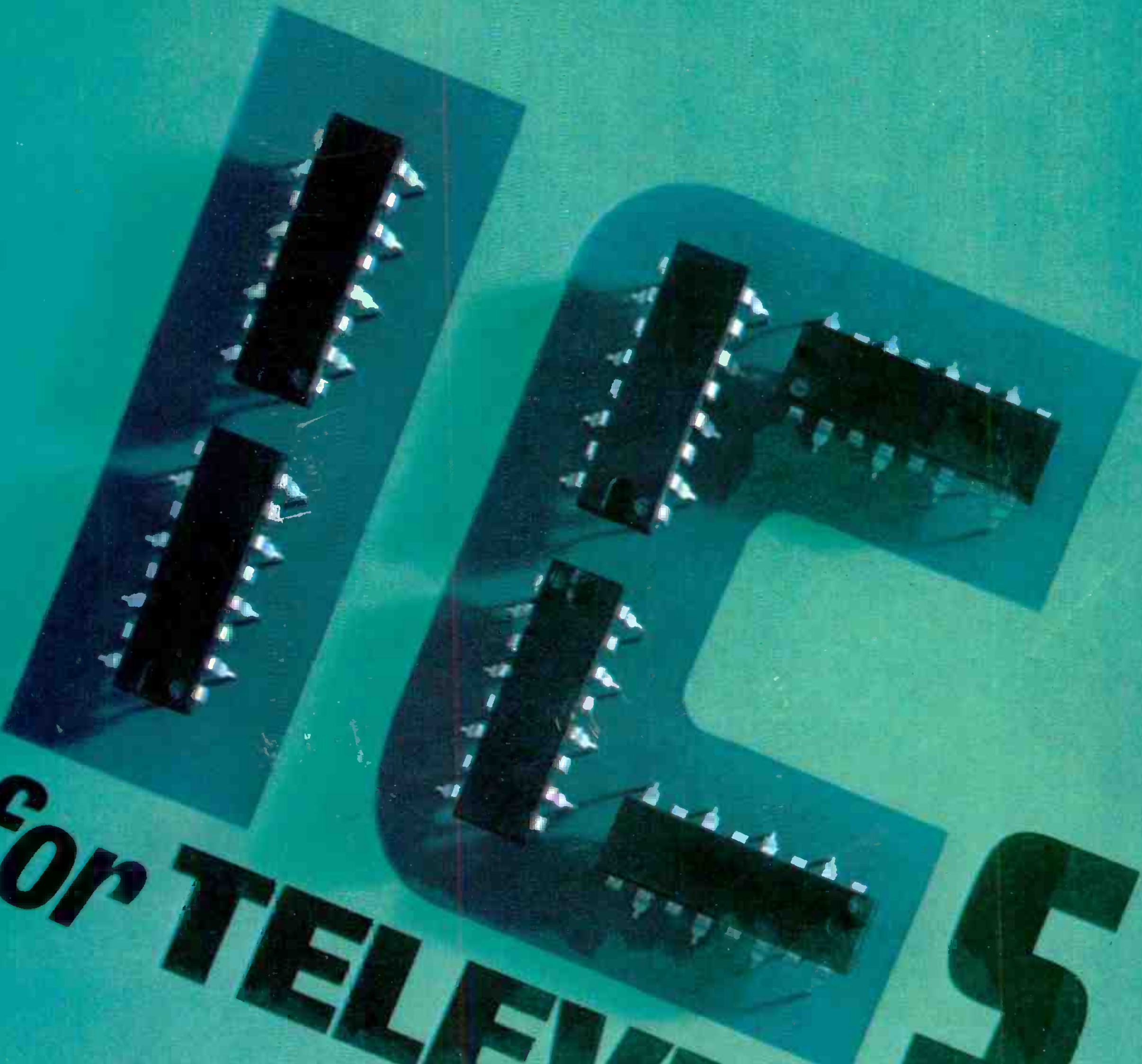
TELEVISION

20p

SERVICING · CONSTRUCTION · COLOUR · DEVELOPMENTS

SEPTEMBER 1971



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·033	600v.	£0·05
·047	600v.	£0·05
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·47	600v.	£0·14
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25	,,	£0·09
33	,,	£0·09
50	,,	£0·09
87	,,	£0·09
100	,,	£0·09
150	,,	£0·09
220	,,	£0·09
330	,,	£0·09
1K	,,	£0·09
2·2K	,,	£0·09
3·3K	,,	£0·09
4·7K	,,	£0·09

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120pf	47pf	£0·06
180pf	68pf	£0·06
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3000pf	180pf	£0·03
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1000mfd	30v.	£0·30
2000mfd	25v.	£0·35
2500mfd	30v.	£0·45
3000mfd	30v.	£0·47
5000mfd	30v.	£0·55
25mfd	50v.	£0·08
50mfd	50v.	£0·10
100mfd	50v.	£0·13
250mfd	50v.	£0·18
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4mfd	£0·11
8mfd	£0·13
16mfd	£0·16
32mfd	£0·23
50mfd	£0·25
8/8mfd	£0·19
8/16mfd	£0·25
16/16mfd	£0·26
16/32mfd	£0·27
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50/50/50mfd	£0·52

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100/200mfd	£0·63
100/400mfd	£0·83
200/200mfd	£0·85
200/200/100mfd	£0·95
200/400/32mfd	£0·95
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100K	,,	£0·07
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500K	,,	£0·07
1 meg	,,	£0·07
2 meg	,,	£0·07
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1 meg	,,	£0·07

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1mfd	18v.	£0·09
2mfd	18v.	£0·09
4mfd	18v.	£0·09
5mfd	18v.	£0·09
8mfd	18v.	£0·09
10mfd	18v.	£0·09
16mfd	18v.	£0·09
25mfd	18v.	£0·09
32mfd	18v.	£0·09
50mfd	18v.	£0·09
100mfd	18v.	£0·09
200mfd	18v.	£0·09

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Miniature	£0·08
TH1	£0·13

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1 amp, 1·5 amp, 2 amp, 3 amp.
Per dozen £0·15

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2 amp, 3 amp, 5 amp, 13 amp.
Per dozen £0·25

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2 amp	£0·12
5 amp.	£0·14
15 amp	£0·29

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BY327	£0·25

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Single point (car radio)	£0·10

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2·2 Meg	£0·08

JACK PLUGS

Chrome standard	£0·20
Standard	£0·15
3·5mm. metal	£0·15

DIN PLUGS (2's)

3-pin	£0·10
5-pin	£0·11
Sockets	£0·06

CARBON FILM RESISTORS

¼ watt, 1 watt and 2 watt.

The following values are packed in cartons of *six of each value*.

10	ohm	1·2K	150K
12	,,	1·5K	180K
15	,,	1·8K	220K
18	,,	2·2K	270K
22	,,	2·7K	330K
27	,,	3·3K	390K
33	,,	3·9K	430K
39	,,	4·3K	470K
43	,,	4·7K	560K
47	,,	5·6K	680K
56	,,	6·8K	820K
68	,,	8·2K	1M
82	,,	10K	1·2M
100	,,	12K	1·5M
120	,,	15K	1·8M
150	,,	18K	2·2M
180	,,	22K	2·7M
220	,,	27K	3·3M
270	,,	33K	3·9M
330	,,	39K	4·3M
390	,,	43K	4·7M
430	,,	47K	5·6M
470	,,	56K	6·8M
560	,,	68K	8·2M
680	,,	82K	10M
820	,,	100K	12M
1K	,,	120K	15M

All the above values are available in both ¼ watt, 1 watt and 2 watt versions.
***Special for Philips TV's:**
8·2M 2-watt, 23p per pack.
Price ¼ watt ·10, 1 watt ·13, 2 watt ·23

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Bush/Murphy/BRC, etc.
Line/frame timebases etc.

3 leg	£0·31
4 leg	£0·31
5 leg	£0·31

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Without switch	£0·19

(One per pack)
5K, 10K, 25K, 50K, 100K, 250K, 500K, 1 meg, 2 meg.

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GP94/1SS. Stereo cartridge	£1·89
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High gain, plenty of output (Jap.)	£0·99
Stereo version	£1·89

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Electrolube 2GX Grease	£0·42 nett
Servisol Aero-Clene for tape heads	£0·53 nett
Servisol Aero-Duster	£0·53 nett

REPLACEMENT STYLI

TC8	£0·23
GC8	£0·23

TELEVISION

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SERVICING·CONSTRUCTION·COLOUR·DEVELOPMENTS

SEPTEMBER 1971

NO HOLDS BARRED!

The trade battle for the colour television receiver market is now really hotting up. The latest manufacturers' home delivery figures from BREMA are impressive, showing a continued acceleration. During the first five months of this year 231,000 colour receivers were delivered to the trade, representing a rise of 52% over the same period in 1970 (152,000 receivers). Deliveries of monochrome sets continue to fall—now at around the 13% level. So people are decidedly beginning to switch to colour.

Manufacturers are also now making a strong effort to fight off the threat from imported products. Examples of this awakening are the new BRC 8000 series 17in. model at a recommended retail price of only £189·75 (less than anything comparable from overseas) and the new low prices of the GEC 19in. range. These and other moves are encouraging signs but it would be foolish for the industry to indulge in premature euphoria. RBM for instance have introduced a new monochrome portable (the TV300) which is being built in Japan, presumably working on the principle of "if you can't beat 'em, join 'em". And coming fast on the news of the BRC 8000 colour chassis with its advanced solid-state design with 41 transistors, 3 i.c.s and other features, and bearing in mind the Philips 520 with its 5 i.c.s, we learn that Toshiba have developed a 20in. colour receiver in which 75% of the circuitry has been accommodated in no less than 15 i.c.s. The secret of this design is said to be a technique which makes it possible to manufacture i.c.s with superior linear operating characteristics and low noise figures.

At the moment the situation is developing into a gigantic game of leapfrog or industrial one-upmanship. Competition is a stimulus of course and keeps manufacturers on their toes but the vicious atmosphere which is becoming part and parcel of modern commercial life can react against the interests of the consumer by way of shoddy products—as it can be seen to have done in many industries already.

Let us hope therefore that the colour TV battle, which is now joined, will not result in a lowering of the high standards to which we have become accustomed.

W. N. STEVENS, *Editor*

THIS MONTH

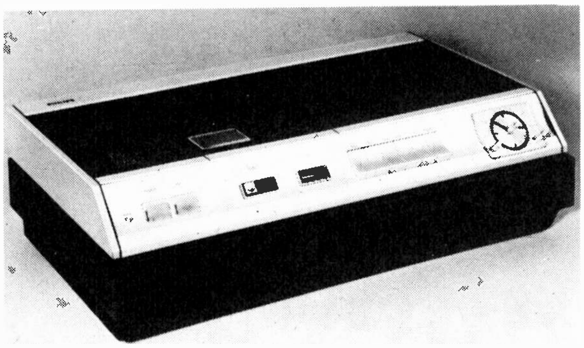
THE NEXT ISSUE DATED OCTOBER WILL BE PUBLISHED SEPTEMBER 22

Cover: Grateful acknowledgements this month to Mullard Ltd. who provided us with the TV i.c.s shown in our cover photograph.

TELETOPICS

FIRST VIDEOCASSETTE RECORDER

Philips have announced preliminary details of their videocassette recorder Model N1500 which is due for release towards the end of this year with full-scale production starting next year. The recorder contains a built-in tuner unit so that recording can be done automatically on plugging in an aerial. In this way the viewer can record and watch his ordinary TV set at the same time. The recorder contains a u.h.f. modulator to enable its output to be played back via the aerial socket of an ordinary TV set. Fully compatible recordings can be made in colour or monochrome and the UK version will be to the PAL standard. There is no reduction in playing time for colour. The whole unit will cost around £280 with 60-minute blank cassettes costing about £12 each.



The Philips N1500 videocassette recorder.

DIFFICULT UHF RECEPTION

Writing in *Electrical and Electronic Trader* recently B. Sykes, Group Chairman, J Beam Aerials Ltd., comments on u.h.f. reception problems in what he calls "diffused-signal areas". These are poor-signal areas where the symptom is found that no improvement can be obtained with a high-gain Yagi in comparison to a much smaller type of aerial. The geographical situation is that a hill obscures the direct signal path from the transmitter, the only signal available consisting of reflected and diffracted signals arriving from different directions and in different phases. The basic conundrum is that because of the diffuse nature of the signal, increased aerial gain cannot be obtained by using a narrow-beamwidth aerial, i.e. as already noted a high-gain Yagi does not improve matters. A solution however is to reduce the vertical aerial beamwidth while leaving the horizontal beamwidth wide. This can be done by using two aerials stacked vertically: when two identical aerials are stacked vertically the horizontal beamwidth is unaltered but the vertical beamwidth is halved and the gain doubled. The J Beam Multibeam aerial of course uses a configuration of vertically stacked director elements and is suggested as a help in such situations. B. Sykes continues: "As much as a three-to-one variation in signals between channels using a single, flat Yagi, with one or more channels completely useless, becomes almost identical signal strength on each channel when the Multibeam is used. Further gain can be obtained by stacking two Multibeams vertically but any attempt at horizontal stacking with the consequent reduction in horizontal beamwidth produces no improvement in gain whatsoever."

ADVANCES IN ICs FOR TV

Plessey Microelectronics have announced that they have succeeded in squeezing the entire chroma signal processing circuitry for a PAL colour receiver into just two i.c.s—most other firms active in this field use some five i.c.s. to perform the same functions. The two i.c.s are now in full-scale production at Plessey's Swindon plant and we understand that the initial production will be used in Rank-Bush-Murphy sets for which they were custom designed (Plessey and RBM have been working together in this field for some time with Plessey producing the i.c.s used in RBM colour sets).

Meanwhile Toshiba in Japan has announced the development of a 20in. colour set in which 75 per cent of the circuitry is incorporated in 15 integrated circuits. The new set, the IC1, also uses 17 ordinary transistors and 49 diodes. Toshiba claim that their advances in crystal device technology have enabled them to achieve this degree of integration in a TV set.

BELGIAN TV CONDITIONS

We have received an interesting letter from a reader in Belgium who describes the very different television conditions there. He comments that DX-TV is part of the normal way of life because of the possibility of receiving extra programmes from foreign transmitters at "ultra-fringe" distances—facilitated by the relatively flat terrain and the use of common languages. The normal sets on the market are designed to operate on the French 819- and 625-line standards, the Belgian v.h.f. 625-line standard, Luxembourg 819 lines and the v.h.f. and u.h.f. 625-line standards adopted in the rest of continental West Europe, with standards switching sometimes incorporated in the channel selector, sometimes semi-automatic and in other sets by means of independent pushbuttons (so we thought *dual*-standard sets rather a complication!).

In Brussels the most popular foreign programme is ORTF-1 from Lille on ch. F8A. ORTF-2 from the same site can also be received but being on a higher channel, ch. 21, satisfactory reception—at 127km.—is more difficult. Dutch speakers can watch NOS-1 and -2 from Goes on chs. 29 and 32 at about 75km. though some are equipped to receive NOS-1 on ch. 4 from Lopik at 133km. On the higher ground in the eastern suburbs of Brussels Band IV aerials can be seen directed towards Aachen WDR-1 ch. 24 (125km.) or Monschau ZDF (ch. 21, cochannel with ORTF-2) while in other parts of Belgium other distant transmitters are used depending on linguistic interest and propagation characteristics. In Flanders rotatable aerial rigs are popular, generally carrying Band III and IV/V horizontal Yagis. Dover is received by some coastal viewers despite the low e.r.p. of this station, the offshore direction of transmission and the need for 6MHz intercarrier sound adaptors—which are available commercially to enable Belgian sets to get the UK sound signal.

There are in Brussels several municipal and private cable distribution systems which offer up to ten different programme services (ORTF-1 and -2, RTB/BRT, NOS-1 and -2, ARD-1 and -3, ZDF and Luxembourg) either on the original standards (but different channels) or remodulated to facilitate distribution and reception. Our correspondent uses a system that converts all signals to the CCIR standard B with PAL colour: Luxembourg is brought in via a microwave relay link but all the other signals are received off-air by aerials mounted on the roofs of tall buildings. Similar systems exist or are being built in other major towns and cities.

TRADE NOTES

The latest BREMA figures for TV set deliveries—for May—show the continuing rise in colour set production and corresponding now marked fall off in monochrome set deliveries. Colour set deliveries for the month at 41,000 were up by over 17% compared to the same month last year while monochrome set deliveries at 91,000 fell by over 33%.

As mentioned in our Show notes last month ITT have reintroduced the **RGD** brand: so far there are two monochrome models, the RV237 a 20in. single-standard set at £74 and a 24in. version, Model RV337, at £82·50. These sets are fitted with the ITT VC200 chassis. **Dynatron** have a remote control unit for use with their colour Models CTV9 and CTV11: we understand that this is the first time in the UK that remote control has been applied to models fitted with varicap tuners. Two **Nivico** models have been introduced by Denham and Morley (Overseas) Ltd., a spherical, rotatable 9in. mains-battery model, the Videoglobe, with visor to conceal the screen when the set is not in use, at £69·45, and a 14in. mains-battery portable model at £77.

Next year's Radio and TV Trade Shows will again be held during the spring in London, from May 21st to May 25th.

ITA's DIGITAL STANDARDS CONVERTER

The ITA's experimental digital line-store standards converter (see *Teletopics*, June 1971) was demonstrated at a recent Royal Television Society meeting. To enable the converter to interpolate over a range of four lines three line stores are used in the interpolator, each store having a capacity of 770 8-bit "words"—sufficient to store one line of video information sampled at three times the colour subcarrier frequency, i.e. 13·3MHz. The converter has been assembled from a number of basic component modules which were designed initially for the computerised monitoring equipment which forms part of the ITA's automation programme. These modules however are equally suitable for use in colour synchronisers and *field-rate* converters. The work being carried out by the ITA on conversion is the subject of several patent applications.

SOLID-STATE IMAGE CONVERTER

A solid-state device for converting optical images directly to a sequential digital output has been developed by Optonetics Inc., of Teterboro, New Jersey. The optical image is focused on to a photosensitive layer of semiconductor material. This is backed by a crossgrid of thin electrical conductors each intersection of which is addressed in turn to obtain a signal corresponding to the image brightness at that point. Using electronic circuitry to scan the entire crossgrid matrix in this way an optical image can be converted into 90,000 to 360,000 points per square inch. The crossgrid of conductors is part of a multilayer sandwich with electroluminescent phosphor laminated to the back of the photosensitive semiconductor layer. Whilst this has been developed with applications such as computer use and character recognition in mind it nevertheless shows up the possibilities that may some day lead to a radically different form of picture display device in TV.

NEW LIGHT-EMITTING MATERIAL

A new company has been set up in the UK to develop what it claims to be an important advance in the field of light-emitting semiconductor material for solid-state displays. The generation of devices about to enter the stage of large-scale production are based on gallium arsenide phosphates but the new company claims advantages in using a new material for this purpose, zinc selenide, which has an attractive band gap for light emission. New processing techniques to obtain pure zinc selenide have been developed and with the evaporation of a thin translucent layer of gold on the zinc selenide chip a light-emitting Shottky diode is obtained. The efficiency of the new material in terms of lumens per watt is apparently already comparable with the best gallium arsenide phosphide lamps while the driving voltages are i.c. compatible at 15V.

TRANSMITTER NEWS

ITA transmissions on u.h.f. from **Durris,** Kincardineshire carrying Grampian Television programmes in black-and-white have now started. The full colour service is to start on September 30th. The channel is 25, polarisation horizontal and a Group A receiving aerial is required.

The BBC has announced the start of engineering tests for the BBC-1 service from the **Sheffield** relay station on channel 31 (receiving aerial Group A, vertically polarised) and for the BBC-2 service from the **Wharfedale** relay station on channel 28 (receiving aerial Group A, vertically polarised).

PART I **K. T. WILSON**

INTERCARRIER SOUND I.C.s

Hardly have we got used to all-transistor colour receiver chassis than we find the first designs incorporating integrated circuits being introduced. This is a trend which is certain to continue in colour sets since so many of the stages are low-level pulse circuits which are readily adaptable to the use of i.c.s; the trend is also showing in monochrome receivers as the volume of production of i.c.s increases and the range of functions they can carry out also increases. In this series of articles we shall examine some of the i.c.s now available or shortly to be available for use in TV sets, how they are employed and the receiver circuitry used around them.

One of the first i.c.s to be widely used in TV sets was the Mullard TAA570 which is encapsulated in a 10-lead TO-74 casing. It is used in the Pye 169 single-standard monochrome chassis, the GEC-Sobell 2047-1047 series of monochrome sets and the Philips G8 single-standard colour chassis to carry out the operations of intercarrier sound i.f. amplification, limiting, demodulation and preamplification of the audio signal. The output of this i.c. can be fed directly to an audio output stage which requires an input for maximum delivered power of around 0.5V. Mullard suggest a Class A single-ended push-pull circuit using a BC158 and two BD131 transistors but it can also be used to drive a triode-pentode such as the PCL86.

The Circuit

The internal circuit of this complex i.c. will not be reproduced here and in any case would not be useful to the service engineer since only a few points in the circuit are accessible at the external pins. Because active stages are as easy or easier to form in i.c.s than passive components, the "circuit design" of an i.c. tends to be more complex than that of the transistor circuits which it replaces. Another factor is that cross-couplings and distributed resistance and capacitance exist which cannot be represented in a conventional circuit diagram. For these reasons we shall show the block diagrams of most of the i.c.s to be covered rather than the detailed internal circuitry.

The block diagram of the TAA570 is shown in Fig. 1 along with the associated external components it requires. The separated intercarrier sound signal at a centre frequency of 6MHz is fed to the input which presents an impedance approximating 4kΩ in parallel with 13pF. The first four stages provide amplification and limiting of the 6MHz signal, using long-tailed pair balanced amplifiers. The signal then takes two routes, one directly to a quadrature detector and the other via an external 90° phase-shift network whose output is then fed into the other input of the quadrature phase detector. The a.f. signal from the detector is de-emphasised by an externally-connected capacitor and passes to an audio preamplifier.

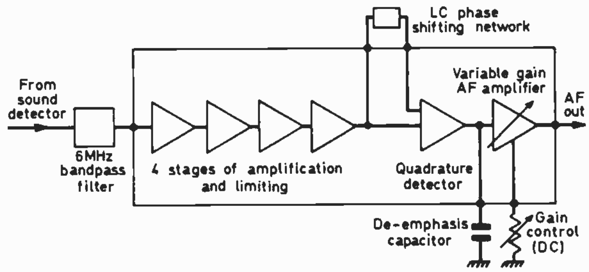


Fig. 1: Block diagram of the TAA570 intercarrier sound i.f. amplifier, limiter and detector i.c. There are 32 transistors and seven diodes in this i.c.

The gain of the preamplifier can be controlled by applying a steady voltage to this section of the i.c. (at pin 4). Alternatively audio gain can be controlled in the normal way by a potentiometer in the signal path at the output of the i.c. D.C. control of gain is particularly useful if remote control is desired, and a minimum control range of 60dB is quoted. The output resistance of the final stage is around 5·6kΩ.

