 valve—a frame grid double triode—which was designed for amplification at VHF, and features low noise and high gain when used in the cascode configuration. This pre-amplifier has been built in many parts of the country and has given very good results, often enabling pictures of good entertainment value to be received for the first time. However, results on Band I have been found to be better than on Band III—signals on Band I have a greater range than those on Band III and are less affected by physical objects. A large hill may cast a " shadow " and prevent ITV from being received on the side of the hill remote from the transmitter, although BBC signals may still be received—considerably weakened, of course.

To obtain good results on Band III in such areas, a pre-amplifier which has a low noise factor is required. When the Two-band Pre-amp was described, the PCC89 was the best valve for the purpose then available to the home constructor. In this latest circuit, a new valve—the 6CW4 American Nuvistor Triode—is employed in a single valve circuit, which, incidentally, makes construction and adjustment easier compared with a two-valve cascode circuit. The 6CW4 has a metal envelope with a ceramic base upon which all the internal electrodes are supported. The

small size (about ¾in. x ¾in. high) enables a small, neat and efficient layout to be employed.

Circuit

The simplicity of the circuit used should be apparent from Fig. 1. Power requirements are 0·15A at 6·3V and 8mA (H.T.) at 80V. A conventional power supply may be used if the resistance R3 is calculated to give 70V at the anode of the 6CW4. (In the prototype, with 180V H.T., R3 needed to be 8·2k.)

As might be expected, the circuit needs neutralisation, and capacitive, rather than inductive neutralisation is provided by VC1 and VC2. The components used are not critical, but VC1 and VC2 must have low minimum valves. Effective neutralisiation cannot be obtained with 3-30pF concentric trimmers, and types having a minimum capacity of 1pF or less *must* be employed. If the minimum capacity is greater than above 1pF, it will be unstable and it will be impossible to obtain good results.

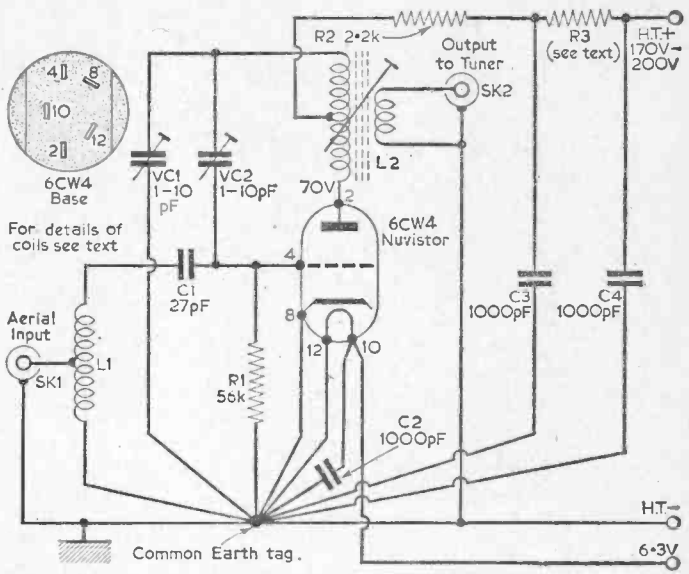
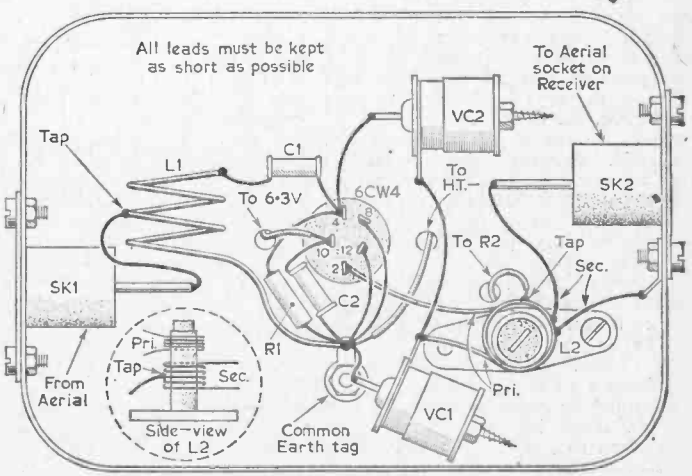


Fig. 1 (above).—The circuit diagram.

Fig. 2 (below).—The under-chassis wiring diagram.



Construction

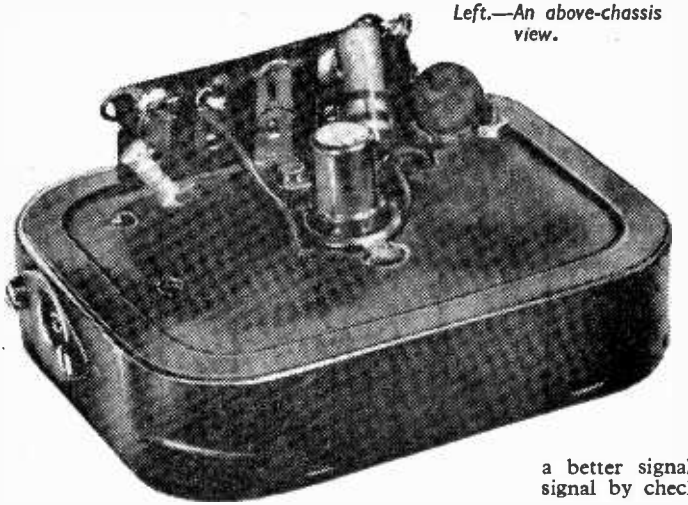
The prototype was connected using a small cough lozenge tin as a chassis, this being used as it was quite large enough to accommodate all the components and the tin-plated surface enabled components, including the valveholder, to be soldered directly to the chassis. The thin metal also enables all necessary holes to be made using a sharp-pointed instrument and, thus, no drilling was necessary.

The layout and wiring given in Figs. 2 and 3 should be followed exactly, particularly the wiring of the heater circuit. The heater leads are not brought through the chassis in the positions shown for convenience, but to avoid decoupling troubles. Note that the "earthy" side of the heater is taken to the common soldering tag, and pin 10 of the valve is also earthed to this tag. The heater wire should not be taken to pin 10 and from there to earth. Likewise, all components shown wired to the common earth tag in Fig. 1 should be wired separately to the tag as shown in Fig. 2. This procedure prevents certain impedances from being made common to two or more circuits.

At first, it may not be apparent that C3 and C4 are wired to the common earth tag. In fact, they are soldered above the chassis next to the bolt which is used to hold the common earth tag to the underside of the chassis; see Fig. 3. If desired, the common earth tag may be soldered to the chassis for extra rigidity.

Adjustment

If it is possible to obtain a Band III picture without the use of a pre-amp, the receiver should be set to give the best picture possible. If a Band III picture cannot be obtained, the TV receiver should be set to the correct channel number and the fine tuner control turned to the midway position.



Left.—An above-chassis view.

The aerial lead is then removed from the set and plugged into the input socket of the Nuvistor pre-amp. A short lead is then prepared with a coaxial plug on each end; this is used to link the output of the pre-amp to the aerial input socket of the receiver.

At first, the aerial input tap in the pre-amp (on L1) is set to the centre of L1. The H.T. feed from R2 to L2 is soldered initially to the centre point of this coil. The trimmer VC2 is set to minimum capacity and VC1 to about half capacity—say 5pF. The unit is then linked to the set using the prepared cable.

Upon switching on, it may be found that results are as they were before or even worse. Screw in the core of L2 for best results. Once some indication of the signal has been seen or heard, the core of L2, VC1 and VC2 must be adjusted to obtain optimum neutralisation. Alteration of the setting of the core of L2 will mean that the setting of VC1 must be altered to keep L2 at resonance — if the core is moved into the coil, the capacity of VC2 must be decreased and vice versa.

