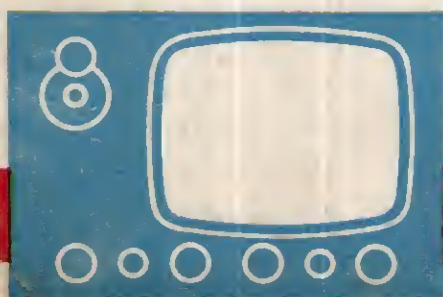
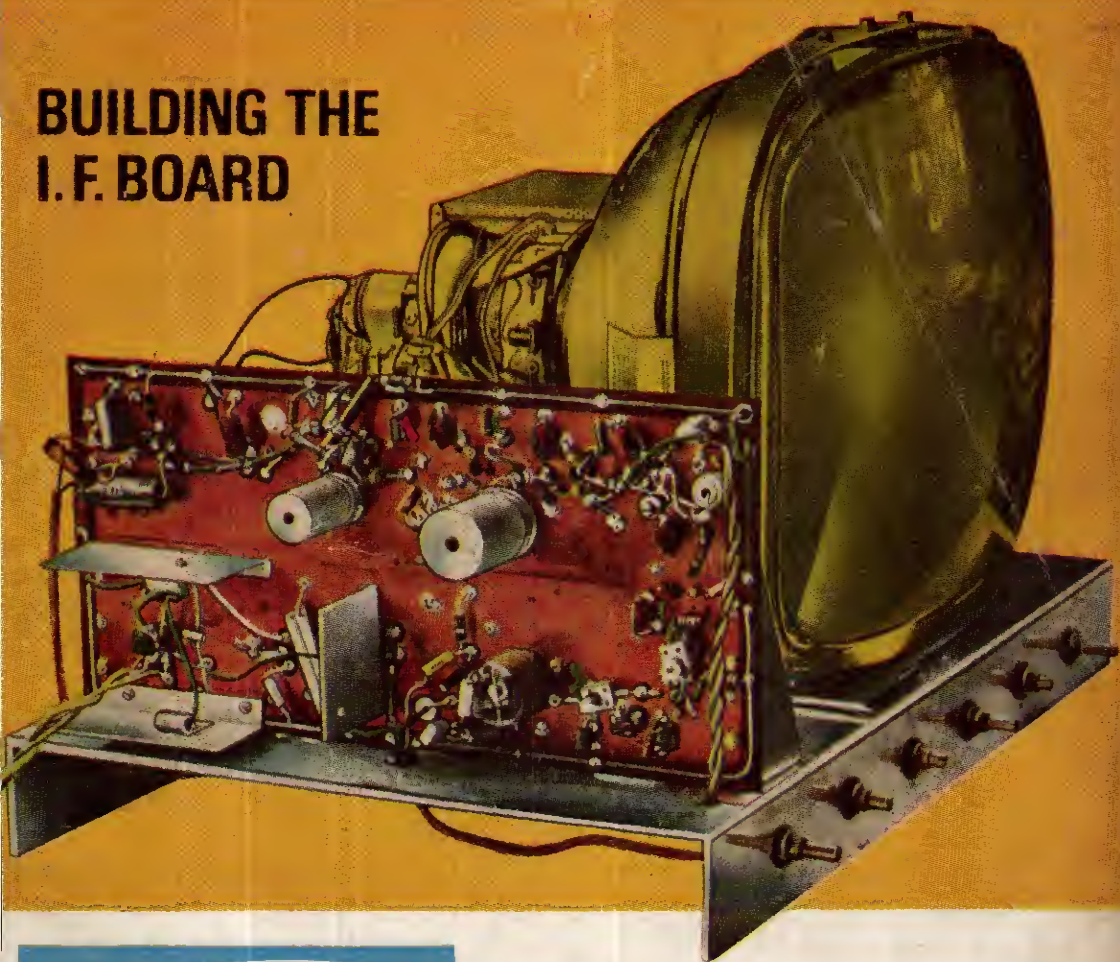


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Practical Television

MAY 1965

VOL. 15 No. 176

COLOUR CHAOS

As these words are being written, EBU delegates are assembling in Vienna for the long-awaited conference on standards for European colour TV. We have no gipsy blood, nor are we clairvoyant, yet it seems safe to prophesy that the conference will achieve nothing much more than to widen the existing gulfs between member organisations.

The conference, in fact, seems doomed before it starts—as it probably was on conception, following the 1963 tests which exposed the near-impossibility of reaching a satisfactory agreement.