Quadrature Detection

As the principle of quadrature detection of an f.m. signal is not as well known as that of the commonly used ratio detector a few notes on this will be given. The most important point about a quadrature detector

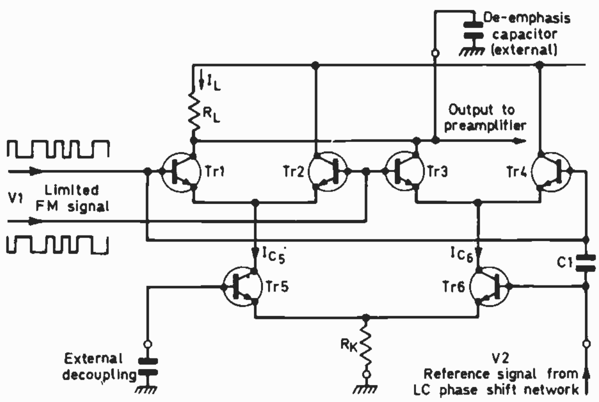


Fig. 2: The quadrature detector circuit. The external LC phase-shift network is driven by the signal fed to it via C1. The sinewave signal from the phase-shift network drives Tr6 base and by emitter-follower action appears across its emitter resistor Rk. Thus Tr6 is driven at its base and Tr5 is driven at its emitter by the same basic waveform. This of course amounts to paraphase drive and Tr5 and Tr6 provide antiphase squarewave outputs.

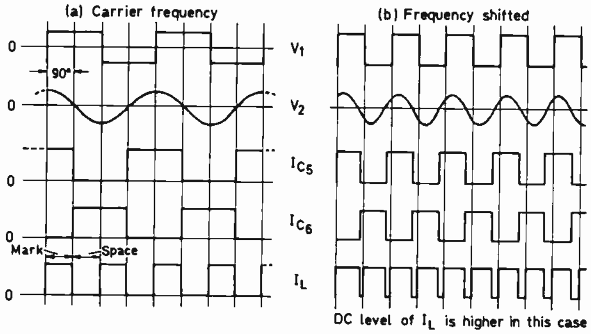


Fig. 3: Quadrature detector waveforms.

is that it uses no inductors in the signal path: this alone makes it desirable for use in an i.c. since the use of a ratio detector circuit would entail having a pin on the i.c. for each transformer connection. In addition this circuit has excellent a.m. rejection and is very easy to set up, the only adjustment necessary being to the phase-shift network which is simply tweaked until the a.f. output is a maximum (with input signal adequate to produce the limiting action).

Figure 2 shows the quadrature detector circuit used in the i.c. Tr1 and Tr2, Tr3 and Tr4, Tr5 and Tr6 are long-tailed pairs. The upper set Tr1-Tr4 is fed with the limited (i.e. clipped or squared) f.m. signal in paraphase and the lower pair with a reference sinewave signal—again in paraphase—whose phase is 90° different from the phase of the f.m. carrier. This reference signal is obtained from the external *LC* phase-shift network. Thus the inputs to Tr1, Tr2 and Tr3, Tr4 are antiphase squarewaves which are frequency modulated while the inputs to Tr5 and Tr6 are antiphase sinewaves which are *phase modulated* since the 90° phase-shifting circuit smooths out the squarewave carrier fed to it and shifts its phase as the frequency varies.

Figure 3 shows the waveforms at different signal frequency conditions. At (a) there is an exact 90° phase shift between *V*1 (the squarewave signal from the limiter section) and *V*2 (the 90° shifted sinewave). At (b) the frequency has shifted slightly (increased).

Taking the collector currents in Tr5 and Tr6 as *I*c5 and *I*c6 respectively we can see that these currents flow only when the voltage waveform *V*2 switches these transistors on; and since *V*2 is applied in paraphase the output currents *I*c5 and *I*c6 flow alternately. The signal voltage *V*1 is fed in paraphase to the upper pairs Tr1, Tr2 and Tr3, Tr4 so that *I*c5 flows alternately via Tr1 and Tr2 and *I*c6 flows alternately via Tr3 and Tr4. We can construct a table (Fig. 4) showing under what conditions current will flow in the load *R*L which is common to the collectors of Tr1 and Tr3 and we can thus predict the current *I*L in the load.

Now examine the case—Fig. 3(b)—where *V*2 has been slightly phase shifted as well as changed in frequency. Following the same procedure we can see that the frequency of the output signal has changed, and its mark-space ratio has also changed. We have thus produced a rectified signal consisting of a series

V_1	V_2	I_{C5}	I_{C6}	I_L
+	+	ON	OFF	ON
+	−	OFF	ON	OFF
−	−	OFF	ON	ON
−	+	ON	OFF	OFF

Fig. 4: Voltage and current conditions in the quadrature detector circuit.

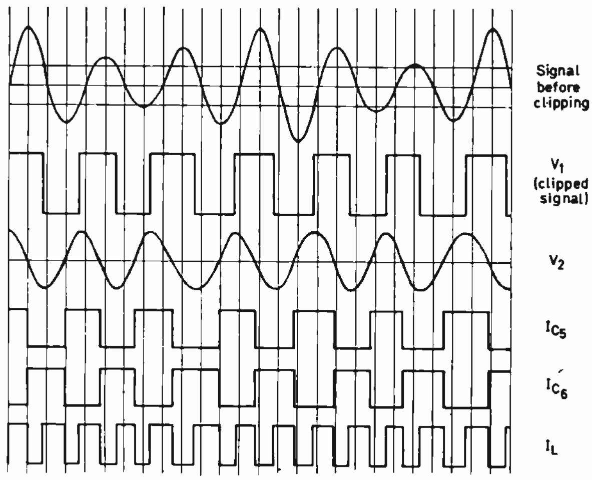


Fig. 5: The effect of amplitude modulation: although IL consists of pulses of differing widths, the spaces alter in proportion so that a constant d.c. level is preserved. In this way a.m. produces no output.

of pulses whose frequency and mark-space ratio vary as the original signal varies in frequency. The load resistor *R*L forms with the de-emphasis capacitor an integrating circuit which adds the pulses, providing an output signal which varies in amplitude as the signal frequency changes, which is what is wanted.

A.M. Suppression

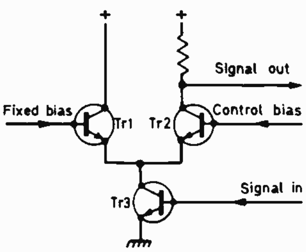
The effect of a.m. in the signal is shown in Fig. 5. When a signal which has become amplitude modulated (because of interference or rapid fading) is clipped the output from the limiter is a squarewave which varies in width at the frequency of modulation. Following the waveforms in Fig. 5 we can see that the width modulation of *V*1 merely shifts the pulses in the output load to-and-fro without affecting the mark-space ratio over a number of cycles so that good a.m. rejection is achieved.

Another incidental advantage of this form of quadrature detection is that the waveform which is finally rectified is at double the intercarrier frequency, i.e. 12MHz. This is of particular importance in an i.c. in which it may be difficult to prevent feedback from one stage to an earlier one, since it means that feedback will be at a harmonic, which causes much less chance of instability.

The performance of this detector circuit is impressive and is a clear example of the advantages of using i.c.s. With discrete components it would hardly be economic to use a detector circuit which required six transistors and an *LC* circuit in addition to the complications of paraphase drive!

D.C. Gain Control

Internal a.f. gain control is achieved by another long-tailed pair in a circuit whose principle is shown in Fig. 6. The input signal is fed to the base of Tr3 which drives the emitters of Tr1 and Tr2. The collector current of Tr3 thus flows through Tr1 and Tr2 and by varying the bias on the bases of these two transistors the proportion of Tr3's collector current passing through each can be adjusted. At low Tr2 base bias very little signal current will pass through Tr2 and



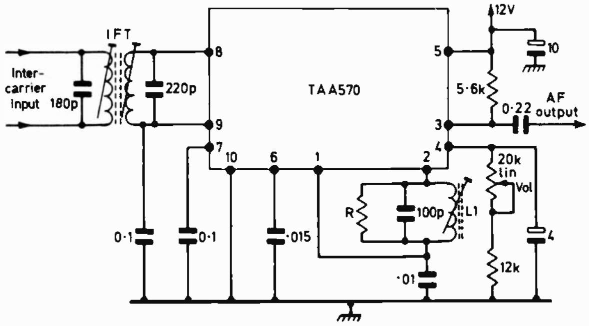


Fig. 6 (left): The principle of the d.c. gain control circuit.
Fig. 7 (right): Suggested external circuits for the TAA570. Resistor R is included if the Q of L1 is greater than the optimum figure of 25.

to its collector load from which the output is taken. At high Tr2 base bias most of the signal current will pass through it. In this way the bias on Tr2 can be used to vary the signal output obtained from its collector.

External Circuitry

A recommended external circuit for the TAA570 is shown in Fig. 7. A 12V supply is needed with a current drain of about 20mA; this will usually be obtained from a zener diode stabiliser. The intercarrier sound i.f. signal from the pick-off point is coupled through a bandpass filter to pins 8 and 9 and so to the long-tailed pair balanced amplifiers. The phase-shifting components are connected between pins 1 and 2 and provide the 90° phase shift for the quadrature detector. The capacitor which forms part of the de-emphasis circuit is connected to pin 6. Pins 1, 9 and 7 are decoupled to earth while pin 10 is directly connected to earth. Pin 4 applies the external base bias to the output stage and can be used to provide gain control as just described: a variable resistor and a fixed resistor in series are required since the bias resistor is internal. An external load resistor is connected between pins 3 and 5, pin 3 being the connection to the collector of the output stage and pin 5 the main positive supply pin, again decoupled. The layout of the circuit should allow the signal decoupling pins 9, 7, 6, 1 to be earth returned as close as possible to the earthing of pin 10.

Philips G8 Circuit

The circuit of the a.f. section of the Philips G8 single-standard colour chassis which employs a TAA570 amongst other i.c.s is shown in Fig. 8. An OA90 diode is used to detect the luminance and chroma signals and provide the 6MHz intercarrier sound signal. The chroma and sound signals are then amplified by the BF194 transistor shown in Fig. 8, the chroma signal being taken from the emitter circuit and the intercarrier signal from the 6MHz tuned circuit in the collector lead of the BF194. This tuned circuit provides the required selectivity for the intercarrier sound signal which is then applied to the input of the TAA570. The bias on the output stage of the i.c. is not varied in this case, gain control being achieved by a conventional volume control in the feed to the BC158 driver stage. The sound output stage consists of a BD131 pair working in Class A push-pull. The working voltage of the i.c. is derived from a zener diode fed from the 46V line used for the output pair.

The TAA350

The Rank-Bush-Murphy single-standard and Pye 691 single-standard colour chassis use the Mullard TAA350 i.c. to provide intercarrier i.f. amplification. This simpler i.c. is used in conjunction with an external slope detector circuit. The external circuit connections were shown in Fig. 6 on page 460 of the July 1970 issue of PRACTICAL TELEVISION.

The Author gratefully acknowledges the help of Mullard Ltd. and Philips Ltd. in the preparation of this article.

NEXT MONTH: THE TAA700 JUNGLE CIRCUIT

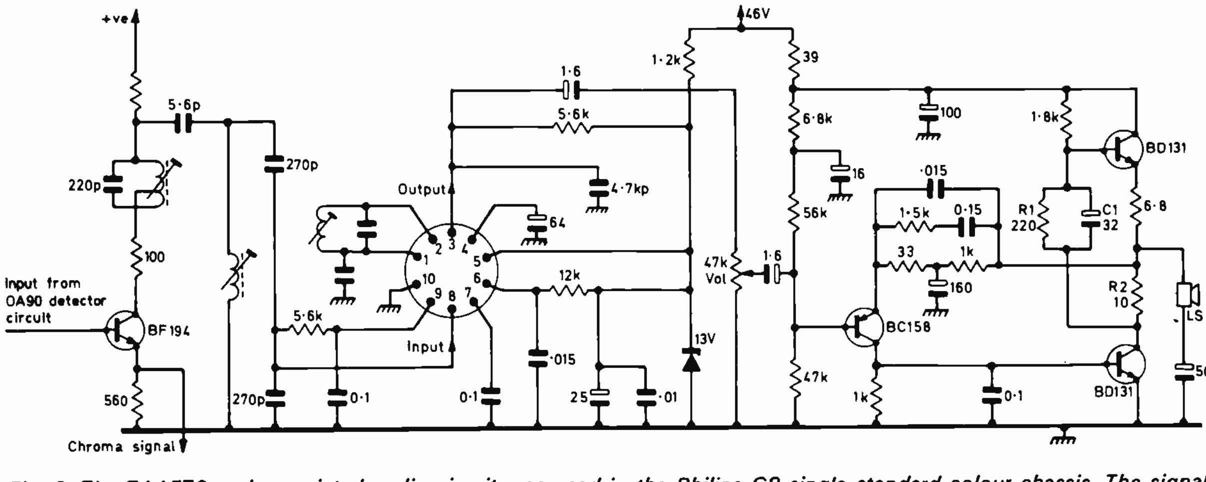


Fig. 8: The TAA570 and associated audio circuitry as used in the Philips G8 single-standard colour chassis. The signal developed across R2 in the collector lead of the lower BD131 is used to drive the upper BD131, being applied via R1 and C1 to the base of this transistor. A.C. and d.c. feedback are applied from the output to the emitter of the BC158 driver transistor.

TV TEST REPORT

E. M. BRISTOL

THE WELLER AUTO-HEAT SOLDERING IRON

An almost bewildering array of soldering irons of various shapes and sizes is now available. Few of these have the facility of thermostatic control yet this is a most desirable feature for workshop use where soldering irons must be ready for instant use and so are usually left on all day.

An iron that does possess this facility is the Weller TCP1 which has a number of novel features. Heat control is by means of a thermal-magnetic element associated with the actual soldering bit thus ensuring that it is always at the correct temperature. The principle of operation relies upon the fact that iron ceases to have any magnetic attraction when its temperature is raised above a certain level known as its Curie point.

Principle of Operation

The bit is made of copper (for maximum heat transfer), iron-plated and aluminised for long life and easy tinning, and incorporates a small iron disc at its base. This is inserted along with the shank of the bit into the barrel of the iron. Next to this disc in the barrel is a bar magnet which is connected by a rod to a switch in the handle. This rod passes through a magnetic tube at the end of the magnet farthest from the bit. There is thus a form of tug-of-war for the magnet between the end of the tube and the disc next to the bit.

When the iron is cold the magnet is attracted to the disc and the rod closes the contacts of the spring-loaded switch. On attaining the desired temperature the disc reaches its Curie point and there is no further attraction for the magnet which is then attracted to the end of the tube. Assisted by the spring action of the switch, it moves down the barrel and the rod opens the switch contacts. On cooling to just below the Curie point the iron disc resumes its attraction and the magnet moves back to close the switch contacts again.

The iron discs can be made with various Curie points enabling interchangeable bits to be made for specific temperatures. In fact Weller have had four different temperature bits available, for 500, 600, 700 and 800 degrees, but I understand that the demand for the 500 degree bit is small so that it is being dropped. Any of these bits can be used with the basic iron and changed at will to give the desired operating temperature.

Range

The range of bits is extensive as they are available in numerous widths, shapes and lengths. There are five different widths from 1/32 to 3/16in. and 10 different types in each temperature rating. Long life is claimed for the bits and the iron cladding is partly responsible for this. Solder has a natural affinity for copper and absorbs minute amounts from an ordinary copper bit resulting after a while in the familiar cavities. The iron cladding is not subject to this effect. Also as the correct temperature is maintained the scaling which is common with ordinary irons is prevented. It should however be mentioned that while these bits are undoubtedly longer-lasting than ordinary copper ones continual workshop use takes its toll and replacements are not infrequent—which can be rather expensive at 50p a time.

The bit should not be filed or cleaned with any abrasive material. A damp rag or the damp sponge which is part of the transformer/stand is all that is needed. Bits are easily removed by unscrewing a ring at the base of the barrel and sliding off the outer casing liberating the bit at the same time. When refitting the ring must be screwed only finger-tight. It has been found over a period of use in the workshop with a couple of these irons that the outer casing tends to escape occasionally from the retaining ring and slide off on to the floor. Flattening out the flange at the base of the casing gives more for the ring to grip and usually keeps the casing in place. All the bits are stamped with their temperature, the 700 degree one being the best for general workshop use.

Irons are available with either four or eight feet of cable, the longer one adding 60p to the cost. The cable is covered in silicon-rubber which is claimed to be burn-proof, and indeed placing the hot bit on the cable for several minutes failed to produce any damage. As almost every workshop iron burns its lead at one time or another this is a useful advantage.

The iron operates from 24V. The original models were rated at 40W but this has been uprated to 48W. A transformer can be supplied which is rated at 60W, this giving ample reserve. With the original 40W models it was possible to operate two irons from the same transformer as the load is intermittent due to the thermostatic controls. With the uprated models this is no longer recommended.

A conical spring fixed at an angle at the back of the transformer affords a parking place for the iron when not in use and of course the weight of the transformer is sufficient to ensure that it is not knocked over. A compartment at the front of the transformer houses a flat sponge pad which must be kept moist so that the bit can be wiped on it when needed. If other stands are used they must not contain steel otherwise the magnetic action of the thermostat may be upset.

Use

In use the first impression is the lightness of the tool. Weight including lead is only 2·5oz. When idling in the stand the iron switches on for between 3-5 seconds and is then off for about 15 seconds. When in use the on periods are longer depending on

—*continued on page 512*

BASIC CIRCUITS FOR THE CONSTRUCTOR

3

J. W. THOMPSON

THIS MONTH: TRANSISTOR VIDEO AND SYNC SEPARATOR CIRCUITS

THE video amplifier is perhaps the weakest link in nearly every domestic television receiver and few manufacturers can feel justly proud of the video circuits they have produced. Mean-level a.g.c., attenuation of the d.c. level and in some receivers blatantly uncompensated a.c. coupling have all conspired to produce pictures which can cause considerable annoyance to the more discerning viewer. Briefly the basic problems are that a.c. video coupling causes the overall picture brightness to change with picture content while d.c. coupling results in interdependence of the brightness and contrast controls which makes optimum adjustment rather difficult.

In this month's article the constructor is given the option of using d.c. coupling, a.c. coupling or a combination of the two. There can be no doubt that d.c. coupling gives the best results, even up to studio monitor standard, but it has several drawbacks. There is the problem just mentioned of brightness and contrast control interdependence and also that a greater beam current must be supplied by the tube when the picture content is predominantly white. It is thus essential to have a modern tube with good emission and an e.h.t. supply with reasonable voltage regulation.

Video Circuits

On 405 lines pin 1 (Fig. 1) of the final 405 i.f. transformer is decoupled to chassis by C31 and C32. A small d.c. bias is tapped off from VR31, passes through the final i.f. coil and the detector diode to pin 3 to set up the operating point of Tr32 and ultimately Tr34. The detected vision signal at pin 3 of the final 405 i.f.t. is passed to the base of Tr32 through a low-pass i.f. filter (L31, C35). The signal is transformed to a lower impedance by Tr32 and is developed across R34 with the picture information positive-going. Similarly the 625 signal is developed across R240 (see Fig. 3, July issue), but with sync pulses positive-going.

Selection of the 405/625 signals is accomplished by relay contact RLY31A and the output from this passes to the base of Tr34. This is a high-voltage transistor specifically designed for use in video output stages and can easily provide the 100V peak-peak vision signal required to drive a modern tube. The frequency response of the video stage is tailored by C39 and L33 and the deleterious effects of stray capacitance are reduced to an absolute minimum by the use of Tr35 as a buffer stage before applying the video signal to the c.r.t. R315 and L34 provide a significant degree of protection from high-voltage flashover within the tube.

Tube Modulation

Because of the differing polarities of the 405- and 625-line signals a relay mounted at the base of the tube (RLY32) is arranged so that the tube is modulated at the cathode on 405 lines (conventional practice) and from the grid on 625 lines. This system works extremely well even though 30% more drive is required for grid modulation. Note that the brightness control will work *backwards* on 625 lines and if this is likely to cause confusion the matter can be easily rationalised at the expense of an additional relay.

Blanking and Sync Separation

The problems introduced by switched tube modulation are two-fold. First the field flyback blanking pulses have to be of opposite polarity for each standard (see Fig. 2). Secondly there is the problem of separating the sync pulses from the vision information. Relay contact RLY31B carries out the necessary switching, taking the signal for the sync separator Tr36 from the video driver Tr32 via R36 an C38 on 405 lines and from the video output emitter-follower Tr35 via R314/C311 and C312 on 625 lines. In both cases the sync pulses are negative-going with positive-going video. A positive bias develops across C313 the level of which is determined by the setting of the presets VR32 (405) and VR33 (625). By suitable adjustment, Tr36 is held cut-off except on the sync tips when it conducts heavily. The system is self-adjusting within a wide range of signal strengths.

The following transistor Tr37 is an npn type and is thus turned on by the positive-going pulses at Tr36 collector. High-amplitude negative-going sync pulses are developed across R318 and are suitable for driving valve or transistor oscillators. The field sync integrating circuit (D32 etc.) provides an output suitable for feeding to the pentode grid of a PCL85 field oscillator-output valve through a 1kΩ limiter resistor (as for example used in the Bush TV135 series). Adjust the value of C321 for optimum sync; if it is too large field bounce will occur.