After each change in the setting of the core of L2, and VC1, VC2 is increased in capacity until any further increase results in instability — shown when the screen of the receiver becomes uniformly bright and a hum is heard from the loudspeaker. The optimum settings for the core of L2, VC1 and VC2 will soon be found, although perseverance may be necessary if the signal is weak.

Adjusting L1

When results may be improved no further, the tapping point of the aerial input on L1 may be altered in an endeavour to secure a better signal.. Coil L1 may be tuned to the signal by checking whether it is at resonance by holding a dust core near to it; if results improve, then the inductance of L1 needs to be increased and the turns of L1 should be squeezed together. If results deteriorate when the dust core is held near to L1, then the turns will need to be spaced further apart.

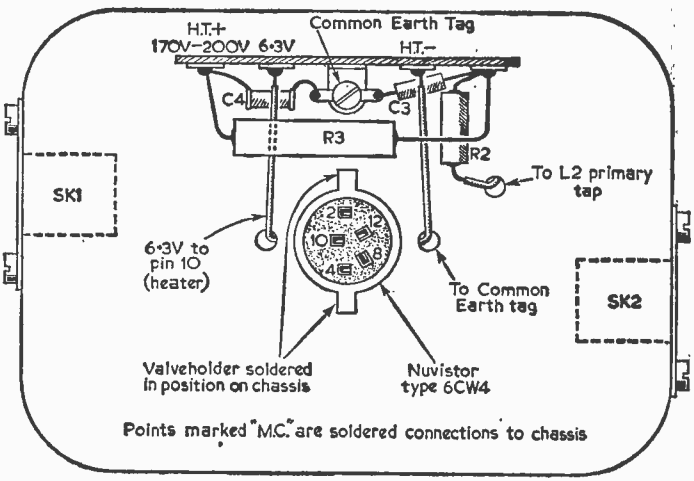


Fig. 3.—Details of the above-chassis component layout.

It will be noted from Fig. 2 that L2 is wound with a larger diameter than its former (which serves to hold the dust core rather than to support the coil) and the H.T. tap may easily be moved along the coil (soldering it each time). Altering the tap may mean altering the settings of the core of L2 and VC1 and VC2 again for best results.

It cannot be emphasised too greatly that in areas of poor signal level, all these adjustments are quite critical for optimum results to be obtained; and they are, to some extent, interdependent, although adjustments in the input circuit have less effect

(Continued on page 528)

COMPONENTS LIST

Resistors

R1	56k ½W	R3	1W	(see text)
R2	2·2k ½W			

Capacitors (ceramic)

C1	27pF	C3	1000pF
C2	1000pF	C4	1000pF

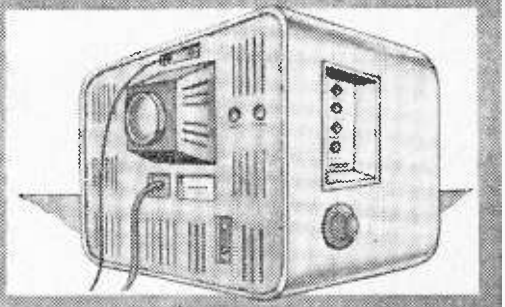
VC1, 2 1—10pF concentric trimmers, with a minimum capacitance of 1pF or less

SK1, 2 Coaxial sockets

6CW4 Nuvistor triode valve

Coil former and dust core (¼ in.)

Servicing Television Receivers



No. 69—THE REGENTONE TR177 AND ASSOCIATED MODELS By L. Lawry-Johns

THE models covered by this article are the TR177, the 58C, the RGD Deep Seventeen and Deep Seventeen C, the Argosy 17C41 and the 14in. versions, the Regentone Ten-8, RGD 502 and the Argosy 14K41. There are several differences between these and models having the suffix A and slightly different numbers.

There are several "usual" troubles which may be outlined before discussing possible circuit faults.

PY32 Failure

The usual symptoms of a failing PY32 are an excessive warming-up period, sometimes resulting in a delay of an hour or more before the sound is at full strength and the picture appears. The width may be reduced, also. The PY32 will often have a blue glow in the envelope and, although this may indicate overloading, this is very rarely the case and a replacement valve will nearly always restore normal conditions. All PY32 valves produced in recent years have had a single section in place of the double assembly of the early version. The diagram shows the connections to pins 3 and 5 through separate surge resistors. When a new PY32 is fitted pins 3 and 5 should be strapped together.

EY51 Failure

The EY51 is V15 in the layout diagram, and this, of course, is the EHT rectifier. The heater of this often becomes o.c., resulting in no picture being displayed on the screen. These symptoms could, of course, be caused by many factors, but a few simple tests will quickly determine whether the EY51 is at fault or not. The first thing to do is to release (not remove) the two screws holding the mains dropper plate. Lift this up and leave it suspended by the leads. Remove the packing (sound insulating) pieces to expose the top of the line output transformer to which the EY51 is wired, single wire end to the left, double wire end to the right. If the EY51 is at fault a strong spark will be drawn from the left side connection. There will be no spark available at the right side. A complication occurs when the act of drawing a spark temporarily welds up the break in the heater element, thus restoring the EHT and the picture. Normally this does not last long, and the heater again fails. It is not easy to replace the valve with the chassis in the cabinet, and it takes only a matter of minutes to withdraw the chassis.

Unboxing

Remove the cabinet back. Remove the aerial input socket (two P.K. screws holding the panel to cabinet). Remove the front control knobs; the inner channel switch and volume knobs have grub screws, but the fine tuner and contrast pull off. Remove the loudspeaker leads by pulling the clips off the speaker tags. Remove the two rear side flange 2B.A. screws which are held at an angle by the shaped bracket under each. Withdraw the chassis complete. (Two wood screws may be found on the rear edge which will prevent the chassis moving.)

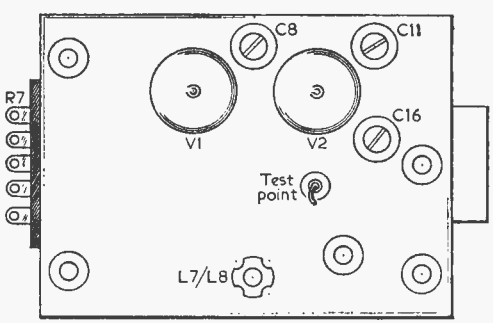


Fig. 1.—The above-chassis layout of the tuner unit.

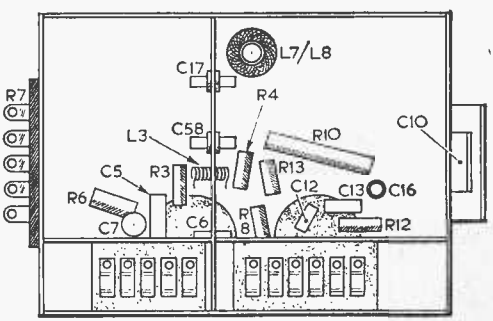


Fig. 2.—The under-chassis layout of the tuner unit.

On some models it is also better to remove the loudspeaker to avoid tilting the chassis unduly.

Tuner Unit

The contacts of the tuner unit usually require attention at frequent intervals as difficulty may be found in locating the desired channel on the selector switch.