The technical aspects are certainly complex. Yet these are the least formidable hurdles. For the whole problem has been taken out of the laboratory and thrown into the political arena.

The UK, with Holland, favours NTSC (see P.T. report last month), the French can see nothing but SECAM and the Germans, PAL. The cases for "national" systems and the attacks on rival systems have been bitter and emotional rather than scientific and detached. The French and Germans are stubbornly entrenched.

One factor which could have resolved the stalemate has now disintegrated into dust. The Russians were at one time apparently sold on NTSC. But the international political climate has changed again and recent events have made it politically "undesirable" for Russia to support an American system. Russian support for SECAM is now the official line and the Eastern bloc will unquestionably follow sheep-like to throw their votes in the same direction.

There is not even a crumb of satisfaction to be gleaned from the announcement last year that if no agreement is reached in Vienna, we will "go it alone". For our domestic political scene has also changed and there is no guarantee that the present Postmaster General will authorise what his predecessors would have done.

Looking at it from any angle, it's a very sorry mess!

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OUR NEXT ISSUE DATED JUNE
WILL BE PUBLISHED ON MAY 20th

All correspondence intended for the Editor should be addressed to: The Editor, "Practical Television", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, including postage: 29s. per year to any part of the world. © George Newnes Ltd., 1965. Copyright in all drawings, photographs and articles published in "Practical Television" is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden.

TELETOPICS

New Equipment Improves Space TV

TELEVISION pictures from the latest Russian manned space flight, which was marked by cosmonaut Leonov's exit from the craft, were transmitted on a different line standard to previous links, and accounted for the improved reception.

Instead of the ten frames per second and 400 lines system which had been used up to then, Russian technicians established a "cosmovision" link on 625 lines with a frequency of 25 frames per second. Improved ground and spaceship station equipment and more powerful transmitters resulted in much clearer pictures for the terrestrial viewer.

FIVE MORE STATIONS FOR BBC-2

DURING the last four months of this year, five more stations will begin transmission of the second BBC television programme. These new transmissions, along with the increased power of a permanent station at Sutton Coldfield, replacing the present temporary station, and the existing Crystal Palace transmissions will bring BBC-2 within reach of a total of more than 26 million people.

The new transmitter at Wenvoe will be opened in September, on channel 51. The Winter Hill and Emley Moor stations will open in October on channels 62 and 51 respectively. Rowridge will open in November on channel 24 and Black Hill during December on channel 46. In each service area, however, there will be the "shadow areas" which are inevitable with u.h.f. transmissions and where reception will be impaired to a greater or lesser degree by local screening. Relay stations, which will operate on a different channel and at low power to serve these areas with boosted signals, will be built once actual transmissions from the main stations have established their exact location.

The opening date for a new station being built at Pontop Pike is as yet uncertain, as site difficulties and weather conditions have hampered work. However, it is hoped that this station will be serving the north-east of England not long after the opening of the other five.

Four New Television Relay Stations

WITHIN recent weeks three BBC and one ITA television relay stations have come into service.

The three BBC stations, all of which also transmit the three v.h.f. sound programmes, are at Larne in Northern Ireland, Scarborough and Carmarthen, transmitting on channels 3, 1 and 1 respectively. At Larne and

Scarborough where horizontal polarization is employed, 16,000 people and 55,000 people respectively will be able to receive the improved BBC-1 transmissions. In Carmarthen, where the BBC Welsh programme will be transmitted with vertical polarization, 13,000 people will be served.

The ITA station is sited at Richmond Hill between Douglas

FORTY MILES OF TV CABLING



This is part of a mammoth wiring job which has recently been carried out at Tyne Tees Television's enlarged and re-equipped City Road Centre in Newcastle. The photograph shows vision wiring on the termination panel of the central camera control, for which British Insulated Callender's Cables Ltd. supplied over 40 miles of cable.