Output Transistor Rating

For the benefit of readers who cannot wait until the end of the series to try this circuit a few comments about power supplies and transistor breakdown voltages will be given. The manufacturer's data on the D40N1 transistor indicates that the maximum safe h.t. voltage in this circuit is 240V and at no time must the h.t. be allowed to rise above this level. On a domestic receiver however the h.t. can sometimes rise to as much as 300V during the warm up period. Power supplies for high-voltage transistors are thus rather a headache for the set designer and there are no less

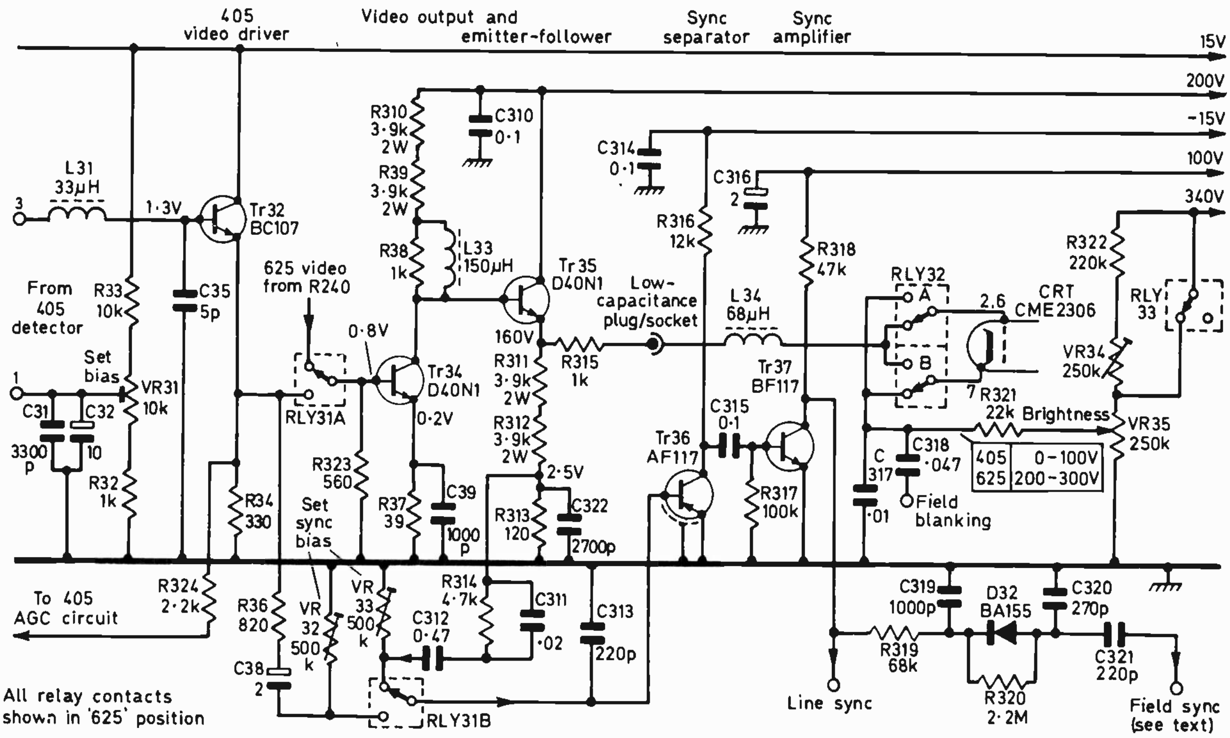


Fig. 1: The video and sync circuits. All relay contacts are shown in the 625-line position. The approximate voltages shown were measured with no signal, the line timebase operational and the video bias presets correctly adjusted, using a meter with an impedance of 10kΩ/V.

than four solutions to the problem: (1) Use a transistor with a higher voltage rating. There is a transistor (D40N3) which will take 300V and we understand that this is available from the supplier mentioned at the end of this article. (2) Stabilise the main power supply. This is a costly solution and will not be considered here. (3) Connect a 15kΩ 3W resistor from the collector of Tr34 to chassis: even if the h.t. reaches 350V the breakdown voltage of Tr34 will not be exceeded. Tr35 is still in danger however, so this method can only be used with the circuit shown in Fig. 4(b). (4) Use a partially loaded mains transformer (this method is used in the prototype receiver). The h.t. for the entire receiver is obtained from a transformer with 190V no-load a.c. output, providing 210V d.c. at 0·25A through a silicon bridge rectifier. At no time does the h.t. exceed 240V: a resistor chain across it (3kΩ plus 3kΩ) draws a continuous current of about 30mA and serves the dual purpose of limiting the peak h.t. value and of producing at the junction of these two resistors a 100V h.t. line for the medium-voltage transistors (e.g. Tr37 which has a maximum V_{CER} of 140V).

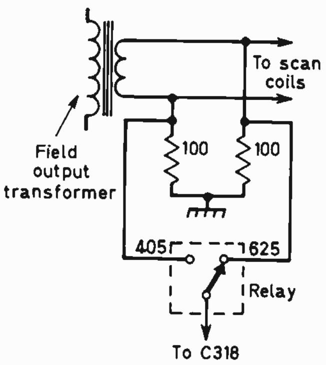
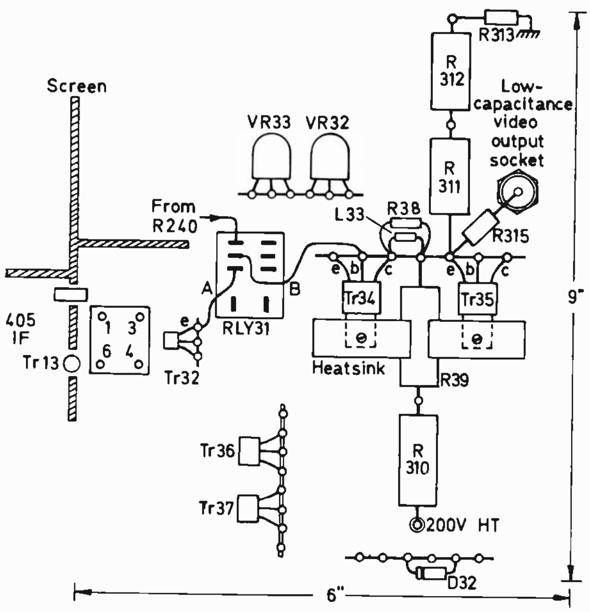


Fig. 2 (left): Because of the switched drive to the c.r.t. it is necessary to invert the polarity of the field blanking pulses on the two systems. The arrangement shown here provides the necessary blanking pulse inversion.

Fig. 3 (right): Suggested layout—as used in the prototype.

Recommended Solution

The fourth solution is recommended because it permits the use of an earthed chassis. Note that the + and −15V supplies may be readily obtained from a low-voltage transformer with suitable rectification



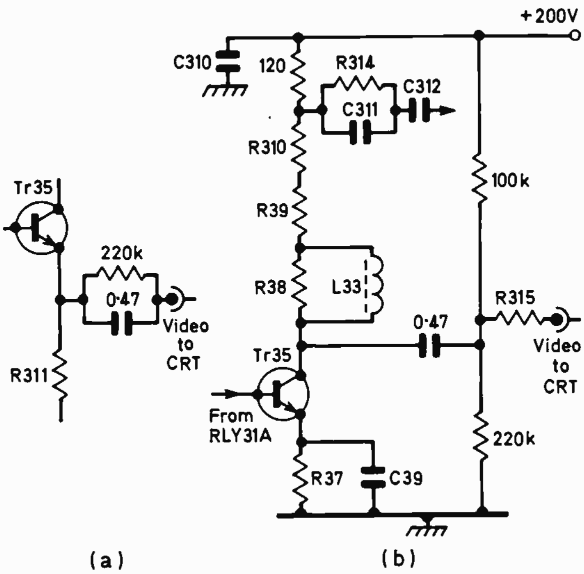


Fig. 4: Optional modifications to the basic circuit. (a) Circuit to reduce aircraft flutter. (b) A.C. coupling to the c.r.t., with the emitter-follower Tr35 omitted.

and smoothing while the 340V line is derived direct from mains live through a BY127 rectifier and 100μF parallel smoothing capacitor.

Layout

The layout (Fig. 3) is not critical so only a rough overall plan is given. It is advisable to keep all signal-carrying leads as short as possible and on the same side of the chassis as the transistors. The d.c. leads may be as long as necessary and it is a good idea to have as many of them as practicable on the other side of the chassis, feeding the circuit through nylon lead-through tags.

The transistors themselves should be mounted on low-capacitance tagstrip (e.g. porcelain stand-off type) and the two video output transistors will each need to be bolted to at least 6 sq. cm. of black painted aluminium. The heat sink tags on these transistors are connected to the collector so the heatsinks should be well away from all stray capacitances and must not touch the chassis. The body of relay RLY31 is on the opposite side of the chassis to the transistors and should be mounted on a squared, inverted U-shaped clamp. The relay tags protrude through a rectangular hole cut in the chassis. RLY32 is mounted on the tube base with due regard to stray capacitance. RLY33 may be mounted almost anywhere.

Setting Up

Turn VR31, VR32, VR33 and VR201 (Fig. 3, July issue) to their mid-positions and polarise the relays for 625-line operation. Do not plug in the aerial yet. Turn the brightness control so that the slider is at the most positive end of its track and attach a meter (250V range) to Tr35 emitter. Switch on the receiver, allow five minutes for it to warm up completely and adjust VR201 to give a reading of 160V on the meter. Any faults at this stage should be apparent from measuring voltages at the points marked in Fig. 1.

Next plug in the aerial and adjust the contrast and brightness to give a well-balanced 625-line picture. All being satisfactory at this stage adjust VR33 for optimum sync conditions. Then switch to 405 lines, set VR31 to give 160V at Tr35 emitter and adjust VR34 and the contrast control for correct grey scale. Adjust VR32 for optimum 405 sync. The value of C321 may need changing, as previously mentioned, for the best field sync conditions.

If the picture is streaky either the vision i.f. is misaligned or there is excessive stray capacitance in

★ components list

Resistors:

R32	1kΩ	R39	3·9kΩ 2W	R315	1kΩ	R321	22kΩ	VR31	10kΩ	VR35	250kΩ
R33	10kΩ	R310	3·9kΩ 2W	R316	12kΩ	R322	220kΩ 1W	VR32	500kΩ	Linear potentio-	
R34	330Ω	R311	3·9kΩ 2W	R317	100kΩ	R323	560Ω	VR33	500kΩ	meter	
R36	820Ω	R312	3·9kΩ 2W	R318	47kΩ	R324	2·2kΩ	VR34	250kΩ		
R37	39Ω	R313	120Ω	R319	68kΩ	Carbon film 5% ½W		Linear preset			
R38	1kΩ	R314	4·7kΩ	R320	2·2MΩ	unless o'wise stated					

Capacitors:

C31	3,300pF 160V P	C310	0·1μF 400V P	C315	0·1μF 160V P	C320	270pF SM
C32	10μF 15V E	C311	0·02μF 160V P	C316	2μF 150V E	C321	220pF SM
C35	5pF SM	C312	0·47μF 160V P	C317	0·01μF 400V P	C322	2,700pF SM
C38	2μF 15V E	C313	220pF SM	C318	0·047μF 400V P	E electrolytic; P polyester	
C39	1,000pF SM	C314	0·1μF 160V P	C319	1,000pF 160V P	10%; SM silver mica 5%	

Inductors:

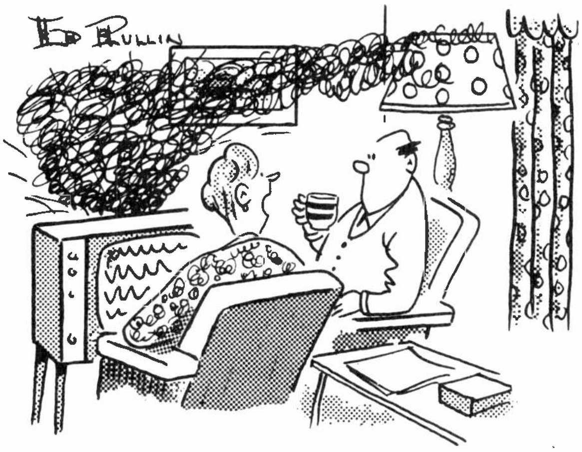
L31 33μH L33 150μH L34 68μH Painton chokes, epoxy encapsulated.

Semiconductors:

Tr32 BC107 Tr34 D40N1 Tr35 D40N1 Tr36 AF117 Tr37 BF117 D32 BA155

Relays:

RLY31 RLY32 RLY33 Omron type MH2, 6V, double-pole changeover. (Home Radio).



"Is it us or them do you think?"

the video circuit, most likely around the collector lead of Tr34.

Modifications

In the writer's opinion the video amplifier stage of a receiver can be the most entertaining stage to play around with, perhaps because the picture is so directly influenced by the smallest adjustment. Having built this circuit the reader will probably want to experiment with different component values. For this purpose it is as well to know the "key" components. These are grouped below in terms of their effect on the video amplifier's performance.

Gain: Basically set by the value of R37. This resistor may need to be increased to reduce the gain if the circuit is driven from a valve i.f. amplifier. Reduction below 22Ω is inadvisable.

Bandwidth: The ultimate limitation on frequency response is the cut-off frequency f_T of Tr34 and Tr35. The upper limit can be increased at the expense of gain by reducing the value of R39 and R310 combined, but not below 4·7kΩ or the transistors will overheat. L33 acts as a peaking coil and may be adjusted.

Pulse response: The time-constant C39, R37 is the main factor determining the pulse response of the circuit. If C39 is too small, pulse edges will be rounded; if it is too large, overshoot will occur. It should ideally be adjusted for critical damping. Do not forget to alter its value if R37 is changed.

D.C. attenuation: A small degree of attenuation can be a positive advantage in areas of low field strength where aircraft flutter is troublesome. Fig. 4(a) shows a suitable network; the picture black level however will be slightly spoilt. For domestic purposes, and especially if an old tube is being used, viewers may be prepared to put up with a.c. coupling. Fig. 4(b) is the ultimate in cheap and nasty circuitry and regrettably has been used on occasion by several television manufacturers. Let us say no more about it.

Component Supplies

In case of difficulty the transistors for every circuit in this series are stocked by A. Marshall & Son Ltd., 28 Cricklewood Broadway, London, N.W.2. The video circuit coils may be obtained from ITT Electronic Services, Edinburgh Way, Harlow, Essex.

TO BE CONTINUED

NEXT MONTH IN

TELEVISION

20MHz PULSE SCALER

This versatile instrument using mainly i.c.s can be used on its own as a self-excited or externally-triggered wide-range pulse generator but has been designed principally to serve as a front-end adaptor for our recently published digital frequency meter. Used with this it extends the frequency range up to 20MHz.

SECRETS OF THE SONY COLOUR SET

The Sony colour receiver is now being widely distributed in the UK and its performance has left a good impression with engineers. It is not however a PAL-D—or a PAL-S—set! Just what does go in this remarkable receiver will be revealed in detail next month.

CIRCUITS FOR THE CONSTRUCTOR

Two circuits this month. First a three-stage 38·15MHz sound i.f. strip for the 405-line system to complement the vision i.f. strip given in our June issue. Secondly a line-gated a.g.c. circuit to provide a control potential related to the signal black level to control the 405 vision i.f. strip.

TROUBLE-TRACING CHART

A clearly presented list of fault conditions with the checks to make in order to pinpoint quickly the source of trouble. All types of monochrome receiver—single- and dual-standard, valve, transistor and hybrid—have been taken into account in compiling this chart. Of particular value to the newcomer to television receiver servicing.

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BAYNHAM HONRI

DEVELOPMENTS in FILMS for TV

THE width of film gauges varies considerably. There are 70mm., 35mm., the CinemaScope and Vistavision variations of 35mm., 17·5mm., 16mm., super sixteen, 9·5mm., 8mm. and super eight. In Britain the BBC and ITV companies use the film print 35mm. standard and 16mm. standard gauges both of which have the long-established Academy aspect ratio of 1·33:1 width to height. This is acceptable to their telecine equipment and of course the screens of television receivers which present that aspect ratio, though many have the squarer shape of 1·25:1. But photography for television is also much concerned with the smaller areas of 2¼ × 2¼in. (for slides) and 8mm. film. With both 16mm. and 8mm. film the photographic area for each frame of picture is relatively small because so much space is occupied by the optical sound track alongside the picture and by the perforations.

When sound-on-film pictures started in the cinema in 1928 an area was sliced off one side of the picture to accommodate the sound track. The resulting picture was square and ugly and was very soon restored to a more artistic shape—to fit the 4 × 3 shaped cinema screens—by masking off small sections of the top and bottom of the picture in the film-gate of the motion-picture camera. This naturally thickened the frame line between successive pictures, further reducing the relative picture area in the cause of achieving a more acceptable screen shape. This expedient didn't seem to worry anybody at that time but doesn't look so good today.

Sound Films for Television

From the very start of television the BBC used 35mm. film for telecine and continue to use this gauge for feature films however old they may be and whether in colour or black-and-white. Gradually, however, for newsreels, magazine items and documentaries the BBC started using 16mm. film, and the BBC has lately been venturing into the use of colour 16mm. film for photographing exterior sequences or even complete productions which can be made on location.

Faults with Small Film Gauges

Nearly all British television documentaries and exterior drama sequences cut into colour videotaped interiors are now photographed on 16mm. colour negative or reversal stock, with considerable success in matching the colour balance between film and videotape. What is the next step? But first what is the difference in the picture obtained from a 16mm. colour film compared with a 35mm. one—apart from the extra cost of film stock and processing? My own colour set—which has been very carefully adjusted—reveals the following faults on 16mm. colour film prints: (1) the grain of the photographic emulsion is more noticeable; (2) the dust, dirt and scratches are more conspicuous; and (3) the picture is slightly less steady. I hastily add that these faults are generally quite slight and scarcely discernible on the majority of colour receivers.

A return to the use of expensive 35mm. colour film for this type of television production could not be justified; but there are ways of achieving a big improvement with 16mm. colour film. This has been achieved in Sweden in the super sixteen system devised by Rune Ericson, lighting cameraman and founder of the Swedish Society of Cinematographers. His objective however was to achieve 35mm. film quality prints for use in wide-screen cinemas by making more efficient use of 16mm. gauge film and camera equipment.

Super Sixteen

Following experiments financed by the Department of Technical Research, Stockholm a 16mm. film camera was modified to photograph an extended frame picture with an area about 40% larger than the standard 16mm. film frame. The principal change is for the picture in the camera to make use of the former sound track area on single-perforated 16mm. film. Several other changes have had to be made, such as moving the optical axis of the lens to a new central position, enlarging the camera aperture plate, replacing the lens with one capable of covering the larger area without vignetting, modifying the reflex mirror-shutter and viewing ground-glass, also the magazines and so on. It wasn't just a matter of doing

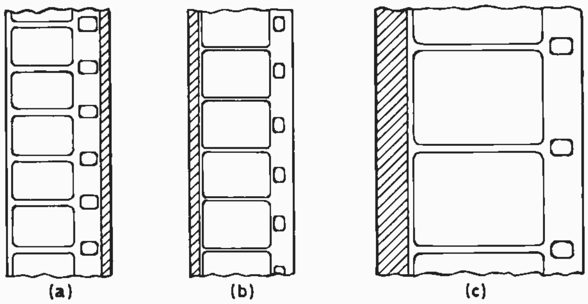
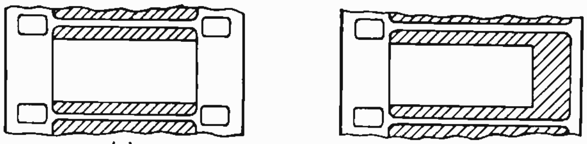


Fig. 1: Comparative picture areas—to same scale—of (a) standard 8mm. film, (b) super-8mm. and (c) 16mm. film, all with sound tracks on the prints. Super-8 has 52% greater area than standard 8.



(a) (b)

Fig. 2: Making the most of the 16mm. gauge. (a) Double-perforated 16mm. film—shaded area indicates loss of picture area when projected on a 1·85 : 1 cinema screen. (b) Single-perforated 16mm. film with sound track omitted, showing (shaded) the additional area available for photographing a 1·65 : 1 frame for television or a 1·85 : 1 frame for cinema release.

without the sound track therefore. The sound can be separately recorded on ¼in. tape (with an accompanying synchronising pulse), transferred to 16mm. magnetic sound film for editing and played off on telecine in sepmag form.

In Rune Ericson's experiments the original negative was blown up to 35mm. Eastmancolour reversal internegative film type 5249 from which large numbers of 35mm. colour prints were struck off. The same basic system however should be entirely suitable for top-quality 16mm. colour telecine play-off use.

It is not many years ago that 16mm. film was called "sub-standard" and was the special province of amateurs. Since then black-and-white photographic emulsions have improved enormously and good reversal colour film stocks have been introduced. It is now fully professional with millions of feet used by television organisations, educational authorities, industry, etc., while its use for advertising is expanding.

Super Eight

When the professional cameramen of television news and magazine items moved into the 16mm. gauge manufacturers of professional film cameras, lenses, tripods and accessories moved too. Industrial and educational films then adopted the gauge as standard, particularly as 16mm. colour film is so much less expensive than the 35mm. gauge they had been using in black-and-white for years.

At this time a large number of amateurs moved out of 16mm. into the "standard" 8mm. gauge. It was a logical development, splitting the 16mm. gauge in half and retaining the same sized perforations—on one side. These perforations now seemed very large in relation to the size of the picture and dirt and scratches became more conspicuous.

Film Hire

Many film libraries hire out 16mm., 8mm. and super eight gauge films. Their 16mm. films are frequently used by BBC and ITV stations without much complaint but the condition of copies for professional hire and use has to be closely watched. The worry really commences however when it comes to the hire of 8mm. standard gauge or super eight. The super eight gauge has over 50% more picture area than standard 8mm. but the perforations are smaller calling for very tight tolerances in the design and manufacture of the film transport mechanisms: dirt and scratches are less noticeable on super eight but the perforations are more easily damaged.

Super 8 Cameras

Nevertheless the manufacturers are starting to make high-precision super eight cameras and projectors for professional use in US regional TV stations, the first being by the Fairchild Co. of Los Angeles in collaboration with the Eumig Company in Europe. An astonishing high-precision super eight camera has been announced by the French Beaulieu Company, associated with the American Hervic Corporation. The Beaulieu cameras have a range of extra refinements available: an infinitely variable speed range from 2 to 70 f.p.s. and an Angenieux zoom lens capable of focusing from infinity to half an inch, retaining focus throughout a zoom of 10 to 1. The Bauer super eight camera includes provision for making lap-dissolves in the camera by mechanically overlapping the fade-out of one shot into the fade-in of another. This facility might be important because contact film printing and optical dissolves and effects cannot at present be carried out in labs from such small negatives.

Projection and Telecine

In addition to the major sprocket-hole changes there is with super eight an increase in the pitch of the film pull-down from frame to frame. Four and a half frames of super eight picture cover the area previously occupied by five frames of standard 8mm. This necessitates a major change in the claw mechanism for transporting the film. There are further complications if a sound track is added and recorded on the original film in the 8mm. camera. Complications thus include the matter of film transport speed—whether the 8mm. film is to be photographed at 16, 24 or 25 f.p.s.—whether the sound is to be recorded on optical or magnetic sound track in the film camera and what is to be the differential position of sound recording—in front or behind the relative position of its corresponding film frame. These points are being fought over in the USA by the many manufacturers interested in 8mm. film.

The Professional Angle

In the amateur field there are projectors in which it is possible to change gear from 8mm. standard pull-down to super eight. For professional use in television in the USA at present the sound is either (a) added later or (b) separately recorded on ¼in. magnetic tape with a synchronising pulse on a parallel sound track. In the USA these differences of standards are dealt with by using the appropriate 8mm. film projectors multiplexed and presented to a photoconductive type telecine machine with a long delay time to cope also with amateur filming at 16 f.p.s. The quality is usually poor but the use justified by the news value of the material. ■

Workshop HINTS

by VIVIAN CAPEL

THIS time our title is somewhat of a misnomer as we are going outside the workshop for a change to give a few hints and tips to help the outside service engineer. Many problems arise with outside service work that are not found in the workshop and some attention to these can make the outside engineer's day that much easier.

Route Planning

First the engineer must actually get to the call before he can start the repair. It is surprising how many firms rely on a very haphazard arrangement in assigning service calls to their engineers. Often when the engineer reports he is handed a batch of calls situated at all points of the compass.

No service department should be without a large street plan of the area normally covered and as building and new streets are continuously progressing in many areas this map must be kept up to date. This can be done by obtaining new editions as they are published (some workshops have grimy maps on their walls that are ten years or more out of date). In between any new roads that are discovered can be drawn in; these need not be accurate or to scale.