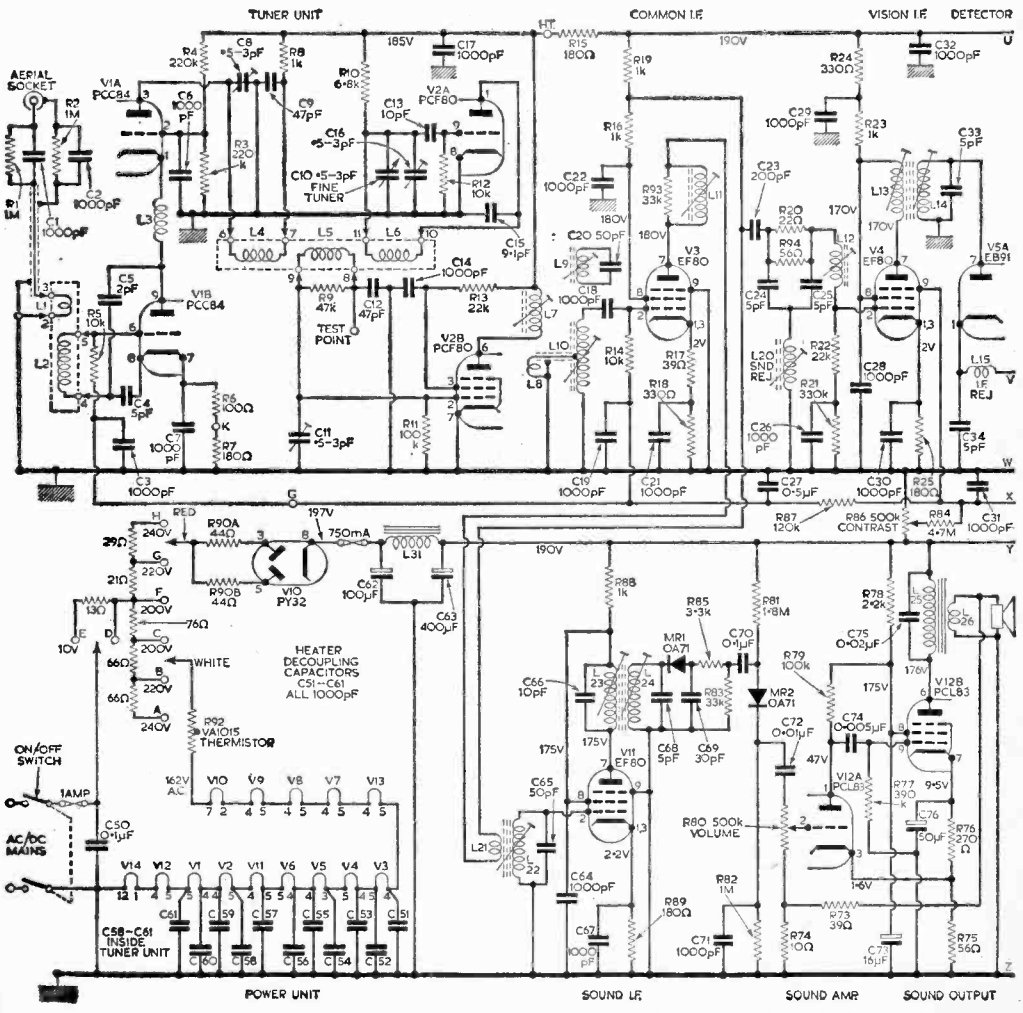
With the cabinet on its side and the bottom cover removed, the lid of the tuner can usually be sprung off, although on some models the bottom of the cabinet interferes with this, and it is sometimes easier to remove the chassis. With the tuner lid off, the coil biscuits of the turret are exposed and the tarnish on the silver studs can be seen. All studs should be cleaned and polished and then lightly smeared with MS4 silicone grease. The contact springs do not normally require attention, but the recent articles on tuner units by G. J. King should be studied. If it is found necessary to retension the bow of the springs slightly, do this with great care as the tuner can easily be ruined by distorted springs.

Weak Signals

In some situations, although an efficient aerial is in use, reception may still be poor. This often involves frequent replacement of the PCC84 to keep a tolerable picture, particularly on Band III. We are often asked whether a PCC89 can be used to replace the PCC84, and the answer to this is no. The input capacity of the PCC89 is too high to allow the circuits to be tuned. However, it is possible to fit a Mazda 30L15, which does give a useful increase in gain when the circuits are properly trimmed. The trimmer C8 will need to be unscrewed a couple of turns and the aerial coil core (L2) adjusted from the rear of the tuner.

It is also possible to increase the I.F. (V4) stage

Fig. 3a (below) and Fig. 3b (next page).—The complete circuit diagram of the Regentone TR177.



gain by disconnecting pin 9 from the AGC line and connecting it to chassis (6) or cathode (1 and 3). As the circuit stands, pin 9 of V4 (suppressor grid) acts as a clamp diode to prevent the AGC line becoming positive. The lead to pin 9 may be connected to a crystal diode, say an OA71, the positive end of which may then be connected to chassis. Valve V4 will then work at full gain, but if the connection of pin 9 to pins 1 and 3 results in instability, connect pin 9 instead to chassis (pin 6).

Sudden Loss of Sound

This is usually caused by V12 (PCL83) developing on o.c. electrode and although a smart tap on the valve envelope may restore signals temporarily, the valve should be replaced. As a general rule, the I.F. stage EF80 valves do not give trouble.

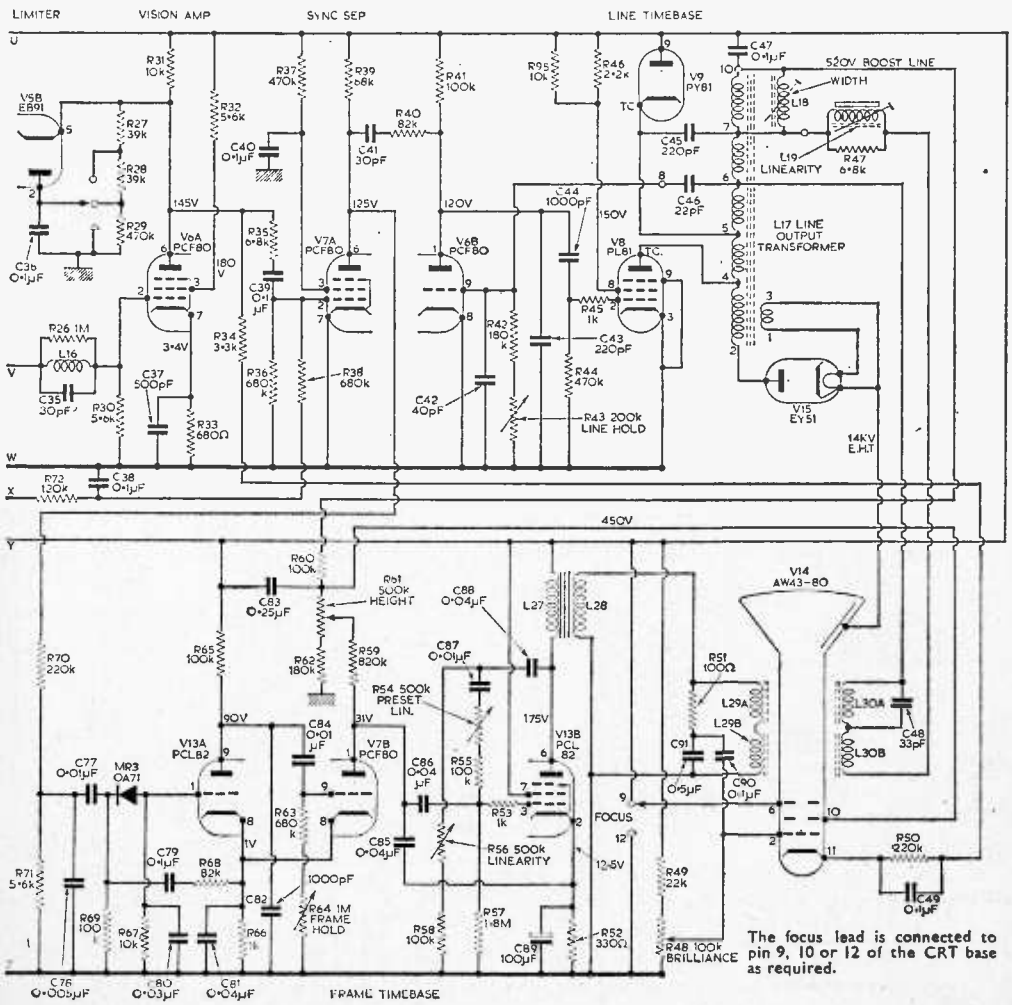
When there is no sound from the speaker at all, and the PCL83 is not at fault, check the H.T. voltage to pin 6 as the sound output transformer (L25) sometimes becomes o.c.