When requests for service are received they should be put together with those in the same area and different areas or collections of calls then assigned to different engineers. If there are only one or two engineers working outside assign a group of calls in one general area each time. The engineer can then report back when these calls are finished and can next be given those calls in another area. It is possible that in the meantime other calls may have come in for the second run and these would otherwise have been missed if all calls had been assigned in the first place.

Thus a rough sorting out should be done by the service manager to start with. Next the engineer himself should work out in advance a route giving a sequence of calls involving the least time and travelling between. A few minutes spent doing this, consulting the map if need be, will be more than made up in the savings accomplished. There will of course always be the few awkward calls that have to be done at specified times which will throw the spanner in the works, but it may still be possible with slight rearrangement to work these in.

It is a good idea to brief the person taking in the requests for service to avoid special times if at all possible. In the majority of cases it has been found that these can be almost eliminated by suggesting that the key be left with a neighbour or concealed at some prearranged place. The former is the preferable arrangement as there is then no risk of unauthorised persons entering the house by discovering the key and suspicion falling on the engineer if anything is missing.

Routes should be further planned to avoid busy roads or thoroughfares during rush periods.

"Not Homes"

Even when customers have stated that someone will be at home on a certain day and in some cases special times have been set engineers sometimes call to find that there is no one at home. To simply call again the next day—unless the van is passing the road—will very likely be a waste of time because a call will not be expected then and a further "not home" will be recorded. On finding no one at home then a note should be left stating that the engineer called at a certain time. An odd scrap of paper or the back of a cigarette packet is *not* the most businesslike reminder to leave of the visit. Printed or duplicated slips are by far the best.

Such slips should state that in response to their request for service an engineer called at (here leave a space for the time). The onus should then be placed on the customer to make a further arrangement. The wording could run this way: "Please let us know which day would be convenient for a further call to be made and whether someone will be home during the morning or afternoon or both." It should avoid being more specific than stipulating morning or afternoon for reasons we have already mentioned. If different from the shop the phone number of the service department should be included.

When leaving a not-home slip make sure that it is well pushed through the letter box or under the door and that no part is accessible or visible to the outside. If this is not done it could well prove an open invitation to housebreakers who are on the watch for such signs of an owner's absence.

Plastic Foam Van Mats

Much of the engineer's time is spent in transporting television receivers to and fro. Modern slim-line receivers give rise to problems in the van. It needs only a slight jolt—a sharp corner or an emergency stop—to send the set tumbling about with disastrous results to the cabinet and probably internal damage too. Some vans are equipped with straps fixed to the sides and sets are duly strapped in place when in transit, with blankets or other means of padding to prevent the straps chafing at the edges of the cabinet. This is quite an effective method of preventing damage but it is rather time consuming if a number of sets are to be carried.

A better idea which has proved very successful in practice is to equip the van with a number of large foam plastic mats which should be about two inches thick. The receiver is placed face downward on the

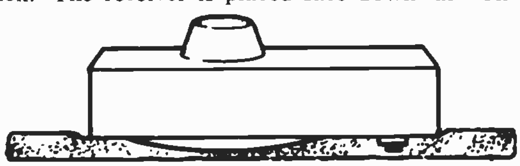


Fig. 1: Slim-line sets lie securely on a plastic foam mat which moulds to their contours.

mat and no other securing is needed (Fig. 1). The mat readily takes the contours of the front of the set and a suction is formed to the c.r.t. face or implosion shield. A grip is also exerted on the floor of the van by the foam under pressure from the weight of the set.

It will be found almost impossible to slide either the mat or the set upon it along the floor. It has in fact proved almost too effective inasmuch as if room must be found in the van for another set after it has been loaded it is not possible to move them all up closer.

Soldering Irons

While it is common practice for soldering irons to be left on all day in the workshop this cannot of course be done by the outside engineer. This being so he must wait for his iron to warm up each time he needs it, and to cool down again before packing it away afterwards. Because of the time taken by conventional irons to do this a considerable amount of time can be wasted each day. Many outside engineers find one of the several transformer-type irons now readily available very suitable for outside servicing work. These are low-voltage models and as a result heat up very quickly—in just a matter of seconds—and cool in much the same time. Some are cylindrically shaped like a normal iron and have separate transformers. While these are more convenient for workshop use they are less so for outside work as there are two objects to carry and pack and also two leads.

Those irons incorporating the transformer in the iron itself are as good as any for this type of work. Admittedly they have drawbacks, for example being heavy and hence tiring to use for protracted periods. Also the bits are short-lived, being usually made of a loop of copper wire which forms the actual element. These though are not serious snags to the outside engineer because the use of a soldering iron is usually much less than in the workshop.

Mains Plugs and Adaptors

A variety of mains sockets are likely to be encountered by the outside engineer in various homes and this raises problems as to what plugs to fit to the soldering iron, crosshatch generator and other test equipment. There are multi-type plugs obtainable which will correct to almost any size or type: although quite ingenious and useful for many applications they have been found to be unsuited for outside service work. Some have been found to be not sufficiently robust to stand the hard use—and often abuse—normal in day-to-day service in the field. If the selecting plate gets buckled or out of line, or if the retractable pins get jammed, selecting the right pins can be quite time consuming and fiddling. Their size is also something of a drawback.

After considerable experimentation the best arrangement has been found to be as follows. A 5A two-pin plug of the round Clix type is fitted to the lead of the iron or test equipment. These plugs will in addition to fitting 5A 2-pin sockets spread slightly to fit also the 5A three-pin socket. A shaver-adaptor in the tool-kit will enable a quick connection to be made to 13A sockets which are by now the most widely used sockets. If however another type is found for which there is no adaptor, a 5A-to-BC adaptor will allow the plug to be used from the nearest lampholder. The iron lead needs to be fairly long to enable this to be done without difficulty.

Thus a single small plug on the lead and two adaptors will care for nearly all eventualities. As for test equipment such as crosshatch and signal generators, many excellent models are now on the market that run from batteries. These are well suited for outside work and eliminate among other things the mains-plug problem.

Coaxial Plugs

It is often found when investigating complaints of low or intermittent signal strength that the trouble lies in the coaxial connector. Slight movement of the plug brings things back to normal. On investigating further the centre conductor is discovered to be lying in the centre pin without any solder and of course the copper wire has over a period oxidized and thus forms only intermittent contact. It seems to be common practice among aerial installers not to solder the centre conductor or to arrange any mechanical contact whatsoever but to leave things as described with the inevitable contact trouble in due course.

The real remedy of course is to solder the connection, but if for any reason this should prove inconvenient there is a method whereby a sound mechanical joint can be made without solder. This consists of simply nipping the base of the coaxial centre pin with the conductor inside using a pair of sidecutters. Fig. 2 shows that the walls of the pin grip and cause

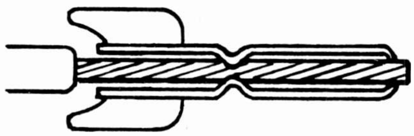


Fig. 2: Coaxial plug inner connector with pin pinched at the base to grip the inner conductor.

an indentation in the solid centre cable conductor. If the cable uses stranded wire this may have to be bent back to double the thickness as it is necessary for there to be no empty space in the pin. If this is not done the pinch will not grip the wire.

The danger in nipping the centre pin is that too much pressure is used so that the pin is nipped right off. There is a knack in getting the pressure just right, as too little will not grip the wire. Do not get the pin too near the joint of the cutter as it is here that the maximum force is exerted and the possibility of severing the pin is the greatest. If there are some old coaxial plugs about it may be as well to practise on them first.

Not all sets exhibiting the symptoms described turn out to have poor connections in the coaxial plugs. Often the trouble is associated with the aerial socket. Repeated removal of the aerial plug over a period for service, cleaning, decorating or just moving to another room can cause bad connections to develop. A common source of trouble is the rivets holding the body of the socket to the paxolin panel. These tend to work loose and as they carry the braid connections this leads to trouble. The most satisfactory way of dealing with them is to run solder over the rivet heads and the base of the socket. Often the print connecting either the body of the socket or the centre pin becomes fractured giving a similar effect. It always pays to check these points.

THE RAINBOW REVOLUTION!

1951-1971 TWENTY YEARS OF COMPATIBLE COLOUR TV

PART 3

I. R. SINCLAIR

We have seen that the development team working on display tubes had considered every possible suggestion which had been made for colour tubes, and had settled on beam shadowing as the most feasible method, a choice encouraged by the new methods of photoetching which had been developed for use with printed circuitry. Both three-gun and single-gun versions of the shadowmask tube were demonstrated to the FCC in March and April 1950. The technical description of these tubes is interesting as it shows how right the RCA engineers were at the time to pursue this method.

Shadowmask Tube Construction

The shadowmask principle is now well known. The phosphors are laid on the screen in dots, grouped in threes in RGB triad sets (see Fig. 1). The tube shown in 1950 had about 117,000 groups (351,000 dots total) and was aluminised. The phosphors used were: willemite, the traditional green phosphor which was one of the earliest phosphors known; a complex calcium magnesium silicate, titanium doped, for the blue; and a manganese doped cadmium borate for an orange-red. Since the last was not close enough to a true red, a special yellow-rejecting glass filter was placed in front of the tube face to correct the red colours. And because of the inefficiency of the red phosphor the output from the other two phosphors had to be reduced by feeding attenuated signals to the B and G guns.

The shadowmask was made of an alloy of 70 per cent copper and 30 per cent nickel, of thicknesses from 0.002 in. to 0.004 in. (0.05-0.1 mm). It had one accurately located hole for each group of phosphor dots, a total of 117,000 holes, each held to a tolerance of 0.0005 in. (0.0125 mm). The holes in the mask were lined up with the phosphor dots by an elaborate hand-operated stencilling technique and the shadowmask was hot when assembled with the screen so that it was stretched slightly at normal temperatures and would not expand noticeably when it heated under electron bombardment. The scanning coils were wound in sections and carefully assembled and wired to give a suitable convergence pattern.

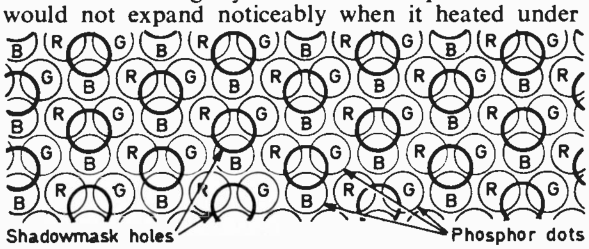


Fig. 1: Alignment of the holes in the shadowmask with the groups of phosphor dots on the screen.

The shadowmask tubes shown in 1950 (see Fig. 2) must have been incredibly expensive and could never have formed the basis of a colour receiver whose price would have been within the range of the public, even in the USA. The subsequent development of the tube is a classic study of how intelligent engineering for mass production can make an extraordinarily complex article for low cost. At today's prices a shadowmask tube is cheaper than most 35mm. cameras of any quality yet the standard of construction and complexity is many orders greater. The investment made by RCA in the tube ran into many millions of dollars and the profits took a long time to come: every cent of profit made now has been richly earned.

Later Development

The resolution of the early tubes was judged to be insufficient so the total number of dots was increased to 585,000. An improved red phosphor based on manganese doped zinc phosphate was introduced and this made the yellow-rejecting glass filter unnecessary. A new blue phosphor was also used as the original one had a rather long persistence resulting in a blue edge to moving objects. (Modern tubes use considerably improved phosphors based on what are known as the rare-earth elements.) The brightness of the picture was increased by the use of these phosphors and also by improvements in mask processing which enabled the beam energy to be increased by two and a half times without creating expansion problems (expansion would make the mask move out of register with the phosphor dots).

The later mask-screen assembly departed from the earlier hand-matching procedures and enabled any shadowmask to be married up with any screen. The shadowmask holes, alignment slits and clamping holes were made in one photoetching operation to ensure uniformity and a system of locating the mask to the screen was devised. This consisted of three pins with collars fitted in a frame to which the shadowmask was bolted. Each pin had a hemispherical, off-centre tip which located exactly in a V groove in the phosphor plate (see Fig. 3). Screwing the collets into the frame had the effect of changing the separation between the shadowmask and screen while rotating the pins moved the phosphor plate round slightly so that the alignment of the mask with the screen could be adjusted.

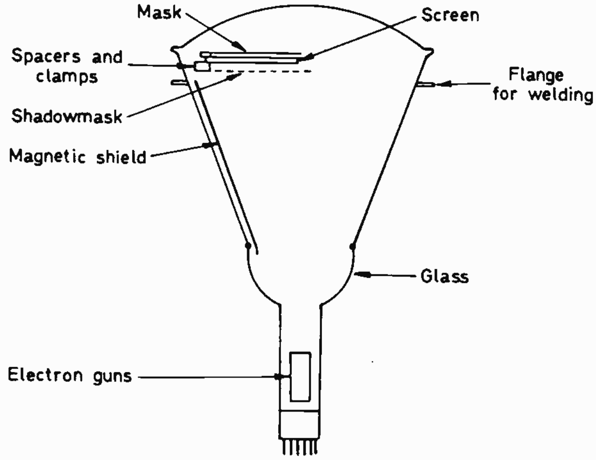


Fig. 2: The early shadowmask tube. The glass face of the tube was not the screen but simply a transparent cover sealed to a metal ring on which were mounted the phosphor-dot screen and the shadowmask. This assembly was in turn welded to a metal cone to which the stem carrying the guns was sealed. The whole tube was adapted from the 16in. metal-cone tube used for black-and-white television for a considerable time (the same as the monochrome tube made in the UK at the time by English Electric).

The method of printing the phosphor dots was also being steadily improved but was unchanged in principle. By projecting light from sources positioned as though they were the guns of a tube a photographic plate was printed with the shadowmask dot pattern. One plate was made (carefully lined up to the mask) for each light position R, G and B and stencils were made from the photographic plates and used to mask the screen as the phosphors were allowed to settle. In practice the phosphors are mixed with a sodium silicate solution, with various additives to control the grain size of the powder, and allowed to settle on the glass on which the silicate acts as a binder. This technique proved very satisfactory at the time.

Improvements in the deflection system included continuously wound coils to replace the elaborate built-up assemblies and the use of "field compensating tabs"—small strips of nickel alloy which could be bent to form a fine adjustment to the magnetic field.

A meeting was held between RCA engineers and TV set manufacturers in New York City on 19th and 20th June, 1951. The operation and manufacture of the shadowmask tube were fully described and each receiver manufacturer was offered a free gift of a shadowmask tube and deflection components. Tube manufacturers were offered a free set of parts for the tube if they wished to consider making it under licence. Altogether 152 tubes were given away then and by March 1953 477 tubes had been supplied to 177 companies. Pilot production of tubes was running at 10-15 per day by late 1951 and planning was in hand for a production capacity of 2,000 tubes per month within a period of nine months. These were 16in. tubes and a 21in. version was also being developed using 969,000 phosphor dots. This tube size was first shown in July 1951 and in a later version in April 1953.

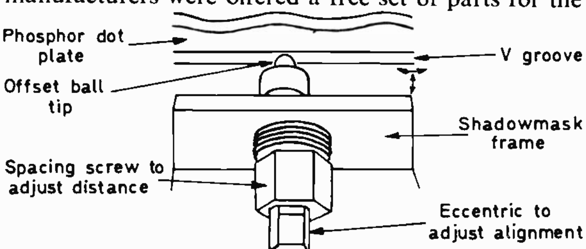


Fig. 3: Lining up the shadowmask with the phosphor-dot plate.

Receivers

Another section of RCA, the RCA Victor Division, was coping with the design of receivers using the NTSC signal and the shadowmask tube. Earlier receivers (Trinoscopes) had used separate c.r.t.s with colour filters and projection screens. The first shadowmask model started life in April 1950 and 35 receivers had been made by December of that year. This model used the 16in. shadowmask tube, 45 valves and had two separate chassis. The second prototype shadowmask receiver used 54 valves and incorporated colour phase alternation, with a subcarrier at 3.58MHz. Six were built and tested in New York during April 1951. The third prototype model used a 3.89MHz subcarrier and CPA, thirty-five were built but at this time the alternative to CPA in the form of I and Q signals of different bandwidths was crystallising. The fourth model started life in December 1951 using 35 valves on a single chassis within a cabinet comparable in size to the black-and-white sets of the time. CPA was still used in the early stages but this was changed in October 1952 to the specification adopted by the NTSC in February 1953. Twenty-one sets were made and demonstrated to the FCC in April and May 1953.

The last prototypes built before FCC approval contained a u.h.f. tuner, a colour hue control, an intercarrier 41.25MHz i.f. strip, crystal controlled subcarrier and colour killer circuits. These sets were the model for the types which went into production immediately FCC approval was obtained for the colour standards.

Picture Quality

In addition to the public opinion surveys RCA also asked qualified TV engineers — their own and NBC employees—to give their opinions on picture quality. These could be given anonymously if wished and no conferring was permitted while the questionnaires were being filled in. The opinions on general picture quality were high, matching the views given by the public, but the engineers particularly noticed misregistration and colour fringing when these were present.

Tests were also conducted with nontechnical staff to find what fault levels would be acceptable to observers. The first set of tests was of cochannel interference—where two stations working on or near the same frequency cause interference. Every combination of possible effects had to be tested and it was found that this form of interference was no worse with colour signals than with monochrome ones. In general an interfering signal 40dB down was just detectable and one 30dB down was just tolerable. The next set of tests was on random noise and sinewave interference and here the observers found that colour

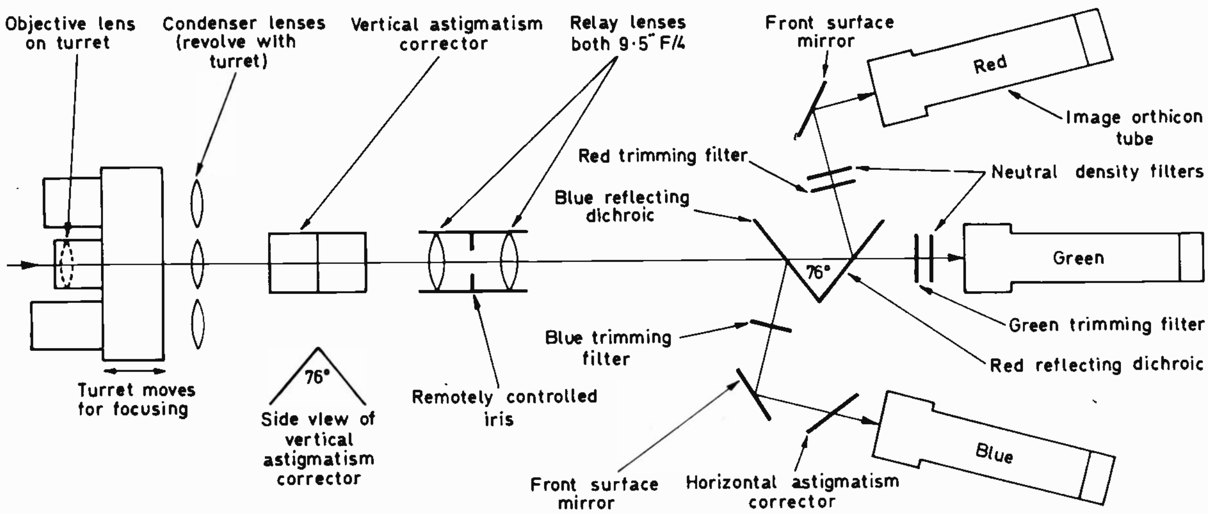


Fig. 4: The optical system used in the three-tube colour television camera developed by RCA.

signals were about 1dB more susceptible to random noise and much more susceptible to sinewave interference near subcarrier frequency compared to black-and-white.

Multipath reception was more troublesome however with colour signals as much as 2.7dB down compared with similar effects on black-and-white signals. There was some doubt as to how far this test could be related to actual field experience for the amplitude of the reflection used was very large, only 8 dB down for the main signal, and then did not simulate the continuous colour change caused by reflection from a moving object. The most serious objections to the NTSC system have always arisen from this type of problem and it was because of this that the phase-alternation principle was revived in the new form of PAL. The extra price paid in Europe for the greater complexity of the PAL system is a measure of how strongly the complaints about colour shifts in the NTSC system affected the Post Office committee which decided in favour of the PAL system in this country.

Studios and Transmission

Considerable changes were of course necessary in studio and transmission equipment in order to handle colour. Sync generators had to be more closely controlled in frequency and had to incorporate a subcarrier generator and burst gate for adding the colour burst to the back porch of the line sync pulse.

The cameras used three image orthicon tubes with the light from a single lens split so as to project an image on to the face of each tube (see Fig. 4). Registration of the three images was the main problem here, along with the enormous size and mass of the camera. The camera viewing tube was a monochrome one since small colour tubes were not available.

Monochrome monitors were used, with switching so that the signal from the R, B or G channel could be viewed separately. The separate RGB channels were maintained throughout the video system and this was also done in other pickup devices such as slide and movie scanners. A new device, the colourplexer, was used to mix the colour signals, to form the I′ and Q′ signals and to modulate them on to the subcarrier. Colour monitors were of two types, one using the separate RGB signals and the other decoding the I′ and Q′ signals.

Transmitters had to be modified so that their phase-frequency characteristics did not appreciably change the colour information of the signal and the amplitude linearity had to be good. In general however the requirements for transmitter equipment were much easier to meet than those for studio equipment, so meeting the claim that RCA colour would not add greatly to the cost of the radio station operator who did not run his own studio.

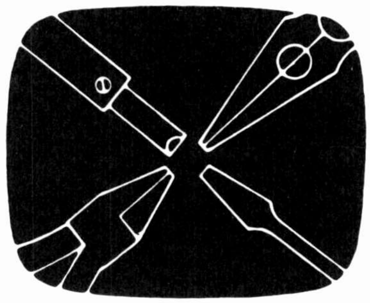
Approval

All the evidence so meticulously assembled was condensed into one document of 697 pages and presented to the FCC. A few copies of this document still exist and are a priceless piece of history. The outcome of the petition was as near a foregone conclusion as can be imagined and the RCA system became the colour-broadcasting system for the USA and later for Japan, Canada, Puerto Rica and Mexico. Hundreds of manufacturers took out licences to build colour sets and components, yet sales dragged and continued to drag for years. RCA had to wait ten more years before seeing any prospect of breaking even financially on their huge investment, but they did have the satisfaction of knowing that their engineering ability would keep them ahead of the game for the foreseeable future.

The NTSC system is still in use, unchanged except in minor detail. Improvements in receiver design have greatly reduced the problems of colour stability as well as greatly reducing the price of sets and there is no likelihood of the system being replaced in the US by any other system of transmission. It provided the world's first viable colour TV service and it is ironical that after much deliberation Europe adopted a variant which, in a primitive form, was tried and discarded.

Acknowledgements

The author wishes to acknowledge gratefully the help given him in the preparation of this series by RCA and also by the Librarian of the English Electric Valve Co. Ltd. who located one of the few copies of the 1953 petition available in this country. ■



SERVICING television receivers

L. LAWRY-JOHNS

SOBELL ST282 SERIES

A large number of these receivers are now available on the secondhand market and properly serviced provide an admirable second set. The basic models covered are the Sobell ST195, ST282, ST283, ST284, ST285 and ST286 and also the GEC BT452 and McMichael MT762 and MT763, with many near relatives. We will set out this article on the basis that one of these sets has been obtained secondhand with no known history.

Mains Adjustment

Assuming that the locality has a 240V mains supply the first essential is to check the voltage setting adjustment. In far too many cases this will be found at too low a setting, not to suit the mains voltage but to avoid replacing a faulty dropper section. It is a great pity that this should be done because it does seriously shorten the life of the tube and valves. Revert the setting if incorrect to the 245V position and make checks on the nearer dropper sections (top) which feed the anode of the PY33. In most cases it will be the 17Ω section R87 which is affected or one of the 23Ω sections R85 or R86. These values are not critical and replacement is quite easy using wire-ended or Radiospares dropper sections.

It is often suggested that the PY33 be replaced with a silicon power diode. We do not agree with this in a receiver which has been used to the slow voltage build up of the valve rectifier. The reliability of the receiver will be maintained by retaining the PY33.

Common Troubles

Assuming that the receiver is working, with the heaters lighting and h.t. at the smoothing choke (Ch1), the common troubles with their symptoms are as follows.

No Sound, Vision or Raster

Although total absence of h.t. is invariably due to an open-circuit dropper section (R85, R86 or R87) there is often full h.t. at the choke along with some evidence of overheating in the line output stage. This should immediately direct attention to the sub-h.t. line resistor R80 (150Ω). If this is burnt out or is otherwise open-circuit, the line oscillator cannot function and there is no supply to the i.f. stages.

The trouble should be looked for on the left side panel and some signs of the source may easily be seen around the vision i.f. stage V4. A shorted decoupling capacitor (often C45) starts the trouble, burning out R30 and perhaps damaging the panel.

This type of damage may not be as serious as it looks and can be cleared away quite quickly with the new components wired on the print side if this is more convenient.

The valves should not be above suspicion. Remove these in turn, starting with the two PCL84s, to see if the meter needle swings up to a higher resistance reading when any one is removed. EF80 valves do not as a rule suffer from internal shorts but frame-grid valves such as the EF184 and EF183 most certainly do.

Line Timebase

When the short has been cleared and a new 150Ω resistor fitted the line timebase should start oscillating and e.h.t. should be present. If it isn't either

VOLTAGE AND CURRENT DATA

The readings given below were measured with a 240V mains input and a weak signal just sufficient to lock the timebases, with the contrast control set for zero voltage across MR1 and all other controls adjusted for a normal picture, using a 20,000Ω/V meter. HT1 210V; HT2 202V; HT3 190V; HT4 173V; boost voltage (C97 to chassis) 700V; total h.t. current 292mA.

Valve	*Anode volts*	*Screen volts*	*Cathode current (mA)*	*Cathode volts*
V3	160	106	11	1·3
V4	172	172	12·6	1·9
V5b	—	—	—	90*
V6a	138	173	11	4
V6b	45	—	—	—
V7a	35†	—	—	—
V7b	189	202	48·7	19
V8	215 a.c.	—	292	210
V9	175	175	12·5	1·5
V10a	92	—	—	—
V10b	190	190	18	2·1
V11a	182	—	1·3	4·3
V11b	127	—	4	4·3
V12	—	130	115	—
V13	202	—	—	—

* With P11 set for minimum suppression. † Dependent on the setting of the height control.

C.R.T. voltages: Cathode 135V; first anode 580V; e.h.t. 15·5kV.

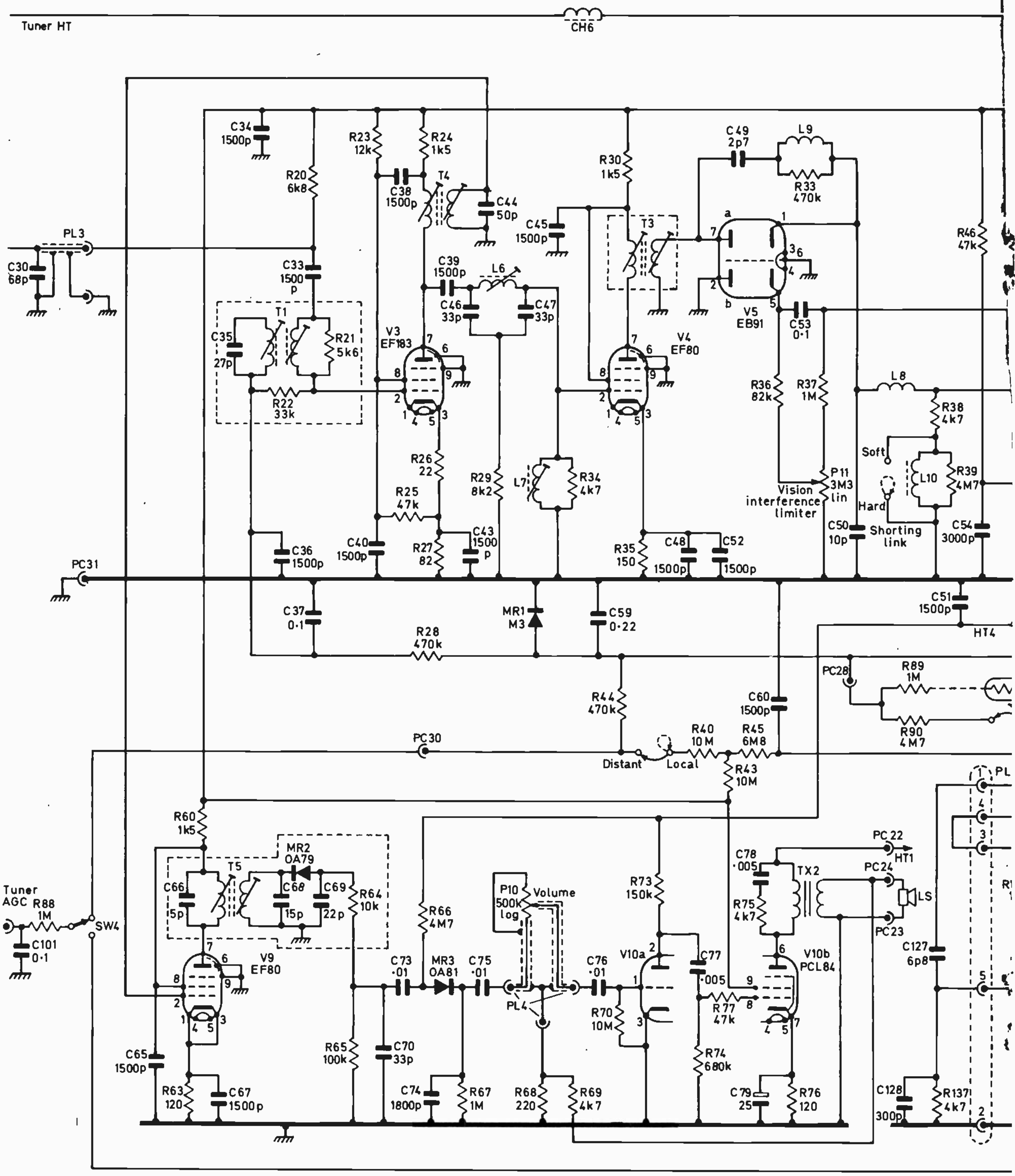
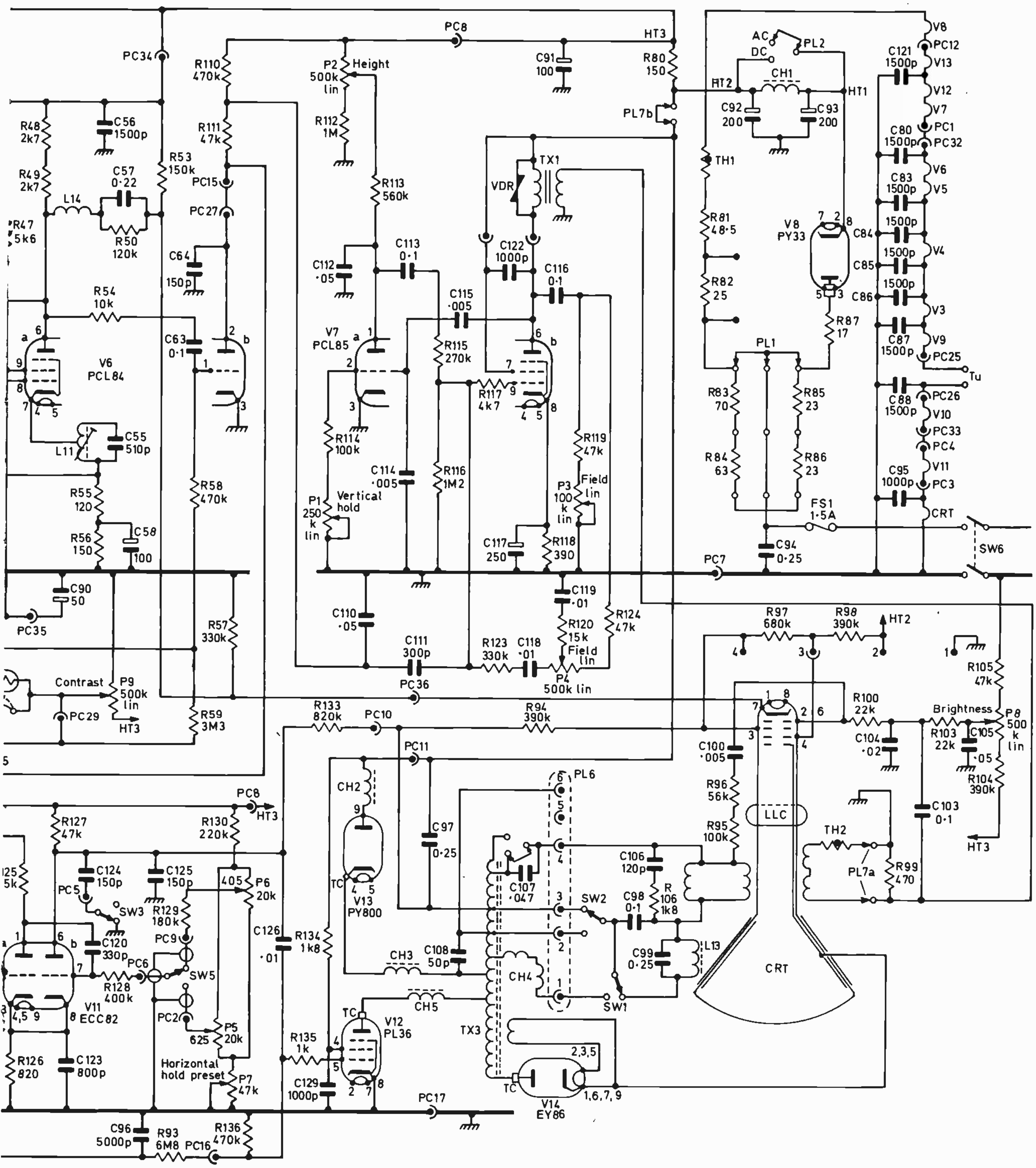


Fig. 1: Circuit diagram, Sobell ST282 series 625-line convertible models. CH6 is only present when a push-button

the PY81 or the PL36 may have suffered damage due to the overheating and the glass of the latter valve may well be cracked.

If the valves are not at fault it is essential to check the screen feed to the PL36. Whilst R134 does not often give trouble it may well overheat. This is because C129 often shorts. This 0.001μF capacitor is in an extremely awkward position and it is quite possible to cut the track across from it and the lower end of the resistor to the PL36 base. With the track removed it becomes possible to wire the resistor from the upper h.t. point to the PL36 valve base, omitting



tuner is used. 19in. models are fitted with an AW47-91 tube, 23in. models with an AW59-91 tube.

the capacitor.

The timebase should then run normally if the ECC82 is in order. If there is still no e.h.t., with no clear whistle, remove the PY81 top cap. If this seems to restore some sort of working replace the boost line capacitor C97 0.25μF. This is over the back of the tag panel where R80 is located, i.e. out of sight behind the rear centre tagstrip.

Apart from the EY86 becoming faulty this is the sum total of the normal line output troubles.

CONTINUED NEXT MONTH

COLOUR RECEIVER CIRCUITS

PRIMARY-COLOUR TUBE DRIVE CIRCUITS—*cont.*

GORDON J. KING

WHEN primary-colour drive is employed the red, green and blue signals are usually fed to the appropriate cathodes of the picture tube (not to the grids). The grids are then connected together (as in effect are the cathodes in receivers using colour-difference drive) and suitably biased for the correct black level.

Cathode primary-colour drive is preferred because the in circuit picture tube has a greater effective sensitivity at the cathodes than at the grids. This eases the drive level requirement for maximum contrast and saturation—indeed when colour-difference drive is adopted an allowance for an extra 30 per cent drive signal from the colour-difference amplifiers must be made. The first anode comes into the sensitivity equation because the effective potential on this is relative to the cathode, not to the supply negative line or chassis.

Last month we looked at the offset luminance system used in the BRC 3000 chassis for beam limiting and brightness control. The Rank-Bush-Murphy chassis employs a modified arrangement for this. However, before we look at the circuits involved here a run-down on the video circuits would be desirable.

RBM Circuits

This chassis uses the primary-colour drive technique in conjunction with transistor amplifiers which incorporate black-level stabilising (see Fig. 3). The three primary-colour signals are obtained from a silicon integrated circuit. This device is fed with the U and V chroma signals from the PAL decoder and also the luminance Y signal from an emitter-follower (3VT5) which is driven from a luminance amplifier in the i.f. channel via the Y delay line. Other inputs are a supply of 18V, the U and V subcarrier reference signals and a brightness pulse signal.

The device is designed to demodulate the U and V chroma signals to obtain the R−Y and B−Y signals, to matrix these to obtain the G−Y signal and then to matrix all three colour-difference signals in conjunction with the Y signal to produce the red, green and blue primary-colour signals. The Y signal input is to pin 10 and the red, green and blue primary-colour outputs at pins 13, 12 and 7 respectively feed the appropriate primary-colour amplifiers (3VT12/3VT15 for the red channel, 3VT13/3VT16 for the green channel and 3VT14/3VT17 for the blue channel) each of which has an input level preset for signal balancing.

The appropriate primary-colour signal is applied to the base of the first transistor of the pair, is d.c. coupled from the emitter of this to the base of the second transistor of the pair, and the collector signal of this then drives the appropriate cathode of the picture tube. Fig. 1 shows the connections to the tube cathodes. The series resistors (4R9/4R10/4R11) are feed hold-offs which work in conjunction with the spark gaps (4SG6/4SG7/4SG9) in blocking any flashover discharge energy from the amplifier transistors. It will be noticed that the collector of the final transistor of each pair is fed effectively from a potential divider (3R85/3R94 in the red channel for example). This enables the stage to be fed from the 200V supply rail.

A very important aspect of the design of primary-colour amplifiers is the need for high black-level stability. Poor black-level performance in monochrome receivers encourages the display of grey when black is being transmitted and depending on the nature of the signal leads to dark-key scenes dropping below the natural black level. Poor black-level stability in colour sets tends to alter the saturation of the colours. This is compensated to some extent when colour-difference drive is used because a black-level drift on the signal applied to the cathodes (i.e. the Y signal) has the opposite effect to a similar drift on the colour-difference signals applied to the grids. With primary-colour drive however the colour-difference and Y signals are matrixed prior to the tube and since only one electrode of each gun is modulated any drift tendency is emphasised. Receivers using primary-colour drive are more sensitive therefore to changes in d.c. level than their counterparts using colour-difference drive. For this reason, primary-colour drive receivers employ special circuits to hold a very stable d.c. black level reference both under conditions of changing picture information and long-term drift of parameters.

There are two factors involved. One is the d.c. level with respect to the operating point of the amplifier itself and the other the d.c. reference with respect to the black level of the signal. We can now return to the circuit in Fig. 3 to see how Rank-Bush-Murphy tackled the problems.

Black-level Regulation

The scheme is based on the use of clipped pulses obtained from the line flyback pulses in the line output stage. These clipped pulses are a.c. coupled to a diode whose cathode is connected to the collector—and hence the picture tube cathode—of the primary-colour amplifier output transistor. It will be seen that there is a diode and an *RC* coupling circuit for each primary-colour amplifier. The coupling components for the red stage for example are 3R97/3C61 and the diode is 3D19. Now the clipping action is arranged to give the pulses an essentially rectangular form and a positive excursion which is equal to the required black level for the cathodes of the tube — 120V above chassis.

It will be seen that the base circuit of each primary-colour input transistor also receives the pulses

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CY31	35p	ECH81	51p	EM71	62½p	PCF80	51p	QQUO2-6	£2·10	UY85	34p	6AT6	45p	6F6G	25p	6SR7	37½p	12K7GT	35p	35A5	55p
DAF91	41p	ECH83	40p	EM80	40p	PCF82	52½p	QQUO3-10		U25	75p	6AU6	29p	6F11	32½p	6T8	32½p	12Q7G	25p	35B5	65p
DAF96	41p	ECH84	47½p	EM81	42½p	PCF84	47½p		£1·25	U26	75p	6AU6	30p	6F12	22½p	6U4GT	62½p	12SC7	25p	35C5	35p
DF91	45p	ECL80	40p	EM84	37½p	PCF86	61p	QVG3-12	65p	U191	72½p	6BA6	47½p	6F13	35p	6U8	35p	12SG7	35p	35D5	65p
DF96	45p	ECL82	49p	EM87	55p	PCF200/1	81p	R19	65p	U193	41p	6BE6	60p	6F14	60p	6V6GT	32½p	12SH7	25p	35L6GT	47½p
DK91	57½p	ECL83	57½p	EN91	32½p	PCF801	61p	R20	75p	U301	85p	6BH6	42½p	6F15	55p	6X4	25p	12SJ7	25p	35W4	25p
DK96	57½p	ECL86	49p	EY51	40p	PCF802	61p	SU2150A	75p	W729	55p	6BJ6	42½p	6F18	40p	6X5GT	27½p	12SK7	40p	35Z3	55p
DL92	37½p	ECLL800		EY80	45p	PCF805	65p	TT21	£2·40	Z759	£1·22½	6BK7A	50p	6F22	32½p	6X8	55p	12SL7GT	40p	35Z4G	25p
DL94	37½p		£1·50	EY81	40p	PCF806	61p	TT22	£2·50	OA2	32½p	6BL8	35p	6F23	77½p	6Y6G	60p	12SN7GT	40p	35Z5GT	37½p
DL96	46p	EF39	52½p	EY83	55p	PCF808	67½p	U18/20	67½p	OA3	45p	6BN5	42½p	6F24	67½p	7Y4	60p	12SQ7	40p	50A5	65p
DM70	32½p	EF80	40p	EY86	40p	PCH200	70p	U20	67½p	OB2	32½p	6BN6	40p	6F25	75p	9BW6	42½p	12SR7	32½p	50B5	35p
DY86/7	40p	EF83	50p	EY87	42½p	PCL82	51p	U25	75p	OB3	50p	6BQ5	25p	6F26	35p	10C2	50p	14S7	80p	50C5	35p
DY802	42½p	EF85	41p	EY88	42½p	PCL83	61p	U26	75p	OC3	35p	6BR7	75p	6F28	70p	10D1	40p	20D1	45p	50L6GT	40p
E55L	£2·75	EF86	66p	EZ35	27½p	PCL84	51p	U31	45p	OD3	32½p	6BR8	95p	6F29	32½p	10D2	40p	20L1	£1·00	83A1	90p
E88CC	40p	EF89	40p	EZ40	45p	PCL85	52½p	U37	£1·50	3Q4	40p	6BW6	82½p	6F30	35p	10F1	90p	20P1	50p	85A2	37½p
E130L	£4·50	EF91	42½p	EZ41	45p	PCL86	51p	U50	30p	3S4	35p	6BW7	69p	6J4	47½p	10F9	50p	20P3	60p	90AU	£2·40
E180F	95p	EF92	50p	EZ80	27½p	PD500	£1·52½	U52	30p	3V4	40p	6BX6	25p	6J5GT	30p	10F18	40p	20P4	£1·00	90C1	60p
EABC80	52½p	EF93	47½p	EZ81	27½p	PFL200	74p	U76	25p	5R4GY	55p	6BZ6	32½p	6J7	42½p	10L1	40p	20P5	£1·00	90CU	£1·25
EAF42	50p	EF94	77½p	EZ90	25p	PL36	64p	U78	25p	5U4G	30p	6C4	30p	6K6GT	50p	10LD11	55p	25C5	45p	807	47½p
EBC33	55p	EF95	62½p	GS10C	£5·00	PL38	90p	U191	75p	5U4GB	37½p	6C5GT	35p	6K7	32½p	10P13	55p	25L6GT	37½p	811A	£1·50
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EBF80	40p	EF800	£1·00	GZ32	47½p	PL83	51p	U301	57½p	524GT	40p	6CBC	27½p	646GT	45p	12AD6	37½p	30AE3	40p	5642	60p
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ECC82/3	42½p	EL90	32½p	PC95	36p	PY81	41p	UCL83	61p	6AM5	25p	6DQ6B	60p	6S4A	55p	12BA7	32½p	30L17	85p	9003	50p
ECC84/5	42½p	EL91	25p	PC97	41p	PY800	41p	UF41/2	55p	6AM6	22½p	6DS4	75p	6SA7	37½p			30P12	80p		
ECC88	55p	EL95	35p	PCC84	46p	PY801	41p	UF80/5	37½p	6AQ5	32½p	6EA8	55p	6SG7	32½p			30P18	35p		
E88CC	62½p	EL360	£1·15			PY82	35p	UF89	41p	6AQ6	50p	6EH7	32½p	6SJ7	37½p			30P19	75p		

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2N698	25p	2N4061	23p	AF118	60p	BC135	P/A	BF163	35p	**DIODES &**	
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2N930	28p	2N4291	18p	AF126	20p	BC138	P/A	BF178	35p	AA119	10p
2N1132	33p	**RCA**		AF127	18p	BC142	30p	BF179	73p	BA102	23p
2N1303	18p	40253	P/A	AF139	38p	BC143	P/A	BF180	35p	BA115	8p
2N1305	23p	40398	P/A	AF178	45p	BC147	18p	BF181	33p	BA114	13p
2N1306	25p	40458	P/A	AF179	45p	BC148	15p	BF184	25p	BY100	23p
2N1307	25p	AC107	30p	AF180	53p	BC149	18p	BF191	23p	BY126	20p
2N2614	30p	AC117	60p	AF181	43p	BC152	18p	BF195	28p	BY127	23p
2N3826	30p	AC126	20p	AF186	67p	BC158	18p	BF196	43p	BZY88	
2N4905	P/A	AC127	25p	AF239	43p	BC169B	14p	BF197	32p	(Series)	33p
2N4914	P/A	AC128	20p	ASY28	28p	BC169C	15p	BF200	37p	OA5	13p
2N1711	25p	AC176	25p	BA144	P/A	BC171	18p	BF224	30p	OA47	8p
2N2147	73p	AC187	63p	BA145	P/A	BC175	28p	BF225	30p	OA70	8p
2N2160	58p	AC188	38p	BA148	23p	BC183	23p	BF257	47p	OA79	9p
2N2646	58p	ACY17	28p	BA155	P/A	BC184	23p	BFX29	35p	OA71	8p
2N2905	40p	ACY20	25p	BA156	P/A	BC187	29p	BF161	P/A	OA90	8p
2N2926		AD140	40p	BC107	15p	BC213L	27p	BF162	P/A	OA91	8p
Green	14p	AD142	58p	BC108	15p	BCY32	38p	BF163	25p	OA202	10p
Yellow	13p	AD149	58p	BC109	15p	BCY58	23p	BFY19	23p	P/A = price	
Orange	13p	AD161	38p	BC113	28p	BCY70	20p	BFY50	23p	on application	
2N3053	28p	AD162	38p	BC114	38p	BD121	65p	BFY51	23p		
2N3055	75p	AF102	58p	BC115	33p	BD123	83p	BFY52	23p		
2N3392	20p	AF114	25p	BC116	63p	BD124	63p	BSX21	38p		
2N3702	18p	AF115	25p	BC116A	38p	BD131	98p	P346A	25p		

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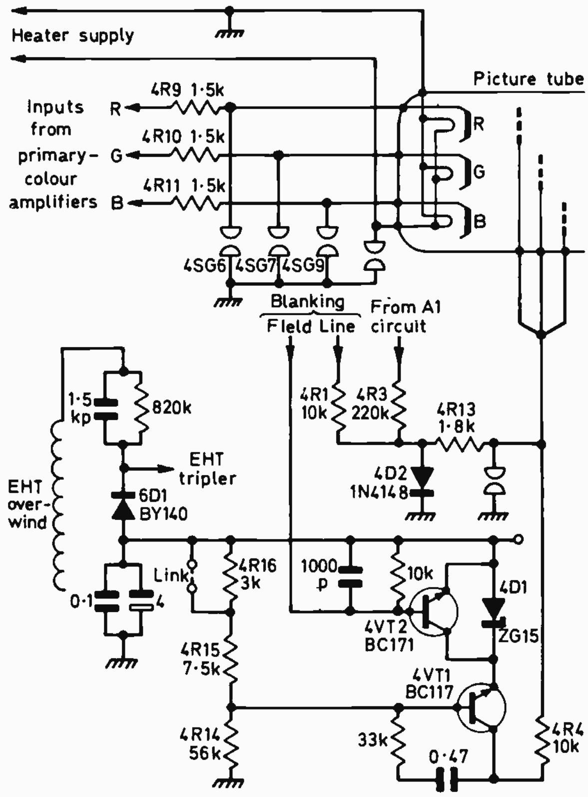


Fig. 1: The picture tube grid clamping, beam current limiting and line and field flyback blanking arrangements.