The more common faults have now been dealt with, and it is now necessary to outline the more routine methods of fault finding in order to rectify the less common, but still quite likely, troubles which can occur.

Line Hold

When the screen is filled with a mass of lines which cannot be resolved into a locked picture at either extremity of the line hold control, check V6 (PCF80) and R42 (180k). This resistor should also be suspected when the hold control is at one end of its travel and the hold is still unstable.

The PL81 could be at fault, but this is less likely. If the condition is accompanied by lack of width and perhaps compression at the bottom of the picture, the H.T. voltage should be checked and, if this is low, the PY32 changed.



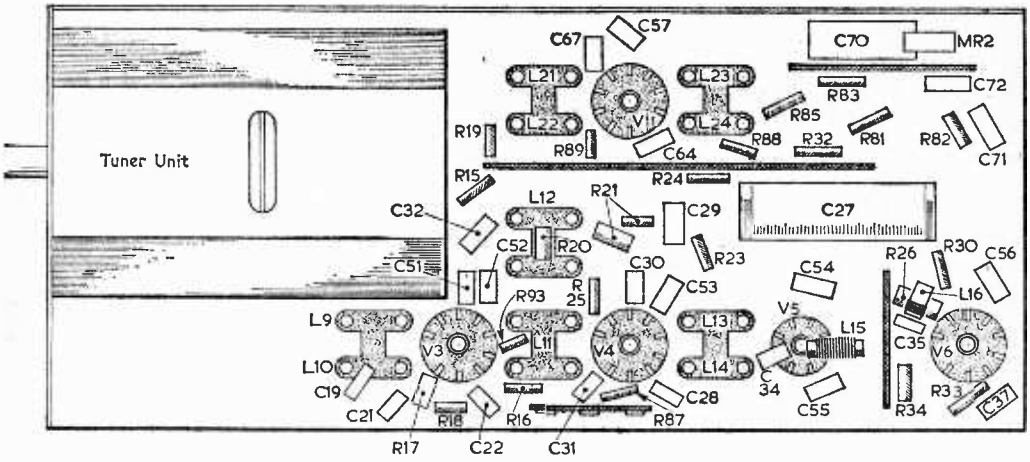


Fig. 4.—The under-chassis layout of the I.F. section.

Lack of Width

If the H.T. Voltage is not much below 190, the PY32 need not be suspected, and the PL81 and R46 (2·2k) should be the first suspects. It is important to check R46, since although width may be restored by replacing the PL81, this may only be temporary and the same conditions may manifest themselves again within a short time. This results when the PL81 is being overrun by R46 falling in value, usually to about 500Ω. To avoid a repetition of this it is better to replace R46 with a 2·2k 5W wire-wound resistor. R95 plays little part in all this, and when R46 is replaced by a wire-wound resistor it can be disconnected altogether.

Striations

When the vertical rulings are observed down the left-hand side of the screen, attention should be directed to R47 (6·8k), which is wired across the linearity coil.

No Picture

No raster when the brilliance is advanced, and no whistle from the line time-base, normally denote a faulty PL81, but V6 (PCF80) and V9 (PY81) should be checked if necessary. If the valves are not at fault, check C47. If the PL81 is overheating check C45 (220pF 5kV).

(To be continued)

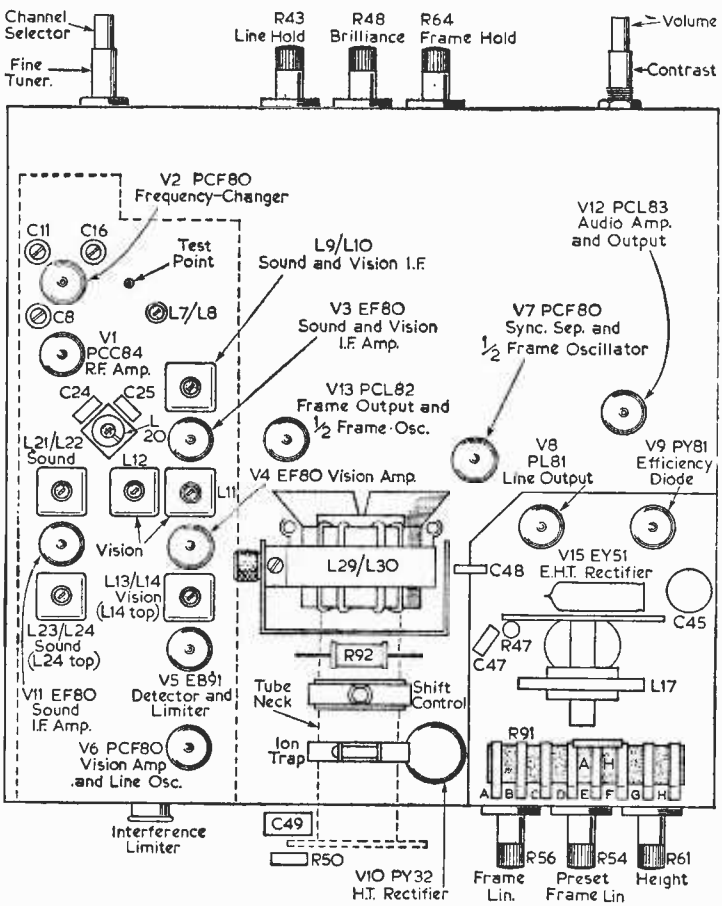


Fig. 5.—Plan view of the chassis.

Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

RELIGIOUS programmes have not been mentioned very often in this column other than in connection with royal weddings and similar important news events. But the attention that is now being given to their artistic and reverent presentation prompts me to refer to one or two morning services of particular interest.

Curiously enough, my bouquets go to ITV Companies who have devoted much thought to this type of programme lately. There was, for instance, the service on the ITV network relayed from St. Clement Danes, London, known as the R.A.F. Church. The simple and moving service of dedication by the Lord Bishop of Maidstone was beautifully photographed, with superb sound reproduction of choir and organ and a reverently spoken commentary. The ceremony of the handing-over of the Royal Air Force Books of Remembrance was smoothly followed in the presence of a large congregation, including H.R.H. the Duchess of Kent, and the ritual was simple yet impressive. There were pleasing shots of the choir, with strong back-lighting of a bright Sunday morning through the church windows.

Ritual

The following Sunday morning another fine religious outside broadcast took place when Westward Television (in co-operation with Southern Television) took viewers to a service at Buckfast Abbey. This remarkable community of abbots, priests and monks completed the building of the abbey only twenty-four years ago on the site of an ancient Benedictine settlement, and though it is modern in many ways, the ritual of the service was traditional, closely followed by strategically sited cameras and microphones under the direction of Berkeley Smith. Close-ups of the monks carrying out the devotions of high mass were impressive, every detail of the symbolism being explained in the restrained commentary by Monsignor G. A. Tomlinson. Long shots of the abbey were particularly impressive.

This kind of Sunday morning offering adds much to the prestige of ITV generally.

Colour

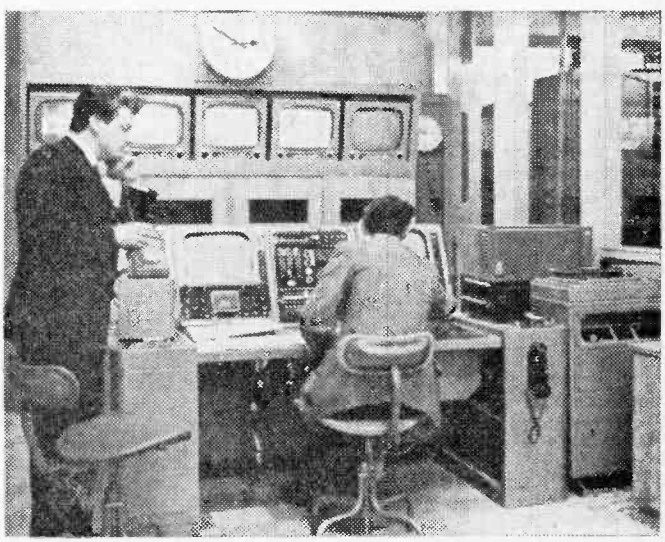
Certain newspapers are campaigning for colour television in Britain as soon as possible—if not sooner. I sometimes wonder if the people who so ardently write about the necessity for colour television would be prepared to give financial backing to a colour television service at the present time. Certainly, the major technical problems have been overcome to a large degree, excepting the cost and reliability of mass-produced sets.

Somebody remarked recently that even in America, where colour television has been operating for two or three years, it is desirable to have a receiver with a "built-in" maintenance man to keep a colour set in adjustment! Just how much money has been sunk in initiating and maintaining the colour television service there up to now I would not know, but it must be millions of dollars.

In Britain, we are still wedded to the 405 line standard and our BBC and ITV networks are largely based upon co-axial cable distribution designed for this standard. On the Continent and in America, microwave links are the accepted method of distribution, already set up for 625 or 525 line standards, which makes a change-over to colour far easier.

Timing

There are some peculiar quirks of programme timing on



The master control of the Westward TV studios. From here there is a good view of the studios through the windows on the right.

both BBC and ITV networks these days. Cowboys and Indians and the "horse operas" of the Wild West are popular items with children as well as grown-ups, but some of the more recent series have been marred by scenes of violence, whippings and stabbings which would not have been tolerated by the British Board of Film Censors a few years ago. They might even make Lord Morrison, chief censor, flinch now.

Well-produced dramas, excellently staged and photographed, make good television material for late evening. "Cheyenne" is a case in point. But for the fascinating adherence to the stock situations originally created in the silent film days of Essanay's Bronco Billy, give me "Lawman", with John Russell as the wooden-faced marshal, Dan Troop.

There is nothing very original about the stories in this series and the outcome of almost every situation can be anticipated; yet the production is so excellently carried out that one's interest is not merely held—it is gripped. The introduction of the very young deputy sheriff, Johnny McKay, is a gimmick that hasn't been used for some years and undoubtedly gives additional appeal to teenage viewers. Much of the technical polish of this series is due to first-class film editing of picture and expert dubbing of music and effects. "Lawman" is on my list of "musts".

Vintage Films

I must say that I thought Associated Rediffusion were scraping the barrel a bit when they put on "Forty Second Street", one of the earliest American musical films, starring Ginger Rogers, George Brent, Bebe Daniels, Ruby Keeler and Warner Baxter. At least, that was what I thought until I saw it again after twenty-five years or so had elapsed!

Old though it was, in style and production values, it still held attention as a robust entertainment about theatrical back-stage life; it was a film which turned out to be the prototype of so many American films with the same theatrical background. This is the original film about temperamental stage folk, and, in particular, about a Broadway producer who was facing-up to his last chance in "big time" shows, after a series of failures. When his star, played by a youthful Bebe Daniels, breaks her ankle in the final rehearsal of the show, all seemed to be lost. However, Ruby Keeler as the inexperienced understudy, steps into the part and saves the show and also the future of the producer.

The part of the producer was played, or rather, overplayed, in the grand manner by Warner Baxter—and a fine flamboyant character he gave us. This is just the kind of cast-iron role all actors long for, a part that gives them an opportunity to rant and rave in the "hammiest" fit-up manner, and get away with it!

"Forty Second Street" contained no "Method" school of acting, and in spite of an early sound recording system being used (Warner Vitaphone sound on disc as an alternative to the normal sound track) every word was audible.

Cup Tie

BBC and ITV are fighting fairly evenly in most regions for the Saturday audience, particularly in the afternoon when the BBC's "Grandstand" seems to score the highest marks in the research polls. It was interesting to watch the Cup Tie Final with BBC and ITV versions side by side on different receivers in a radio shop. I visited several radio shops that were within a few yards of one another and compared results under differing reception conditions.

On the whole, I thought the the ITV picture was better, but that the BBC had the best commentary and sound treatment. This must have been the general opinion because almost every shop put on the BBC sound to pictures from both ITV and BBC.

Both organisations covered the victorious goals by Tottenham Hotspur, with skilled following by cameras with zoom lenses. The ITV version was produced for Associated Television by Anthony Flanagan, and a fine job he made of it.

This rivalry reminds me of the days when the four cinema newsreels used to compete for being the "first out" with their films of the Derby, the Boat Race and the Cup Tie Final. At that time, if you asked anyone in Wardour Street who had won the Cup Tie Final, you would probably get the "Pathe Gazette" or "Gaumont Graphic" — whichever firm's motor cycle despatch rider, with the precious film in his haversack, turned the corner out of Shaftesbury Avenue. So far as this year's Cup Tie Final is concerned, I would say it was a 1-1 draw between the BBC and ITV, with "sound" scoring for BBC, and sight" for ITV.

Letters to the Editor

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

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

LINE CONVERSION

SIR,—I read recently, in the daily Press, that a German engineer had developed a unit which would enable any receiver, no matter for what line system it was designed for, to be converted to any other line system. Perhaps you could print some details, or one of your more knowledgeable readers could enlighten us as to how such a scheme can be used. It does not appear possible to include any form of electronic device in a set to change the line data, and I feel that this is another case where a non-technical journalist has been either hoodwinked or has misunderstood what has been told to him. I think I am right in saying that the European transmissions are radiated to us in this country by the simple expedient of having two sets facing each other, one receiving the Continental transmission, and the camera opposite then picking up the received picture and retransmitting it to us.—R. E. BRIGDEN (N.W.).

AERIAL MATCHING

SIR,—I recently had an aerial installation put up by a local service-man, and it consisted of two separate aerials with a single down-lead. Results were fair, but I did not think they were the best which could be obtained. I decided to experiment, and after trying two separate leads and finding these were capable of much better results, I decided to try to make adjustments at the single lead receiver end. I found that odd lengths of coaxial played a vast part in the signals received. I finally got best results with two feet of coaxial, and I feel that there is some grounds for this and should be glad if any readers could let me have some data on the way this arrangement works. It does not seem to be the standard type of matching stub.—R. TRENT (Swansea).

TRANSISTOR TV

SIR,—Many transistors have now been available for a considerable time, and all these different types would appear to make it possible to design a television receiver round them. Why has no set manufacturer yet brought out such a receiver? Is there some major snag? The overall size is controlled by the actual tube, but the weight, and also the generated heat could be greatly reduced by a transistor arrangement, and I think it is time one of the firms did something in this connection.—R. E. BURTON (Cardiff).

TELEVISION PROGRAMMES

SIR,—During a discussion at our works club the other day a most interesting thing developed as a result of an argument. It transpired that so far as we can trace there is not a single television programme on the air! This does sound a rather dramatic statement, but during our discussion we came to the conclusion that this is, in fact, the case, and when you consider all the programmes that are radiated you find that the majority are just sound programmes, put on TV without any modification, or they are stage or film plays. We could not find one programme that was pure TV. It is true that some of the film and stage plays are entertaining, but they are produced in the former case with the large screens in mind and mass entertainment audiences—not for a small screen at home. The plays also, are originally written for large audiences and pauses to permit laughs etc., are worked in. But we had to admit that we could not think of anything ourselves which would be pure TV.—R. G. HALCROW (Perth).