(through 3R82 and 3R73 in the red channel). Each input transistor however passes a fairly high current because of the other resistor in the base potential-divider arm which is returned to the 18V rail (3R76 in the red channel). Since the emitter of the input transistor is d.c. coupled to the base of the second transistor, the collector current of the latter is controlled by the base current of the former and under no-signal conditions the collector current of the second transistor is thus fairly high. A substantial voltage is thus dropped across the collector load (3R85 in the red channel) and if it is assumed for a moment for the sake of description that the lower circuit of the base potential-divider of the input transistor (3R82/3R73 in the red channel) is open-circuit then the potential at the collector of the second transistor of each pair would be about 30V relative to chassis. The subsequent description relates to the red channel but the other two channels work in exactly the same way.

The cathode of 3D19 is thus at 30V positive which means that between pulses it is non-conducting. It is turned on each time a pulse occurs however because the pulse amplitude (120V) at the anode over-rides the positive cathode voltage. The result of this is that the coupling capacitor 3C61 charges negatively. The charge is conveyed to 3C55 through 3R82, this capacitor thus also charging negatively and counteracting a portion of the forward bias at 3VT12 base applied by 3R76. The result is that 3VT15 collector current falls causing its collector voltage to rise.

On succeeding pulses the same process occurs but with each pulse more charge is added to that already

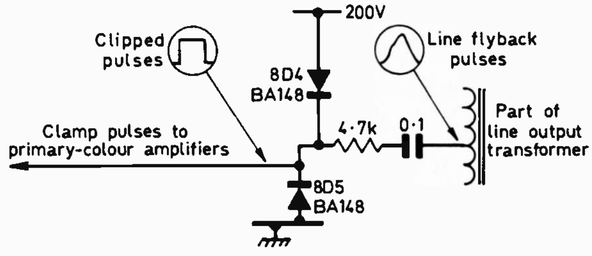


Fig. 2: Method by which the clamping pulses are obtained by clipping the line flyback pulses.

in 3C55 until eventually after a few lines 3VT15 collector potential rises to that of the pulse amplitude (120V) which corresponds to the black-level voltage. The degree of 3D19 conduction during all subsequent pulses is very small and corresponds to that required to maintain a steady charge in 3C55.

Stability

The stability of this circuit is very high (better than 1 per cent) because with the feedback arrangement between 3VT15 collector and 3VT12 base, coupled with the loop gain of the d.c. coupled stage (about 50), only a small change in 3VT12 base bias conditions is required to reflect a larger change at 3VT15 collector. Thus even very small departures from black level are corrected. The heavy effective negative feedback occurring during the period of the pulses acts as a very efficient d.c. stabilising system without inhibiting the gain during the lines of the picture—since during these periods there are no pulses and hence no feedback! The pulses which operate the circuit are timed to occur during the back porch periods and the circuit from which the pulses are derived is shown in Fig. 2.

Because the cathodes of the picture tube receive the drive signals the primary-colour signals are negative-going on picture information and positive-going on sync, relative to the black level. The black level is established by the flyback pulses during the black-level porches and the clamp diodes will fail to conduct when the sync pulses are present because these represent a *positive-going* signal at the cathodes of the clamp diodes. The sync pulses thus tend to hold the clamp diodes away from the conducting level.

Gain and Bandwidth Characteristics

To conclude this discourse on primary-colour drivers it is worth noting that in addition to having stable black-level regulation each amplifier must have balanced gain stability and balanced bandwidth. Owing to spreads in transistor parameters the gain should as far as possible be tied to the passive circuit components rather than to the active devices. The same applies to bandwidth consistency. If the bandwidth of one of the primary-colour channels is wider than that of the others the signal will pass through this one more quickly and horizontal colour fringing will occur at points on the picture corresponding to sharp changes in signal level.

In Fig. 3 the network 3C58/3R91 across the second transistor's emitter resistor increases the gain at high frequencies (because the reactance of the capacitor falls as the frequency increases, thereby reducing the total impedance and hence the current feedback in the

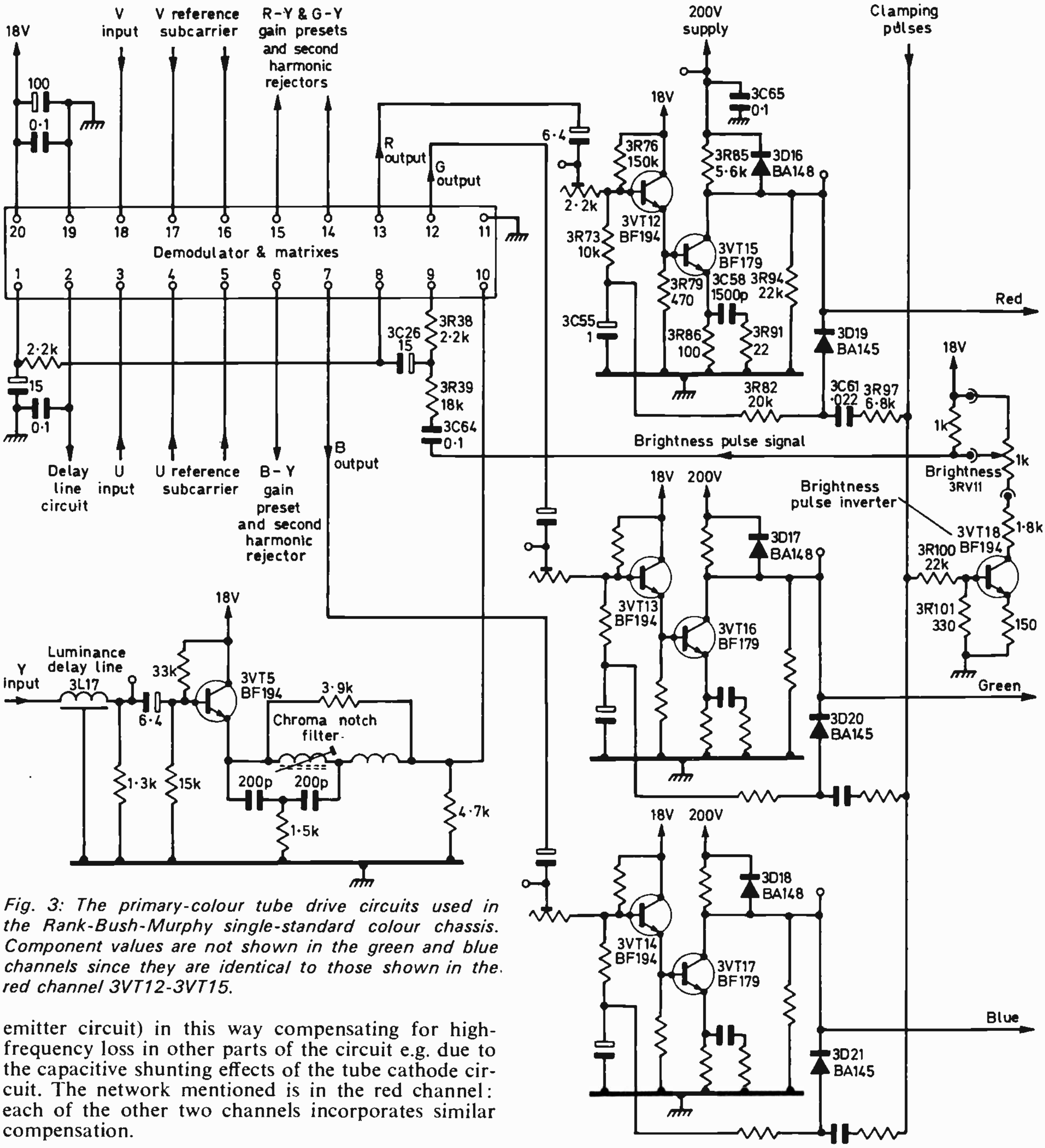


Fig. 3: The primary-colour tube drive circuits used in the Rank-Bush-Murphy single-standard colour chassis. Component values are not shown in the green and blue channels since they are identical to those shown in the red channel 3VT12-3VT15.

emitter circuit) in this way compensating for high-frequency loss in other parts of the circuit e.g. due to the capacitive shunting effects of the tube cathode circuit. The network mentioned is in the red channel: each of the other two channels incorporates similar compensation.

Brightness Control

The brightness control works in conjunction with the black-level clamping system. It will be seen (Fig. 3) that the clipped clamping pulses are also fed to 3VT18 base via the potential-divider 3R100/3R101. The collector of this transistor is loaded in part by the brightness control 3RV11 and the pulses appear across this in inverted form after being phase reversed by the transistor. From the slider of the brightness control the pulses are fed through 3C64/3R39/3C26 to pin 8 of the i.c. in which they are mixed with the decoded signal. Since the primary-colour clamping pulses and these "brightness" pulses coincide, the setting of the brightness control which adjusts the amplitude of the inverted pulses fed to the i.c. determines the nominal black-level potential to which the primary-colour stages are clamped and hence the brightness of the picture.

The remainder of the picture-tube circuit relating to the modulation electrodes is shown in Fig. 1. The three grids are connected together and clamped to chassis by reason of the steady 700μA of bleed current which flows through 4R3 and diode 4D2 from the first anode circuit which is energised from the boost h.t. supply. 4D2 is thus held heavily conducting and presents a low impedance to chassis thereby ensuring

—*continued on page 512*

SERVICE NOTEBOOK

G. R. WILDING

Delayed V Signal Changeover

In a PAL colour receiver the phase of the R – Y signal or that of the locally-generated reference oscillation fed to the R – Y synchronous detector must reverse during the blanking period at the end of each line. If this changeover occurs later there will be a strip of incorrect colours on the left-hand edge of the screen, e.g. red and cyan will be transposed, the width of the strip depending on the extent of delay. Though not common, this fault can be produced by many different causes according to the R – Y or reference signal switching circuitry employed.

In the BRC 3000 series chassis for example the reference oscillation is switched by a conventional switching circuit (see Fig. 1) controlled by the ident signal. The sinewave signal at the collector of the ident amplifier is first clipped by a pair of clipping diodes to produce an approximate squarewave for driving the switching amplifier VT307. This transistor produces a magnified version at its collector, increasing the cathode potential of W309 and the anode potential of W310 on one line and reducing them both on the next. As the anode of W309 and the cathode of W310 are held constant by the 4μF electrolytic C330 this line-by-line change in VT307's collector voltage alternately biases each diode on in turn.

The output from the reference oscillator is applied to the junction of C328 and C329 so that when W309 is conductive the top half of transformer T301's primary winding is energised while on the next line when W310 is conductive the bottom half of the primary is energised. Thus the phase of the reference signal induced in T301 secondary reverses at the end of each line and the R – Y output from the synchronous detector similarly reverses on alternate lines to cancel the R – Y signal phase inversion on alternate lines carried out at the transmitter.

Normally when the 7·8kHz coil in the collector lead of the ident amplifier is correctly tuned the diode switching occurs at precisely the right moment, but in these models it is worth noting that delay can occur if this coil—L303—moves on its former. This affects both the tuning and the amplitude of the ident signal, so if a miscoloured strip develops on the left-hand edge of the screen check the position of this coil. The correct position for the top of the winding is 0·45in. from the top of the former. Secure it with adhesive or wax. The right-hand edge of the picture can also be affected in this way by mispositioning of the coil.

Insufficient Height

Like so many things TV complaints tend to run in cycles. For example we have had three GEC sets come our way recently all with the same complaint—insufficient height—although we can't recall a similar failure with these excellent receivers for years. The models were the BT454DS, 2018 and 2020 all using a PCL85 in a conventional self-oscillating circuit with the pentode section cross-coupled to the triode to give a multivibrator action as well as providing the power output.

As previously mentioned in these columns loss of height with linearity largely unaffected is usually caused by low voltage on the triode anode and this proved to be the case in all three instances. The basic cause in the BT454DS was that R127 (Fig. 2) a 1·2MΩ resistor in series with the boost h.t. feed to this valve was high-resistance. In the 2018 however we found that the height stabilising v.d.r. had drastically reduced in operating resistance and on unsoldering one end we obtained an exceptionally tall raster. Disconnecting one of these v.d.r.s will of course always result in increased height since stabilisation is effected by this component taking a small current drain which varies with applied potential. If therefore you find an instance of reduced height which is nicely restored by

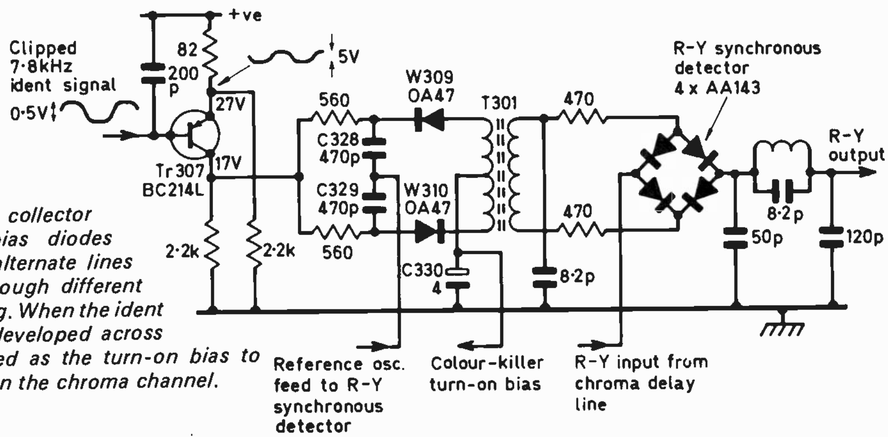


Fig. 1: The PAL switch circuit used to invert the reference signal feed to the R – Y synchronous detector on alternate lines in the BRC 3000 chassis. The variations in VT307's (labelled Tr307 in the circuit) collector voltage alternately forward bias diodes W309 and W310 so that on alternate lines the reference signal passes through different sections of T301 primary winding. When the ident signal is present a voltage is developed across C330. This voltage is thus used as the turn-on bias to remove the colour-killer action in the chroma channel.

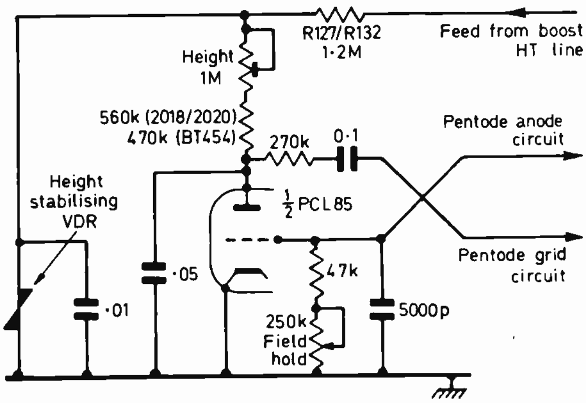


Fig. 2: Triode section of the field timebase circuit used in GEC/Sobell dual-standard models. Reduced height can be caused by increase in value of the feed resistors to the boost line or by decrease in the operating resistance of the height stabilising v.d.r.

snipping out the v.d.r. be assured that the v.d.r. is not at fault, for if it is not in circuit the increased voltage at the triode anode should cause grossly excessive height when the h.t. feed resistors are OK. In the third case—the 2020—we found it necessary to change both R132 the boost h.t. feed resistor and the v.d.r. Doubtless the extra current taken by the latter had caused the resistor to change value.

Voltage-dependent resistors are—especially in this application—very reliable components but as it is virtually impossible to test them with an ohmmeter—save by direct comparison with the exact equivalent—check whether any of the associated high-value feed resistors appear discoloured as this can be taken as sure evidence of change of value.

Excessive Blue

WHEN tracing faults in complex circuitry it always pays before getting too involved to check components such as miniature electrolytics and diodes which tend to have a higher failure rate than resistors and other types of capacitor. This point was emphasised recently when servicing a receiver fitted with the BRC 2000 colour chassis. This had been giving intermittently a very blue picture and was now constantly doing so. The chassis uses RGB drive, i.e. the luminance and colour-difference signals are matrixed before being applied to the shadowmask tube which is therefore driven by primary-colour signals applied to the three cathodes.

Our first move was to check the voltages in the blue video circuit, working back from the cascade output stage (see Fig. 3). With only one or two exceptions all voltages were incorrect indicating a defect in an early stage as with the d.c. coupling employed an incorrect transistor voltage in an early stage produces voltage changes throughout the whole circuit. Some of the voltages in the maker's service manual are given with respect to chassis and some with respect to the 30V l.t. rail. There should be about 2V dropped across the collector load R73 of the clamp transistor VT19 but we obtained only the smallest meter deflection. It appeared therefore that either the transistor was failing to pass collector current or that there was a short in C31 which shunts the load resistor. The latter was obviously the most likely cause and after checking

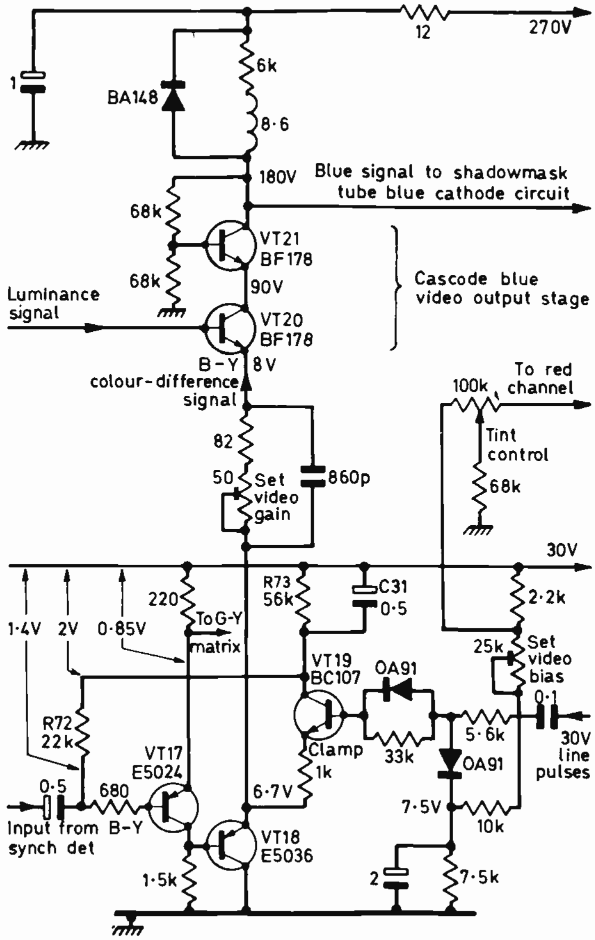


Fig. 3: The B—Y channel and blue output stage of the BRC 2000 chassis. The fault was excessive blue. The B—Y preamplifiers VT17 and VT18 are d.c. coupled and their gain controlled by the clamp stage VT19 which provides forward bias for VT17 via R72. VT19 is driven fully on once each line by the pulses from the line timebase applied to its base. C31 then charges to the potential set by the set video bias control, this voltage forming the base bias for VT17. C31 was found to be short-circuit and there was in consequence excessive bias to VT17 so that the gain of the B—Y preamplifier stages was excessive.

with an ohmmeter we found it to be almost completely short-circuited. On replacing this component normal operation was obtained.

Always check for voltage across electrolytics therefore, especially on printed panels where it is much more difficult and time-consuming to check transistor voltages.

Weak Picture

A MURPHY Model V2311 displayed a very weak picture on a bright raster, the brilliance control having only slight effect. The first suspicion in such a case is that the tube is defective. On checking at the c.r.t. base however we found that operating the brilliance control varied the grid voltage normally but the cathode voltage was only about half the correct 150—170V.