HEADPHONES AND TV

SIR,—I recently had a relative staying with me who was very hard of hearing, and we had to have the set turned up very loud. I tried to find a way to include headphones in the set, but thought it might be risky on account of the fact that it was an A.C./D.C. set. I finally carried out what I think was a simple modification and should be glad to hear whether there are any snags to the idea. I found an old broken B9A valve in my spares box, and I removed all the glass leaving the supporting wires intact. To these I attached a short piece of dowel and a B9A holder and tracing out the electrodes in the valve in the set, I wired an ordinary output transformer so that it would come in at the anode circuit of the first L.F. stage. I included it in series with the normal anode load-resistor. To the secondary I wired two lengths of flex and took these to a small paxolin strip mounted on the side of the cabinet and over this I screwed a lozenge box as a screen, and to prevent accidental contact with the terminals. The headphones are joined by long leads (low-impedance) and are thus not overloaded, and give just the right strength of signal without the rest of the viewers being deafened. The inclusion of the transformer primary has not affected the signals so far as I can trace. The original valve is inserted in the holder mounted on the top of the dowel. I hope the idea will be of interest to others.—F. R. TREWEN (Colindale).

OLD TUBES

SIR,—I have read one or two articles in your magazine, in which one is told to rejuvenate an old tube which is nearing the end of its useful life by running it from a transformer which has the function of driving the heater at a percentage above its normal rating. I was told some time ago of another idea for carrying out the same purpose, only in this case it was to be used with a tube which had passed beyond the stage at which the above-mentioned arrangement was carried out. Here one had a tube which had practically given up the ghost entirely, but a new spell of activity could be obtained by driving the heater at very much above its rating. The idea, as it was explained to me, was to take a D.C. source of over 100V (an H.T. battery for instance) and to attach two leads to the positive and negative ends. A clip was fitted to one of these ends which was then clipped on to one of the heater pins of the old tube. The remaining wire was then taken (the covering of course being removed to expose the bare wire), and this was then very carefully held and swept across the exposed tube base pins so that it made, very momentarily, contact with the remaining heater pin. This application of a high voltage for an infinitesimally short time was supposed to burn off the deposit of the heater and rejuvenate it. Has somebody been pulling my leg, or is this a legitimate "trade secret"?—D. E. WINNINGTON (Bradford).

A READER'S THANKS

SIR,—I suppose you often receive brickbats from dissatisfied readers, but for the first time in my life I am writing to the editor of a magazine, and this time it is with a word of thanks for a recently published servicing article. My set had failed and a local man had looked at it and suggested it was time I bought a new set, but soon after this your magazine appeared and I saw the article on my set. I tried it with much trepidation, and you will be glad to know that as a result I found the fault, which cost me 7/6 to repair, and the set is now working as good as ever. I cannot resist saying "thanks" as we now have the "old faithful" and are quite an appreciable amount in pocket.—R. E. BATES (Southampton).

LINE SCANNING AND COLOUR

SIR,—I cannot see why the Pilkington Committee has to be quite so long-winded in their decision about line definition for colour television. After even a number of meetings and discussions on the matter, I would have thought that the ultimate outcome can be simply a Yes or a No on 625 lines, and as quite good pictures are received on 405 lines I see no reason why the same can't apply with colour. For heaven's sake let's have a decision now, not next year.—K. R. CRASKE (Lincoln).

A Nuvistor Band III Pre-amp

(Continued from page 518)

than those in the output circuit. However, alterations to the setting of the core of L2 *must* be followed by alterations to VC1 and VC2.

The adjustment procedure is long to set out, but is quite easy once initial adjustments have been tried.

Curing Mis-Match

Note that if there is a mis-match between the receiver input and the output of the pre-amp, then the length of the cable linking them may influence results — try increasing or decreasing its length. It is also worth remembering that low-loss downlead is essential — in areas of weak signal, more than half of the received signal may be lost between the aerial and the receiver.

It is hoped shortly to describe another pre-amp which will cover Bands I and III (BBC and ITV) and as soon as development work and field tests are complete, full constructional details will be given. ■

COIL DETAILS

L1 : 3 turns of tinned, or silver-plated, copper wire (the *single stranded* wire sold as "earth" wire is very suitable). The turns are spaced by the diameter of the wire and the coil is wound on a $\frac{3}{8}$in. former which is then removed. One end of the coil is left long for soldering to the common earth tag. The aerial tapping on to L1 is arranged to give optimum results during the alignment of the unit.

L2 : primary—$4\frac{1}{2}$ turns of tinned copper wire (about 22s.w.g.).
secondary—3 or 4 turns of DCC copper wire (about 34s.w.g.) positioned at the VC1/VC2 end of the primary.
Note: As mentioned in the text, L2 is wound with a diameter of about 5/16in.—larger than that of the former used which serves to accommodate the dust-core, rather than to support the coil. This is to enable the H.T. feed easily to be tapped on to L2 at the position.
The number of turns on the coils may have to be altered to secure best results, but the above data should be used for initial experiments.

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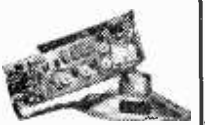

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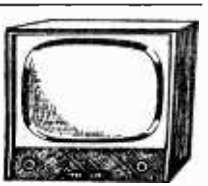

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Trade News

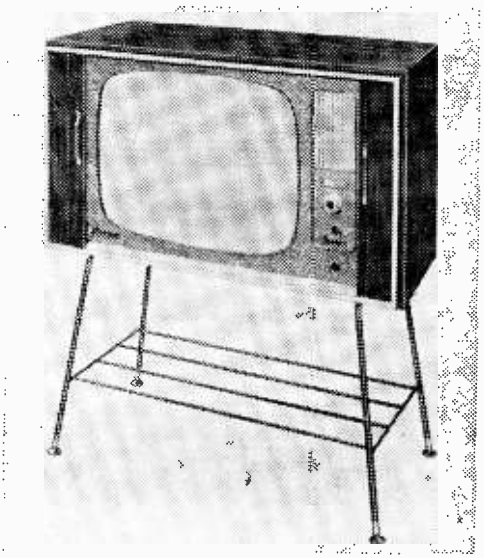
New Range of Receivers

SEVERAL new television receivers are now available from Pam Radio and Television Ltd., including Model 120A, a 19in. receiver featuring automatic tuning and a remote control unit which permits the viewer to select the channel and to adjust the brightness and volume from a distance. This model has sliding tambour doors which cover the control panel and the screen when the receiver is not in use.

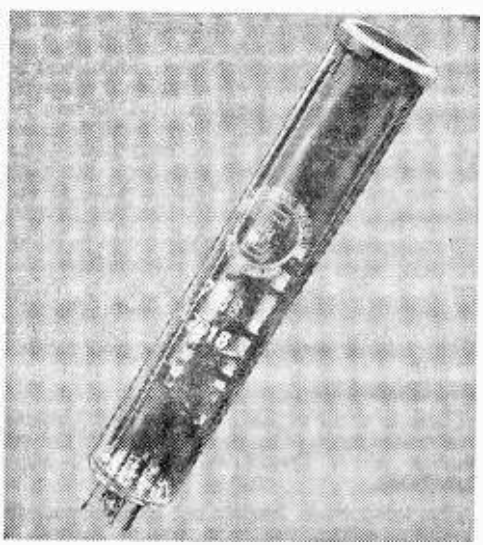
Also from the new range of receivers is the Model 119A which features a 19in. 110° tube. Available with this model—and with Models 120A and 123A—at a cost of 2 guineas, is a slim metal stand which is intended for part use as a magazine rack.

Model 123A is a 23in. model (110° tube) which is finished in a high gloss walnut veneer, with a contrasting facia.

All of these three models feature transistorised sync stages and printed circuit chassis. The Model 120A costs 79 guineas, the 119A costs 69 guineas, and the 123A costs 82 guineas. These receivers are made by *Pam Radio and Television Ltd., 295 Regent Street, London W.1.*



The Model 120A television receiver made by Pam Radio and Television Ltd.



The 7038 Vidicon television pick-up tube which has recently been introduced by the English Electric Valve Co. Ltd.

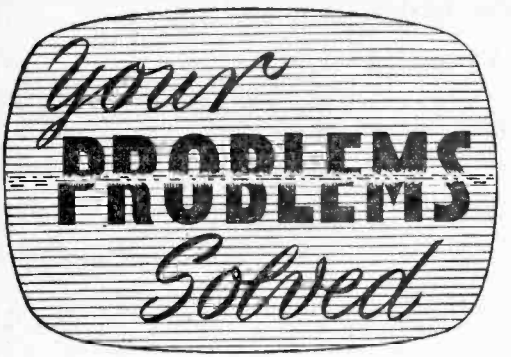
110° TV Components

A NEW range of 110° television scanning components has recently been introduced by Direct TV Replacements Ltd. The 110° Line Output Transformer, Type AL is primarely intended for use with the Mullard 110° cathode ray tubes—AW43/89 and AW53/89. The transformer is of the desatuated type. Suitable valves to be used for the circuit are ECC82 for the line oscillator, PL81 for the line output, PY81 diode and EY86 EHT rectifier.

Type BL is similar to the type AL, but is designed to work in conjunction with Mazda valves and cathode ray tubes. Both these transformers are made by *Direct TV Replacements Ltd., 138 Lewisham Way, New Cross, SE14.*

Vidicon Pick-up Tube

THE 7038 Vidicon television pick-up tube has been introduced by the English Electric Valve Co. Ltd. to meet the increasing diversity of vidicon applications. This tube is sufficiently comprehensive in design for it to be used in film scanning, studio broadcasting and industrial applications, where several specialised tubes have been used previously. The 7038 has a resolution capability of approximately 600 lines in the centre of the faceplate, and a uniform photoconductive layer is used as the light sensitive element. The Vidicon tube is manufactured by *The English Electric Valve Co. Ltd., Chelmsford, England.*



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. 536 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

COSSOR 938

How can I convert this set from flywheel sync to direct sync? This set has suffered from line jitter from when it was first installed. The overall gain of the set is inclined to be low. All vision valves and voltages have been checked and are in order.—J. Hammond (Malton).

Our own method of disconnecting the flywheel sync is to earth the anode (pin 6) of the ECL80 coincidence detector and take a suitable value of condenser from the triode anode (pin 1) to the second triode grid of the ECC82 line oscillator. This is the grid to which are connected 220pF and 220k components. A suitable value to begin with as sync coupler is 10pF. Low gain may sometimes be overcome by fitting a frame grid 30L15 in place of the present PCC84 (7AN7) carefully retuning the preset condensers along the top of the tuner.

G.E.C. BT1252

Whilst the picture on ITV is quite steady, on BBC it is completely distorted. Now and again on a close-up it is clear, but apart from that it is broken up to such a degree that we are unable to decipher what the picture actually is. We have an outside aerial for BBC and also an outside aerial for ITV.

Another fault is the height—the picture is continually contracting; we can alter this by adjusting the height control, but it soon slips again.—W. Ellis (Sheffield 6).

Adjust the Band I oscillator trimmer on the tuner unit for loudest sound. Adjust the aerial and R.F. trimmers for optimum picture, then readjust the oscillator for minimum sound on vision. The slipping is probably due to the fact that the set is mistuned and should be clear when it is retuned.

MURPHY V230

I have had this set for 4½ years and the only replacement has been a U801 twelve months ago. Recently the picture disappeared except for a 2in. band at the top of the screen which was broken up into lines—the rest was black. All valves except the U25 have been checked and the 20P4 has been replaced. The sound is still working but a bubbling noise can be heard when the sound is turned down.—J. Thompson (Canning Town, E16).

Your symptoms indicate mains hum on picture and sound. Check the 500mA fuse and the main electrolytic smoothing block, and if neither of these components cause the fault suspect a heater-cathode leak in one of the tuner valves. This may not show on a tester and rotating the fine tuner should vary the depth of the hum.

PYE V14C

The picture on this set has suddenly developed a fault exactly as shown in one of your "Servicing" articles. The picture has become distorted and it shakes from time to time across the screen. I cannot trace any magnetised object near the set and the picture reverts to its normal steady and proper picture at intervals.—E. Brazel (Swansea).

Your trouble is not likely to be caused by magnetisation as this would produce symptoms which did not move from their initial position. Suspect instead the sync separator and line oscillator stages, which are the two PCF80 valves at the top of the chassis either side of the focus assembly. The one nearest the postage stamp trimmer is the line oscillator, and the other one is the sync separator, and this latter may on some models be a PCF82 instead of a PCF80. Should replacement of this pair not cure your fault, a progressive check of the sync stages with a 'scope and service sheet is the most rewarding course to take.

EKCO T342

I have had this set for nine months but recently the following fault occurs: after switching on, the picture is perfect for about four minutes and then commences to break up vertically, as if the vertical height or hold needs adjusting. A slight manipulation of the height control always rectifies matters. But I have to do this every time now. I may add that if I am patient and leave the picture to jump about for about half an hour or so, it automatically rights itself.—G. Brackher (Beeston).

We suggest that you check the 30P13 frame scan generator valve, which is on the right of the printed panel. If this valve is satisfactory try replacing the 2μF and 500μF frame timebase decoupling condensers housed in a common can in the middle of the printed panel, but on the opposite side.

FERGUSON T103

There is slight sound on vision and I presume a valve is at fault. Can you please quote the valve number which should be tested.—R. Malpas (Aylesbury).

This symptom is possibly not caused by a valve. Carefully adjust the fine tuning control for maximum sound consistent with minimum sound on vision. If this cannot be achieved by adjustment, turn the volume control to minimum and if

trouble persists have the turret oscillator coil adjusted to provide maximum sound consistent with minimum sound on vision when the fine tuning control is set at mid-position. We suspect microphony in the frame amplifier valve is the cause and if so, turning down the volume control will eliminate the fault.

REGENTONE 14T

All the valves in this set are in good condition but there is little or no spark from 6X2. On switching on, the picture and sound are all right but, after a moment or so, the 6X2 goes out and there is no picture. Also the PL81 (21A6) becomes red hot internally.—A. Prentice (Motherwell).

Change the PL81 and if necessary the V9 ECL80 line oscillator. If the trouble persists replace the 300pF capacitor wired from the drive control to chassis and check the 750pF. Disconnect the EHT lead to check the tube.

FERRANTI 14T5

With a full screen, the picture is good. But when switching on in the evening it shows a raster only, with flyback lines and no picture. The flyback lines are stationary. Also, whilst this condition exists, the brilliance control is ineffective whichever way it is turned. I may have to remove the set from the case as the volume control is very noisy. Could you please advise me how to do this, particularly the focus control knobs in the front as they seem to resist any normal efforts to remove them.—J. Pearl (East Dulwich, S.E.22).

The tube is apparently at fault with a heater-cathode short (check the EB91 noise limiter also). This will necessitate fitting a 6.3V isolating transformer to supply the tube heater separately. The front knobs pull off but if they are stubborn, remove the two rear P.K. screws and the speaker plug and pull out the chassis. This action will push off the front knobs.

PAM T954

The picture is ragged around the edges of figures on the screen, and if I brighten the picture it bends to the left. The hold control is at the limit. I have fitted a new PL81, but this has made no improvement.—R. Daniels (Cumbran).