In this model the c.r.t. cathode is directly fed from the PFL200 video pentode anode (see Fig. 4) and we

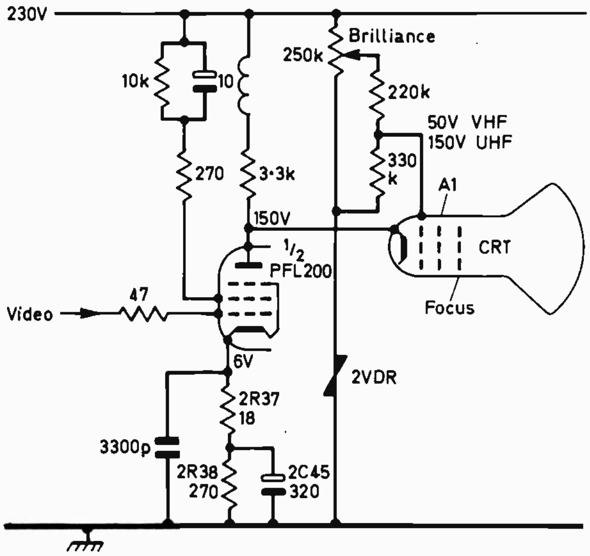


Fig. 4: Video output stage used in the Bush-Murphy TV161U-V1910U series. 2VDR provides switch-off spot suppression: as the h.t. falls on switch-off its resistance rapidly falls thereby quickly reducing the c.r.t. grid voltage.

found this valve and nearby feed resistors severely over-heating. A replacement valve produced similar results and also over-heated quickly. On making voltage tests at the cathode we obtained only a marginal meter deflection instead of the normal 6V. A resistance test then indicated slightly over 20Ω to chassis instead of the normal 288Ω formed by the series resistors 2R37 and 2R38. Reference to the circuit showed that the only cause of the low reading could be a short-circuit in 2C45, the 320μF capacitor decoupling 2R38, leaving 2R37 (18Ω) as the sole cathode resistor. Replacing this electrolytic restored a normal picture but it was found necessary to change the two screen feed resistors and the anode load resistor as they were all discoloured and slightly reduced in value.

The weak contrast had been caused by negligible bias on the video pentode while inability to reduce the brightness normally was due to the valve's anode voltage and therefore the c.r.t. cathode voltage being abnormally low.

TO BE CONTINUED

COLOUR RECEIVER CIRCUITS

—continued from page 509

the correct black-level operation relative to the drive signals at the cathodes.

Beam Limiting

Beam-limiting control is applied to the grids via 4VT1. The base of this transistor receives a negative control voltage, derived from diode 6D1 which rectifies sample line output stage signal, via the potentiometer network 4R14/4R15/4R16. Under low beam current conditions the transistor is non-conducting due to the biasing. With increasing beam current however the negative base bias decreases turning on increasing 4VT1 collector current which flows via 4R13/4R4 and the bleed network. Since 4VT1 collector current flows in opposition to the bleed current there comes a time when 4VT1 current predominates. This switches off 4D2 and causes the grids to go negative, thereby automatically pulling back the beam current.

The circuit component values are arranged for 4VT1 current to cancel the bleed current when the beam current exceeds 1mA in 19 in. models. In the 22 and 25 in. models the base potential-divider resistor 4R16 is shorted out by a link and the changeover point then occurs at 1.5mA beam current.

Flyback Blanking

The picture tube grids also receive the flyback blanking pulses. Field blanking utilises 4VT2. Positive-going flyback pulses from the field timebase are fed to the base of this transistor, causing heavy conduction. During the pulse periods therefore 4VT2 collector-emitter impedance is very low so that the zener diode 4D1 is virtually shorted across. Since this diode is in 4VT1 emitter circuit the current through this transistor rises sharply and the resulting negative-going pulses at its collector are communicated to the grids of the tube thereby cutting the tube off during the flyback period.

The line blanking is less complicated: negative-going pulses from the line output transformer are fed through 4R1/4R13 direct to the grids, resulting in the same sort of blanking action.

NEXT MONTH: PAL CODING AND DECODING

TV TEST REPORT

—continued from page 491

the nature of the work. These figures were noted with the older 40W irons.

An advantage with all low-voltage irons is their rapid warming up time. The Weller TCP1 is ready to solder less than 25 seconds after plugging in. Heat recovery time is also very fast and solder can be made to run freely on a chassis even with the 700-degree bit. It thus does the job of both a normal instrument iron and a heavy-duty one. Most low-voltage irons have a spring-loaded trigger or switch so that continual pressure is needed when soldering. This can be very tiring and it is not always easy to judge the right temperature for the job. The automatic control on this iron takes the fatigue and guesswork out of low-voltage iron soldering.

Care must be taken when unsoldering components not to use the bit to unpick joints or lever back bent-over terminal tags as this may damage the protective coating and so greatly shorten its life.

The overall length of the iron is 8in. and the distance from bit tip to handle just 3in. This is rather short for some applications and I would have liked at least another inch on the barrel length. The many good features however outweigh these minor disadvantages and make this a worthwhile addition to the equipment of any workshop and indeed a useful tool for the home constructor.

Prices are £5·50 for the iron alone with 4ft. of mains cable and £6·10 for one with an 8ft. cable. The combined price of iron, 4ft. cable and transformer is £11·10. The instrument is made in Canada and the UK distributors are Weller Electric Corporation, Horsham, Sussex.

LONG-DISTANCE TELEVISION

ROGER BUNNEY

THE excellent conditions experienced during May have largely continued into June except for a short lull at the beginning of the month. It certainly looks as though this year will have one of the best Sporadic E seasons for possibly seven years and we have every reason to think that conditions will remain active for some time yet! In view of the amount of reception logged here I will limit my report as last month to periods of sustained Sporadic E only.

1/6/71 TVP (Poland) R1, R2; ORF (Austria) E2a; DFF (East Germany) E3, E4.
2/6/71 RAI (Italy) IA, IB; TVE (Spain) E2, E3, E4; NRK (Norway) E2, E3.
5/6/71 Switzerland E2; TVE E2.
6/6/71 TVP R1, R3; USSR R2; MT (Hungary) R1, R2; RAI IA, IB; JRT (Yugoslavia) E3, E4; ORF E2a, E4; WG (West Germany) E2; ORTF (France) F2; plus unidentified signals.
7/6/71 TVE E2; JRT E3; plus unidentified signals.
9/6/71 NRK E2 (twice), E3.
13/6/71 DFF E4; TVE E2, E3, E4; JRT E3, E4; RAI IA, IB; Switzerland E3; plus unidentified signals.
14/6/71 TVE E2, E3, E4; RAI IA, IB; ORTF F2, F4.
15/6/71 SR (Sweden) E2; NRK E2; Denmark E3, E4; RTP (Portugal) E2, E3; RAI IA; ORTF F2, F4; CT (Czechoslovakia) R1; TVP R1, R2; plus unidentified signals.
16/6/71 USSR R1, R2; DFF E3; NRK E2, E3; RAI IA; TVE E2, E3, E4; RTP E3; plus unidentified signals.
17/6/71 RTP E2, E3; TVE E2, E3, E4; RAI IA; MT R1; TVP R1.
18/6/71 USSR R1 (twice), R2; CT R1; TVP R2; DFF E4; NRK E2; RAI IA; ORTF F2, F4.
19/6/71 TVE E2, E3, E4; RTP E3; RAI IA; Switzerland E3; WG E2; JRT E3, E4, TVP R1.
20/6/71 USSR R1; CT R1 (twice), R2; WG E2; JRT E3 (twice), E4; RAI IA; RTP E2, E3; MT R1, R2.
21/6/71 ORF E2a; RAI IA; ORTF F2; plus unidentified signals.
22/6/71 TVP R1; CT R1; RAI IA; JRT E3, E4.
23/6/71 USSR R1; TVE E2; RAI IA.
26/6/71 CT R2; ORF E2a; WG E3, E4; RAI IA; TVE E2, E3; plus unidentified signals.
27/6/71 USSR R1, R2; TVP R1, R2; plus unidentified signals.
28/6/71 SR E2, E3; NRK E2; RAI IA; JRT E4; plus unidentified signals.
29/6/71 TVE E2, E3.

Excellent openings which I unfortunately missed were also noted on the 11th, 24th, 25th, 28th, 29th while on certain of the days above the Sp. E openings were well under way when I switched on. Good tropospherics were noted in many parts of the UK at the beginning of the month, brought about by the sustained fine weather, with signals from France, Belgium, Holland and West Germany—notably on u.h.f. Of particular interest here was my reception of Leige E3 via tropospherics—a difficult one due to an extremely strong local signal on ch. B3.

In an opening here on 15/6/71 Denmark was noted using the old Test Card G—with "Danmarks Radio" identification—prior to the ORF type electronic card the latter with *no* identification. With Austria on ch. E4 with the similar card care is called for when logging this station.

The same Sp. E opening brought forth an interesting event on ch. E2 with NRK Norway. Within the space of 10 minutes they were noted to change from Test Card G to the ORF type electronic card (with identification) and then to the electronic card used by SWF (West Germany) and Finland (see June DX-TV column for photograph). The latter card carried the identification NRK in the central black rectangle. With Finland also using this distinctive card on both the TV1 and TV2 networks obvious precautions need to be taken. (We have heard that the TV2 ch. E2 Finnish transmitter at Tampere was off the air 1/6/71-15/6/71.)

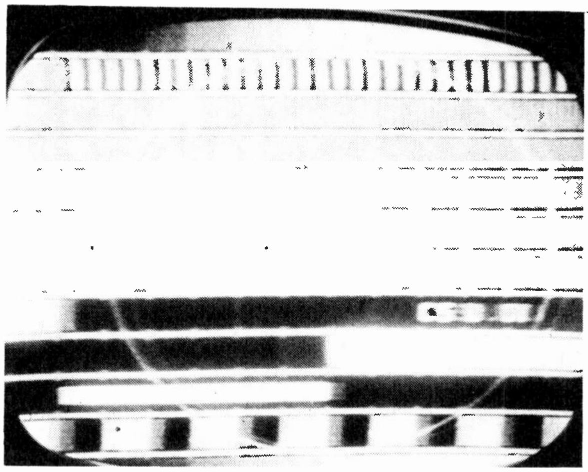
The USSR has been noted to change the identification on their test card. Usually it carries the number "0249" within the central circle but at times this is replaced with the letters "CCCP". Possibly the former orginates from the transmitter itself while the latter version indicates a network transmission card.

With recent reception favouring the South East, Yugoslavia has been well received and has brought about a number of queries. There are three main networks in this country: Zagreb (using the Telefunken card and checkerboard pattern); Ljubljana (using the Retma card, with identification, and EBU pattern); Beograd (using the Retma card, no identification, and EBU pattern). Often one network will be transmitting a programme while the others are on test patterns. Yugoslavia has also been noted in the recent openings using numerous patterns on E3 and E4—various grey scales, contrast wedges etc.

From our Correspondents

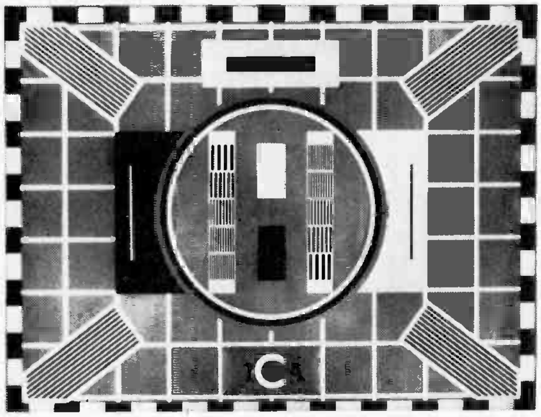
A number of enthusiasts have from time to time noted the DFF (East Germany) test pattern, which usually carries the identification "DFF Berlin", carrying other wording often too small to be deciphered. Keith Hamer (Derby) has sent us the answer to the problem. The wording is "DFF UBERNIMMT DAS PROGRAM VON RADIO DDR". Keith tells us that this means basically that the DFF TV network is taking the sound from Radio DDR and relaying it over the television transmitters. (This is similar to ORTF who relay the France Inter radio programme during the TV test transmissions.) Our grateful thanks to Keith for clearing up this mystery which has puzzled more than one person!

P. Watts (Grimsby) has written with a log of stations



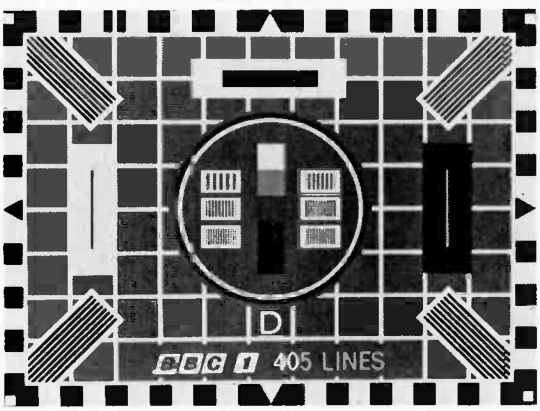
The "CS U 01" Czechoslovakian test pattern.

DATA PANEL 2—2nd series **STANDARD PATTERNS**



Test Card C

Test Card F



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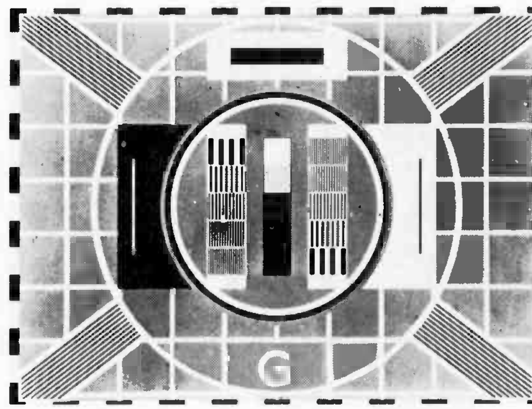
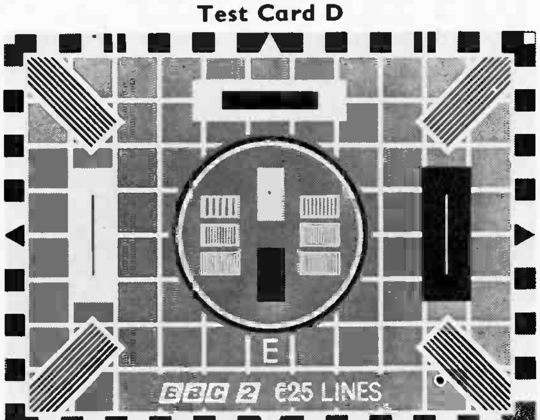
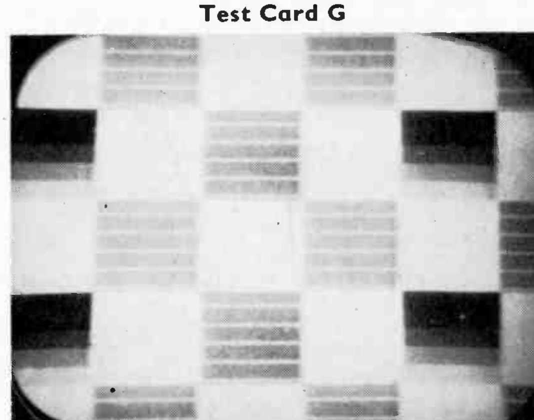


Test Card G



Test Card E



Checkerboard Pattern

Photographs by courtesy of ITA, BBC, BREMA, S. Wedge and P. D. Van der Kramer.

he received during the recent good conditions. He too has noted the tendency for reception to the South East and has also received the Hungarian test pattern with the new identification in the black rectangle (see last month's column). The new Czechoslovakian test pattern was also received at good strength, and we are most fortunate to be able to feature this pattern with the column this month.

P. D. van der Kramer has sent us a photograph of the Czechoslovakian "CS U 01" test pattern as received by him in Slikkerveer, Holland. He too has been most active with reception on most days throughout May and June. In his letter he mentions that Belgium has used the ORF (Austria) type electronic card which confirms the observations of Mr. Bunyan of Sittingbourne Kent, mentioned in the April DX-TV column. P. D. van der Kramer goes on to say that he organises a small DX-TV club currently active in the Low Countries. This includes publication of a monthly bulletin in Dutch. If there is sufficient interest he is considering an English version. Readers interested should write to him direct (with an I.R.C.) at Europese Testbeeldjagers, Diepenbrockstraat 2, Slikkerveer 3210, Holland.

Our friends Lothar Scholt (Ziegelroda, East Germany) and Seppo J. Pirhonen (Lahti, Finland) have both written to us with latest news. They report excellent conditions prevailing in their respective countries. Lothar has seen openings on most days since May 14th although he is unfortunately unable to resolve the BBC-1 405-line signals that are often received there. Seppo tells us that he has been looking in the early mornings with his aerials to the South East and as early as 0515 BST has logged weak signals on ch. R1 which he suspects—and I agree—may have originated in the Central Asian part of the USSR!

To complete the list of Italian transmitters featured in the May DX-TV column the following information is now to hand: No. 19, Gambarie, ch. D; No. 28, Badde Urbara (Sardinia), ch. D.

News

Luxembourg: We now have more detailed information about the changes at Tele-Luxembourg. As mentioned last month a changeover to 625 lines with positive video will take place from September 1st 1971 and test transmissions are already in progress. A new 300 metre mast is under construction and in the Spring of next year higher gain ch. E7 transmitting aerials will be brought into service at the 260 metre level. During Summer 1972 a 1000kW ch. E21 transmitter will come into service with transmitting aerials at the full 300 metre height. The studio will be capable of colour transmissions using the SECAM system (similar to ORTF-2).
Monaco: Tele Monte-Carlo is to construct a 1000kW u.h.f. transmitter in the Alps—North of Tenda on Mount Bec Rouz—to transmit programmes in Italian to Northern Italy along the Po Valley and Tuscany. Another transmitter is planned for Corsica with a coverage into Rome. Both transmissions will be using the SECAM system.
Sunspot Counts: Predictions of the smoothed monthly counts: June 64, July 62, August 60, September 58, October 56, November 54. Courtesy Swiss Solar Observatory.

New Transmitters

France: Toulouse/Pic Du Midi ch.24 500kW horizontal.
Autun (Central France) ch.51 500kW horizontal.
Lebanon: Jounieh ch.E2 1kW horizontal.
This station is virtually impossible but has been listed as showing an encouraging sign of possible further stations in Band I in an area where Band III tends to be used in preference to other frequencies.
Sweden: Halmstad ch.24 1000kW horizontal (approximately 70 miles north of Copenhagen).
Boden ch.36 increase of e.r.p. to 1000kW horizontal from 100kW.
Denmark: Copenhagen ch.31 has been taken out of service.
Holland: Goes ch.E7 has been taken out of service.

DX-TV Pamphlet

We decided some while ago to produce a small pamphlet giving basic information on DX-TV. Due to Charles Rafarel's untimely death this was held up but is now however complete, containing information on vision standards, propagation, aerials and amplifiers, receiver requirements and modifications, interference rejection, photography, etc. To cover costs it is necessary to make a charge of 15p. Postal orders should be made out to R. Bunney and sent care of Television, IPC Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD.

a look at Imported SETS.....

The Crown 7TV105 mains/battery portable

H.K.HILLS

It is always interesting and informative and for the service engineer frequently essential to become conversant with the often very different circuits and design ideas used in the many foreign sets now being imported into this country. Getting to grips with these circuits is however hampered for the busy service engineer by the fact that, certainly in the case of the many single-standard monochrome portable sets around, the service manuals seldom contain circuit notes while the circuit diagram draughting is usually completely different to the accepted UK style. The aim of this new occasional series therefore is to highlight and explain the many interesting technical features to be found in the various types of imported sets. To start the ball rolling we shall first take a look at a typical Japanese mains-battery portable model, the Crown 7TV105. This single-standard, solid-state monochrome model is fitted with a 7in. tube and uses 21 transistors and 19 diodes. It is a compact set weighing just 6·6lb.

Vision Receiver

The receiver stages up to the point where the video and 6MHz intercarrier sound signals are separated are shown in block schematic form in Fig. 1. Looking first at the tuner we immediately see a complete contrast between current UK and Japanese practice, for this tuner uses just one transistor, as oscillator, whose output together with the aerial signal is coupled to a diode mixer. Two tuned lecher lines provide the required pre-mixer selectivity and the i.f. output is taken to a single-stage "bandpass amplifier" mounted on a separate printed-circuit board. The tuned input and output circuits of this stage are centred on 36·8MHz and the amplified output is then taken to a three-stage vision i.f. strip. As the receiver can give a usable picture from a 40μV input signal, absence of an r.f. amplifier stage implies low-noise conversion by the mixer diode.

The first two vision i.f. amplifier stages are both gain controlled and are shown together with the associated a.g.c. circuitry in Fig. 2. The collector coils of these two stages are series tuned, also to 36·8MHz, by the associated 15pF capacitors. The base feed to the following transistor is in each case taken from the junction of the coil and the 68Ω resistor—R107 or R113—which also forms part of the total collector load. This series arrangement is quite different from the conventional parallel-tuned circuit in which the coil, capacitor and loading resistor are all shunted together with the feed to the following stage taken either from the collector or a coil tapping point to suit the input impedance of this stage. The final i.f. stage in this receiver however has a parallel tuned collector load, tuned to 35·35MHz, which is capacitively linked to a tapped coil tuned to 38·15MHz which feeds the vision detector diode.

Overall, therefore, there are five i.f. coils tuned to 36·8MHz, only the final pair of coils being stagger tuned. In the input circuit to Q1 a bridged-T filter is tuned to 40·9MHz to eliminate the adjacent channel sound while an acceptor trap tuned to 32·9MHz deletes the adjacent channel vision. The overall vision i.f. response, shown inset in Fig. 1, locates the vision carrier at 38·9MHz midway down the h.f. flank and the sound 6MHz lower at 32·9MHz.

AGC Circuits

A comon feed from the a.g.c. amplifier Q6 controls the gain of Q1 and Q2 while a delayed a.g.c. line con-

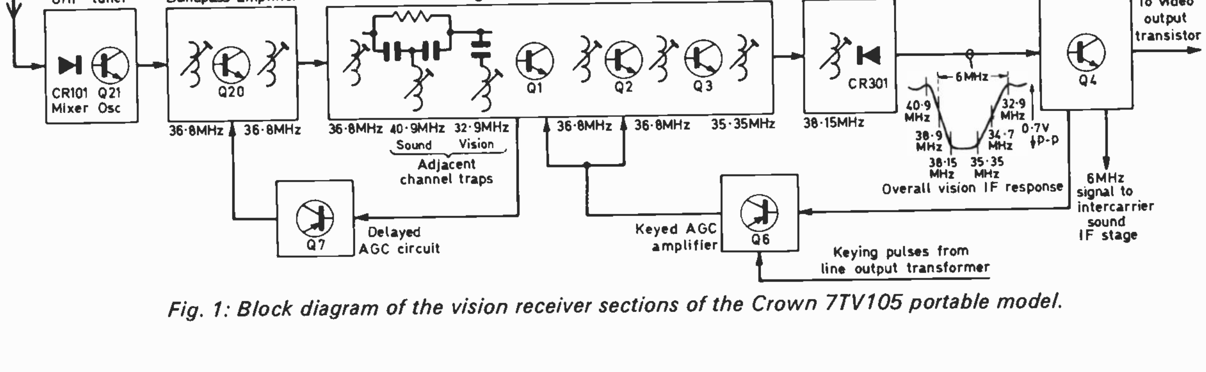


Fig. 1: Block diagram of the vision receiver sections of the Crown 7TV105 portable model.