If the ragged edges are not due to insufficient signal (aerial input and first stages are in order) and the effect worsens when the brilliance is increased, change the EY51 which may be passing A.C. If this does not help, check the electrolytic capacitors, 12μF, as well as the main smoothers. Check the 5·6k 1W screen resistor from H.T. to the PL81 pin 8 winding of the oscillator transformer.

AMBASSADOR 17in.

There is no picture or sound on this set, but there is a good raster indicating that there may be some trouble with the input.—C. Cook (Rugby).

Assuming the receiver is a model TV17, we would suggest you replace the 30C1 (PCF80) valve in the tuner unit. Also check the 30L1 (PCF84).

COLUMBIA C506

I wish to add a tuner to this receiver. What type of tuner would be best to use and what are the I.F.'s? The tone of this set is not very good. I checked the output valve ECL80. Could the trouble be in the bias of the output valve?—R. Brown (Macherafelt).

The Columbia C506 has an I.F. of 16Mc/s-19·5Mc/s. The Cyldon P16M or Brayhead 16s turret tuners are directly suitable and some of the surplus 16-19Mc/s tuners can be adapted. Poor sound should direct attention to the loudspeaker and to the noise limiter diode wired from pin 1 of the ECL80 (check pin 1 resistors, etc.).

SOBELL SC24

On this receiver, there are a series of light vertical bands on the left hand side. Can you suggest the cause of the trouble? Unfortunately, I do not possess a circuit diagram.—T. Plant (Romford).

A 0·1μF capacitor decouples pin 3 of the CRT base and this is wired from the 470k boosted H.T. line resistor to the normal H.T. line. Check it by shunting with a similar capacitor.

INVICTA 123

For some time there has been an up and down vibration of the picture (just enough to make everything double). I have replaced the frame oscillator valve and also the frame output valve but it has made no difference. Lately, the picture does not fill the screen as there is a space at the top and bottom which no manipulation of the frame amplitude control or the line linearity control can put right. If I alter the frame control the picture seems to stretch up but instantly shrinks back.—D. Hutchinson (Oxford).

If you are sure the ECC82 and PL83 valves are not at fault, check the 2·2M resistor from pin 6 of the ECC82 to the vertical amp. control. Check the 1μF decoupling electrolytic of the height control, the 2·2M grid leak resistor of the PL83 and the linearity capacitors. Also check the V311Y interlace diodes and the associated filter capacitors 220pF, 0·001μF, etc.

WHITE IBBOTSON 2015

The above set has developed electrolytic trouble in the H.T. circuit; none of the large cans give any indication as to what capacity and voltage working they are as the chassis is isolated and the H.T. rectifier is a pair of GZ32 valves.—W. Laine (Angus).

The electrolytics are two cans of 60+100μF 450VW (all large can electrolytics have adequate ripple current rating). The original version had one of the above cans rated at 450VW and one at 350VW but we prefer to fit 450VW rating in both positions.

BUSH TV24

This set has not been in use for some months. It was in perfect working order when it was put away, but I can now obtain sound only. I had the vision and sound demodulator valves tested (EB91), one of them had low emission so I replaced it.—A. Tyson (Manchester).

The trouble is probably in the line output stage. Check the PZ30 and PL38 valves in the top right

screened section (removed when lid and rear p.k. screws are released). Note whether the line whistle is audible or not and whether the EY51 on the line output transformer lights up. If the PL38 is very blue inside, check the hold control (over the brilliance control) at the front.

ELECTRONIC ECV1527

There is good sound on this set but no picture, just a bright white line ½in. wide, horizontal across the centre of the tube. When switching on the set, V8, a 6AL5, lights up very brightly for a second or two.—N. Connell (Ashton).

You should check both of the 7C5 valves, the continuity of the frame output and blocking oscillator primary windings. Check H.T. to pin 2 (linked to 3) of the output 7C5 and to pin 3 of the oscillator 7C5. Also check H.T. to pin 2 of the latter base as the frame size (height) control could be o.c. Check the scanning coils if necessary, and also the frame hold control, etc. The bright light from the 6AL5 is not a fault.

ALBA 324

The picture on this receiver is very much stretched on the left-hand side. Although it can be improved by means of the horizontal form control it also introduces severe striations of light bars almost half-way across the screen. The line output valve and efficiency diode (PY81) have been checked, the screw fixed to the line output valve has also been checked. Which coil needs to be adjusted to reject vision on sound; L9 or L12? —J. Horner (Clapham, S.W.4).

You should check the 10k 3W resistor wired across the horizontal form coil. This is probably o.c. There is no vision rejector coil. The sound I.F. coils are peaked for maximum sound at 38Mc/s. Check the 0·001μF decoupling capacitors (from pin 8 of the EF80 valve bases) by shunting each with a similar capacitor.

PHILIPS 115 U-15

Although the frame hold is full clockwise, I can only steady the picture by turning both brightness and contrast controls right up and of course the picture is useless. Before this trouble started, I noticed that the picture jumped a couple of frames whenever the scene was changed or a dark scene appeared, even someone with black hair on the screen caused this effect. All the valves have been checked and found to be in order. Is it safe to check capacitors by bridging suspect ones with a good one?—L. Litchfield (Nottingham).

Check the 1M resistor situated under the chassis near the connecting socket. This is wired from the hold control to the frame blocking oscillator transformer. Check the 0·015μF decoupling capacitor in the supply to the control and the electrolytic capacitors associated with the video amplifier under the rear of R.F. chassis (10μF and 100μF). Capacitors may be checked by shunting a near value across each in turn, e.g. 8μF to 16μF for testing the 10μF and 32μF to 100μF for testing the 100μF.

REGENTONE 17T

Since fitting a new tube to this set there has been bad streaking on white pictures. When white titles are shown on the screen they are accompanied by a black line. It is possible that this condition existed with the old tube but the picture was so dark that it was not noticed?—P. Vine (Coventry).

Check the components associated with the centre EF80 valveholder including the small crystal diode which connects via a 1k resistor to pin 2. The 6·8k resistor to pin 7 and the cathode components including the 250μF electrolytic should be suspect. Note effect of disconnecting pin 1 of the EB91 (noise limiter). Check the 16μF which decouples pin 8. This is part of a double capacitor under the chassis in front of the metal rectifier, but is best checked by shunting pin 8 to chassis with a test capacitor.

BUSH TV24C

This set is not very old. When it is first switched on it is satisfactory for about half an hour then a low buzzing noise is heard from the loudspeaker. This increases over a period of about half a minute until it completely distorts the sound. The horizontal and vertical holds slip and the picture drops and disappears. On slight retuning of the oscillator control, the sound can be obtained again with the buzzing superimposed as previously, and a distorted picture can be returned for a period of about 15 seconds. Then the fault returns again. —N. Payer (Thorpe Bay).

First try the effect of a new PCF80 valve in the tuner. This is the left side valve on the lower deck as viewed from the rear. Check by replacement the PCC84 to its right to be sure. Then try the effect of connecting a fairly high value smoothing capacitor (say 60 to 100μF) across the H.T. line. The EF80 valves could be responsible but are less likely to be at fault.

FERRANTI 14T3

On ITV the Band III contrast is full up and on Band I half-way. On switching on, the picture is fine but after about three minutes it disappears leaving a dark screen. There is no change in the picture size. If the Band I contrast control and brightness controls are turned fully up, the picture is reasonable, but not as good as normal. When the aerial is removed, there is no raster and the screen is still black, even with the brightness control fully up. —A. Norman (Crawley).

The symptoms suggest a short in the heater element of the tube. Sharply tap the base end of the tube neck and note the effect. Whether or not this has any effect, the only real remedy is to replace the tube.

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(Continued on facing page)

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6J6	5/6	80	9/6	EM84	9/6	UY41	8/6
6J7G	6/6	807	5/6	EZ40	7/6	U22	8/6
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BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
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