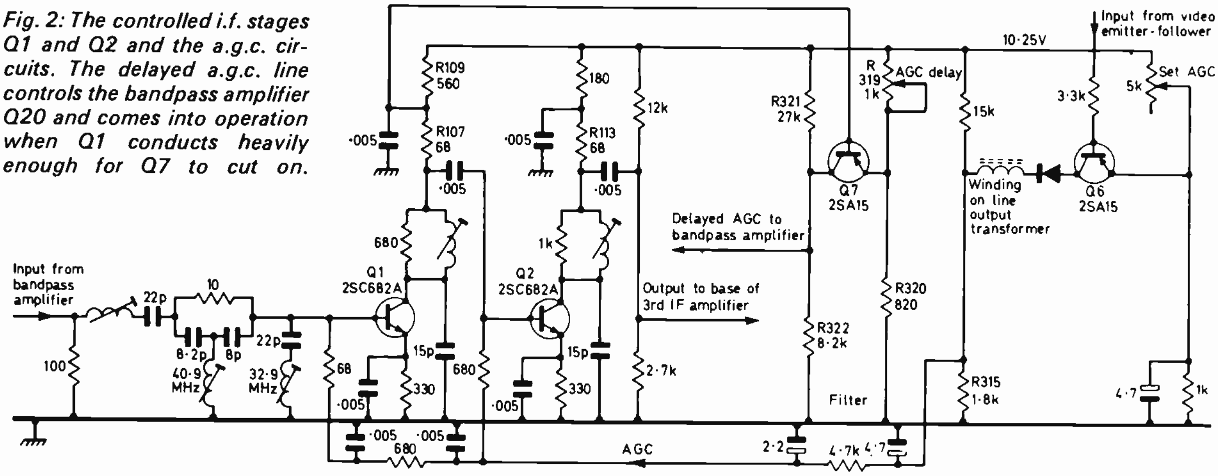


Fig. 2: The controlled i.f. stages Q1 and Q2 and the a.g.c. circuits. The delayed a.g.c. line controls the bandpass amplifier Q20 and comes into operation when Q1 conducts heavily enough for Q7 to cut on.

trolled from a point in Q1's collector circuit is used to bias the bandpass amplifier stage Q20. Thus three of the four i.f. stages are gain controlled. A wide a.g.c. control range is important in portables which must be sufficiently sensitive to give a good picture from the built-in telescopic aerial but must not be overloaded when fed with a strong signal from an exterior aerial array.

As is usual with single-standard receivers the a.g.c. potential is directly related to the true signal strength —the amplitude of the sync pulses—but an unusual feature is that the a.g.c. amplifier is gated on during the sync pulse period by flyback pulses from the line output stage. As indicated in Fig. 2 the a.g.c. amplifier Q6 is driven from the emitter of the video emitter-follower (the point is shown in Fig. 3). At the input to Q6 the video information is positive-going while the sync pulses are negative-going, i.e., the sync pulse tips represent the most negative signal level at the input to Q6. The a.g.c. amplifier is a pnp type with its emitter connected to a potential divider across the 10.25V l.t. rail. The sync pulses will thus drive the a.g.c. amplifier into conduction and the increased current through R315 will result in a positive-going pulse at this point. These output pulses are smoothed by the filter and used to bias the bases of the controlled stages Q1 and Q2. Increase in signal strength will produce an increasingly positive control potential which will drive Q1 and Q2 harder on to reduce the gain through forward a.g.c. action. The collector of Q6 is linked to its load via a low-voltage winding on the line output transformer: this provides a negative-going flyback pulse which switches Q6 on during the line blanking/sync pulse periods to give the gating action.

Delayed A.G.C.

As with r.f. amplifiers in tuners, the gain of the first controlled stage, in this case the bandpass amplifier, must if the signal-to-noise ratio is to be preserved be maintained at maximum unless it is necessary to reduce the gain of this stage to avoid crossmodulation. The a.g.c. supply to this transistor is therefore "held off" by the delay amplifier Q7 until the signal strength rises to an excessive level at which crossmodulation could occur.

The base bias for the bandpass amplifier is taken from the junction of R321 and R322. Q7 is another pnp type transistor and is normally non-conductive because the voltage at the junction of R109 and R107 to which its base is taken is positive with respect to the voltage at the junction of R319 and R320 (with R319 correctly set) to which its emitter is connected. With excessive signal strength the forward a.g.c. action drives Q1 hard on so that the voltage at the junction of R109 and R107 falls below the emitter potential of Q7. Q7 is thus brought into conduction and the increased current through R322 produces an increase in the voltage at the junction of R321 and R322. This positive-going potential is used as the delayed a.g.c. and increases the forward bias applied to the bandpass amplifier, reducing its gain through forward a.g.c. action.

Video Circuitry

The video circuits are shown in Fig. 3. So far as the video signal is concerned Q4 acts as an emitter-follower to give impedance matching between the vision detector and the video output transistor Q5. As with most current designs from all sources however, this emitter-follower acts as a conventional common-emitter stage so far as the 6MHz intercarrier sound signal is concerned. This signal is of course developed by the video detector and appears amplified across the tuned circuit in Q4's collector lead. The diode shunted across the tuned circuit tends to skim off any amplitude variations in the f.m. signal due to its non-linearity at low signal levels. The 6MHz acceptor wavetrap across Q4's emitter load resistor R309 serves two purposes: it prevents the sound signal reaching the video output stage and by eliminating negative feedback across R309 at 6MHz enables Q4 to give maximum amplification to this signal in the collector circuit.

The video signal developed across R309 is a.c. coupled to the base of the video output transistor Q5. R307 provides base bias for this stage and as this bias is taken directly from Q5's collector instead of from the 68V supply rail both d.c. and video negative feedback are introduced, stabilising the operation of this stage. As is the usual practice in small portables of this type contrast control is effected by means of a potentiometer in the emitter circuit which varies the degree of negative feedback. Being in series with a 100μF capacitor its adjustment has no effect on the d.c. working conditions of the stage. L303 and L304

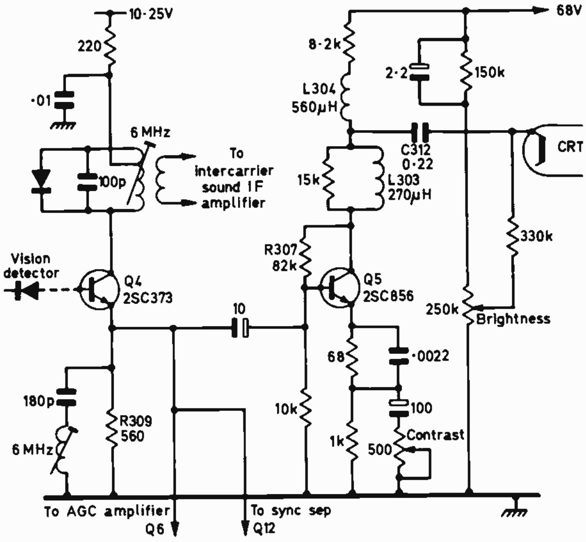


Fig. 3: The video circuitry.

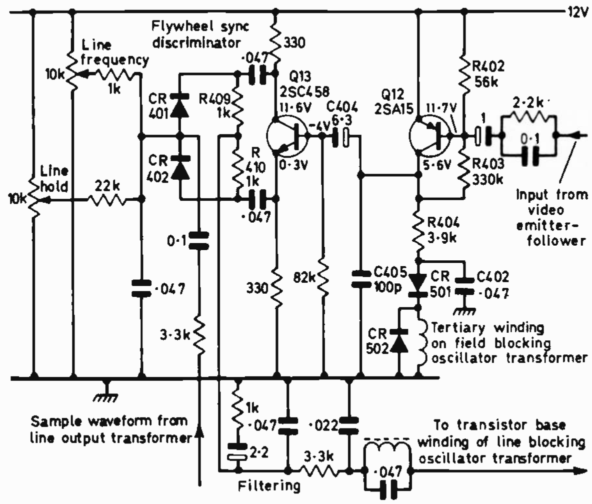


Fig. 4: Sync separator and flywheel line sync.

provide h.f. peaking and the signal is coupled by C312 to the tube cathode. The small value of C312 compared to the capacitor feeding Q5 base—though both pass the same signal—clearly shows the need to relate the feed capacitor value to the load impedance if l.f. attenuation of the signal is to be minimised. The c.r.t. input impedance is quite high, representing about 100kΩ in parallel with 10pF, while the input impedance of the video output transistor Q5 may be no more than 1kΩ.

Sync Circuits

As we have seen the signal developed across R309 is used to drive the video output stage and the a.g.c. amplifier. It is also used to drive the sync separator Q12. The sync circuitry (Fig. 4) incorporates several interesting features so we shall now take a look at this section of the receiver. The sync pulses at Q4 emitter are negative-going. A pnp transistor is therefore used as the sync separator, with its emitter taken to the 12V l.t. rail. Slight forward base bias is provided by the potential divider R402/R403 to ensure that the transistor completely saturates during the sync pulses. The collector voltage of Q12 thus rises from just above chassis potential during picture information to almost rail voltage during the sync pulses.

The field sync pulses are integrated by C402 and fed via the pulse sharpening diode CR501 to a tertiary pulse-injection winding on the field blocking oscillator transformer. Diode CR502 is held non-conductive as the field pulse builds up, but on the negative-going overswing caused by the transformer inductance when the oscillator triggers CR502 conducts to protect the blocking oscillator transistor.

The line sync pulses are established across C405 and fed via C404 to the flywheel line sync phase splitter Q13. This is an npn transistor without fixed forward bias so that it conducts only when the positive-going pulses from the sync separator appear at its base. It then produces equal but antiphase output pulses across the 330Ω load resistors in its emitter and collector leads. The pulse at Q13 collector is negative-going so that CR401 is switched on while that at its emitter is positive-going so that CR402 also switches on. A sample waveform from the line output transformer is fed to the junction of these two diodes. D.C. feeds from the line hold and line frequency controls are also fed to this point. These two controls have a similar effect: the use of two controls enables the picture to be locked with the main user control in the mid-position. When the pulses from the line output transformer coincide with the pulse feeds from Q13 the voltages across the diode loads R409 and R410 are equal but opposite so that the bias applied to the base of the line oscillator transistor is the voltage tapped from the line hold and frequency controls. If however the sample pulse train deviates in frequency the diodes do not conduct equally, the voltages developed across R409 and R410 alter differentially and a correcting positive- or negative-going voltage is applied to the line oscillator to restore the correct operating conditions.

Timebases

The output from the field blocking oscillator transistor is taken from its emitter and a.c. coupled to a driver stage which is in turn a.c. coupled to the field output transistor. The latter is loaded by an inductor, its ouput being capacitively coupled to the field deflection coils.

A tertiary winding on the line blocking oscillator transformer feeds the line driver stage which is transformer coupled to the 2SC664 line output transistor. The line output stage also provides the 9·5kV e.h.t., a 248V supply for the tube first and focusing anodes and the 68V rail for the video output stage.

Miscellaneous Points

In the audio section an npn driver is transformer coupled to a pair of 2SB77 pnp output transistors in a single-ended push-pull circuit.

One pole of the two-pole on-off switch is used to switch the live feed to the mains transformer while the other pole controls the output feed from the power supply circuits to the rest of the set.

All in all, this is a high-sensitivity portable with many interesting features.

TO FOLLOW: THE SANYO 10in. MAINS-BATTERY PORTABLE

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PYE CT78

There is an intermittent buzz on sound though the picture and colour are not affected in any way. The buzz is sometimes present on switching on and can occur two or three times a night. It can be completely cured for a time by touching TP3 with a metal object. The buzz can also be reduced to almost zero by placing a finger on top of transistor VT3. Otherwise the sound is OK but is very occasionally reduced and slightly distorted when the buzz is present. Thinking that the trouble could be frequency drift in the tuner the a.f.c. voltage was checked but found to be correct even when the buzz is present.—G. F. Young (Corby).

The symptoms suggest a dry-joint in the sound i.f. section—around T2, T4 and the integrated circuit—which should be carefully examined for this likelihood. Check also the tuning of the slope detector circuit by adjusting L19 for optimum sound.

FERRANTI T1046

The picture has moved to the left—the picture only, not the raster. By moving the line hold control the picture can be moved to the right and the foldover on the left gets very small. As however the picture approaches the correct position it breaks up. This set does not have flywheel sync yet there appears to be a phase shift in the line synchronisation.—G. Penrose (Burton).

This picture shift can occur on sets such as this where the feedback to the line oscillator stage is tapped from the line output transformer and sometimes indicates that the line output transformer is ageing. However, first check the line oscillator and output valves, the cross-coupling capacitors C90, C94 and C89, the sync coupler C99 and the grid resistors.

PAM L123A

The sound is OK but there is no picture, only a thin horizontal line across the screen. The field timebase valves have been replaced without effecting a cure.—R. Jackson (Welwyn).

A frequent cause of this trouble is the VA1054 thermistor inside the field scan coil assembly. The fault could however be almost anywhere else in the field timebase: a check with an oscilloscope would quickly reveal it.

REGENTONE 195

The fault on this set is no raster, sound OK. The voltages on the PL36, PY800 and ECH84 are correct and the line whistle can be heard. A $\frac{1}{2}$in. spark can be drawn from the DY86 anode and about $\frac{1}{8}$in. from its cathode. The boost voltage is correct at the test point.—G. Barth (Greenford).

The e.h.t. section appears to be in order so we suggest you check the tube base voltages particularly that at pin 3 (first anode) where you might find the 0·02μF decoupler shorted.

MURPHY 929U

The height of the picture and the spacing between the lines increases, the picture also rolling. If the set is switched off for about twenty seconds the trouble goes and the set functions correctly for the rest of the evening. The timebase valves have been replaced without overcoming the difficulty.—T. Downing (Bristol).

We have come across the odd Murphy 929U receiver where this fault is due to shorting turns on the field output transformer. Normally however it is simply due to poor h.t. smoothing. Check therefore the main reservoir and smoothing electrolytics 3C43 and 3C42, then 3C46 which smooths the supply to the field timebase and the other electrolytics in this block—the common fault with these multiple electrolytics is leakage between the sections in the same can, virtually short-circuiting the effect of the smoothing resistors. If these electrolytics are OK check the field output valve cathode decoupler 3C35 500μF from pin 8 of the PCL85.

PYE 62

One of these sets which are fitted with the Pye 368 chassis is suffering from vertical jitter and pulling on whites. The jitter starts on mainly white pictures. The PCL85, PFL200 and ECC82 have been replaced and the capacitors in the field timebase checked. The preset contrast and width controls have also been adjusted.—J. Maundy (Cardiff).

Check that the l.t. feed to the tuner—a sleeved yellow wire running above the system switch—has not got too near the line linearity choke.

HMV 1893

There is cramping at the bottom and stretching at the top of the picture. The field timebase valve (PCL82) has been replaced and all components to the valve checked and found to be OK. The linearity controls and associated components also seem to be OK. The ECC82 which forms the other part of the field generator has also been replaced. Apart from this fault the picture is perfect.—L. Warner (Bristol).

Check the 22kΩ anode load resistor (R113) of the field generator section of the ECC82 and the 0·01µF capacitor C97 behind the linearity control.

MURPHY V510

A picture is only obtained by putting the contrast control hard over but the picture is then negative. As the contrast control is adjusted the picture gradually becomes less negative until a point is reached where the picture becomes positive. At this point, however, the picture and sound—with no further movement of the contrast control—suddenly go off (the tube stays on). Both picture and sound can be brought back as before by putting the contrast control hard over again.—H. Redman (Blyth).

The abrupt action of the contrast control denotes a fault in the a.g.c. circuit. This is a rather involved circuit consisting of a 6-30L2 valve coupled to the common i.f. amplifier stage and the tuner unit. Check the 6-30L2 valve then the 30L15 on the tuner and the 30F5 common i.f. amplifier before getting involved if necessary with the components associated with the 6-30L2.

FERGUSON 3602

The sound is very distorted though if the volume control is turned fully up the distortion clears. The distortion returns a few minutes after turning the volume control down to a reasonable listening level. The volume control and audio valve have been replaced without improving matters.—B. Cox (Birmingham).

There are two 0·02µF capacitors (C106 and C109) behind the PCL82 audio valve on the upper left-hand side. Change these capacitors: one of them appears to be leaky. Also check the loudspeaker.

BUSH TV97

There is excessive width on this model even though the width tapping adjustment has been set to its lowest setting.—G. Truecott (Axminster).

Check the setting of the line linearity sleeve under the deflection coils (make sure that it has not at some time been removed). If this does not solve the problem check C123 (0·25µF) and C124 (0·1µF). These are the S-correction capacitors in series with the line scan coils. One of them may be short-circuit.

PHILIPS 19TG158A

This set has developed uncontrollable brilliance and having checked out all the associated circuits I am forced to the conclusion that the tube is at fault. Are there any steps I can take that may make a new tube unnecessary?—D. Docker (Perth).

A voltage check at pin 2 or pin 6 (grid) of the AW47-91 will probably show approximately the same voltage as at pin 7 (cathode) whatever the setting of the brilliance control. Short across the base socket heater pins 1 and 8 and note what happens to this voltage when the c.r.t. base is removed. If the voltage now follows the setting of the control the tube has a cathode-grid short. Leave off the base socket and with pins 1 and 8 still shorted to maintain heater line continuity connect pin 7 of the tube base to chassis. Connect a well-insulated lead to pin 6 and touch its other end momentarily to the top cap of the line output valve. This should result in a slight discharge inside the tube and this should clear the short. Repeat if necessary, taking care not to give yourself a little of the same treatment.

FERGUSON 3703

There is an intermittent fault on this set. A very severe vertical line of patterning about ¼in. wide suddenly appears on the right side of the screen, accompanied by lesser patterning all over the screen and also noise. This sometimes lasts only a minute or so while at other times it lasts up to half an hour after which it suddenly disappears. It can always be cured by switching the set off and on again. The fault affects all channels and usually occurs during the first hour. Otherwise the picture is perfect.—G. Lorrimore (Chester).

The trouble is most likely to be in the tuner unit and is probably caused by improper contact between the tuning gang spindle, the earthing clips on the spindle and the tuner bulkheads (the divisions between the sections). Cleaning these clips may be effective or the tuner can be replaced.

STELLA ST1017U

There is heavy snow present on all the Band I channels but after about two hours' viewing this slowly disappears until only very faint snow is visible. The trouble has been slowly getting worse. Band III is not affected in this way.—F. Moorfield (Bath).

Since the Band III channels are not affected it appears that the trouble is in the Band I coil biscuits. Remove these and resolder the connections as there seem to be one or more dry-joints or other faulty connections. Also check the PCC89 r.f. amplifier valve.

GEC 2039

Sound and vision on u.h.f. suddenly went completely. About the same time the ITV picture started to pull badly to one side in the middle while a week or so later ITV sound and vision also went completely. BBC-1 vision and sound are still excellent. Having had some trouble with the Band switching on the v.h.f. tuner I opened this up and cleaned the switch contacts. After this ITV sound was obtained again but still no vision and no response on u.h.f. A new u.h.f. tuner has been tried with no improvement.—R. Green (Clerkenwell).

The u.h.f. tuner i.f. output is taken to the v.h.f. tuner where it is amplified by the mixer section of the PCF801. If as seems likely the loss of ITV and absence of u.h.f. are due to a common cause this is likely to be in the screen feed to the PCF801 mixer section. Check R7, 22kΩ, to pin 7 of the valve base.

PHILCO 1030

The picture is displaced to the left leaving a 3in. wide black vertical band on the right. There is also intermittent picture break-up which necessitates very careful adjustment of the line hold control. This requires further attention from time to time. The following valves have been replaced: PL81, EY86, PY32, PY81.—E. Gunn (Swansea).

You do not mention the two ECC82 valves V12 and V13. These must be checked together with their associated components. There is no direct sync on this model, locking being determined by the line sync comparator valve V13 which is the first suspect.

EKCO T231

The fault is that the picture is darker, or "shaded", over about one third of the screen on the left-hand side. Could this be due to a failing h.t. metal rectifier and if so could this be replaced by a BY100 silicon rectifier? The set is fitted with spot-wobble: can you tell me the purpose of this?—R. Wise (Aberdeen).

The shading trouble is due to a faulty field flyback suppression capacitor. This 0·001μF capacitor is below the chassis near the main smoothing components and feeds flyback suppression pulses from the field oscillator circuit to the tube grid circuit. You can use a BY100 rectifier with series surge limiter to replace the metal h.t. rectifier if you wish. There is a switch which brings the spot-wobble circuit into operation. This consists of an oscillator coupled to the scanning assembly and moving the spot as it scans the line so as to diffuse the line structure. It is unfortunately liable to cause patterning on the set next door.

EMERSON E704

The set operates correctly for about five minutes after which the width of the lines at the top of the picture increases, those at the bottom remaining the same. Adjusting the linearity control helps a little but the effect is still prominent. The field hold control keeps needing adjustment as well.—R. Blackwell (Birmingham).

Check the PCL82 field output valve and its associated components, including the biasing which in this circuit is applied to the grid from the triode oscillator section. The bias is sometimes cancelled by leakage through C77 the 0·01μF coupler from the oscillator triode.

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TELEVISION SEPTEMBER 1971

TEST CASE 105

Each month we provide an interesting case of television servicing to exercise your ingenuity. These are not trick questions but are based on actual practical faults.

? A Rank-Bush-Murphy colour receiver came into the workshop with the complaint of incorrect colour displays but with the blue and yellow hues the least affected. The receiver was set up in the workshop from an off-air signal and it was discovered that while the reproduction was normal on a monochrome transmission and on a colour one with the colour control turned right down the symptom of incorrect colours occurred when the colour control was advanced on a colour transmission. The symptom was accompanied by Hanover bar interference (i.e. horizontal lines across the picture, fairly closely spaced).

The receiver was then operated from a PAL-encoded colour-bar generator. At normal viewing distance the white bar appeared white, the yellow bar green-yellow, the cyan bar light blue, the green bar gold-yellow, the magenta bar blue-towards-magenta, the red bar dirty-red or brown, the blue bar blue-towards-magenta and the black bar black. What area in the receiver would be at fault and what particularly would be most likely to cause incorrect hue displays of this nature? See next month's TELEVISION *for the solution and for a further Test Case item.*

SOLUTION TO TEST CASE 104

Page 474 (last month)

On changing from one channel to another the *line* timebase tends momentarily to fall out of synchronism. This change in generator repetition frequency results in a change in the flyback pulse potential and hence a change in the e.h.t. and boost voltages. There can also be small differences in the sync/blanking signals of different stations which can reflect minor line timebase potential changes.

Now as the field oscillator anode is fed from the boost line a mild fault in the field generator could be aggravated by the change in boost voltage when changing channel and under certain conditions this could lead to loss of field lock as described last month.

Since the technician discovered that the symptom could be influenced by shorting the anode of the field oscillator triode to chassis the next check should have been of the components in the anode circuit. The resistors were found to be without fault but the voltage-dependent resistor used in the set in question to stabilise the height was found to be passing excessive current and thus starving the triode anode circuit. Replacement of this component completely cleared the fault.

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