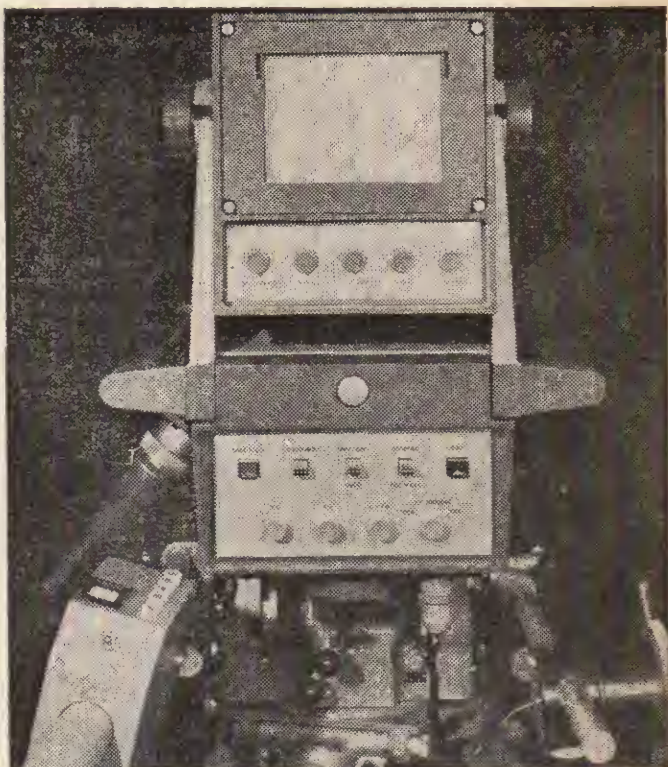
and Newtown on the Isle of Man. Working unmanned by remote control, the station receives Border Television programmes on channel 11 and re-transmits the signal on channel 8. The signals are horizontally polarized and should reach approximately 34,600 people in the service area of the transmitter.

A Transistorised TV Camera from Marconi's

GRANADA Television Network Ltd. and ABC Television Ltd. are two of the first companies to order the new Marconi mark V image orthicon camera. This camera is the latest result of Marconi's ten years of development on the 4½ in. image orthicon and is said to be the smallest and lightest camera of its kind in the world. In the mark V camera, valves have been eliminated by a completely transistorised circuit.

Granada plan to use the new camera in their re-developed Studio Centre in Manchester. ABC on the other hand have ordered 16 cameras, together with sound mixers, picture and waveform monitors and synchronizing pulse generators, to re-equip three outside broadcast vans.

Apart from their reduced size, the new Marconi cameras are exceptionally simple to use and flexible in operation. Higher degrees of circuit stability and reliability have made it possible to relieve the cameraman of many of the controls appearing on standard equipment and to his benefit too goes the incorporation of a unique tilting viewfinder, which can display the picture from the camera, a picture from an outside source, or a mixture of the two. A single zoom lens on the camera removes the restriction of a number of fixed focal lengths occurring with the usual lens turret.



A cameraman's view of the new Marconi transistorized TV camera. At the top is the camera's unique tilting viewfinder, below which are the simple on off and "talk-back" communication controls.

London Conference on U.H.F. TV

RECEIVER and transmitter design, propagation, aerials, parametric amplifiers, and test equipment are among the subjects to be covered in an international conference on "U.H.F. Television" to be held in London during September this year.

The sponsoring bodies of the conference are the Institution of Electrical Engineers (Electronics Division), the Institute of Electrical and Electronics Engineers, the Institution of Electronic and Radio Engineers and the Television Society. The timing of the conference has been arranged to coincide with the Radio Show, which itself will be, for the first time, international in scope.

SECAM RECEIVER IMPROVEMENTS

FOLLOWING the recent announcement of the USSR's intention of adopting the French SECAM system of colour television, came the claim from the French television industry, that recent developments make the SECAM colour receiver simpler and cheaper than any of its rivals.

These developments, resulting in improved reliability and lower production costs, have been achieved by a reduction in the number of adjustments and components in each receiver. Amplification functions, which were formerly separate and which are now obtained from a single circuit, and new low-cost, mild steel delay lines have been developed as part of these receiver improvements.

Microwave Link for New Zealand

MICROWAVE link equipment operating between 7,000 and 7,300Mc/s and manufactured by EMI Electronics Ltd., has been ordered by the New Zealand Broadcasting Corporation. The equipment will be included as part of an expansion of New Zealand's television service.

When installed in the Christchurch and Wellington regions, the link equipment, along with its associated tower equipment, will be used to carry both vision and sound signals.

PART 4 — POWER, FOCUSING, ETC.

WHILE it is possible to operate a transistorised camera from a battery (and this is now made even more feasible by the introduction of the Ever Ready TV1 heavy duty battery designed for use with transistor television sets), the majority of commercial cameras employ a mains power supply.

The vidicon anodes require low-current potentials in excess of those obtainable direct from a battery, as revealed in Part 2 of this series, but it has been found that a "ringing choke" e.h.t. generator using a power transistor and obtaining its drive signal from the line timebase in the camera can produce suitable potentials.

The pulse potential so obtained is rectified by a silicon e.h.t. rectifier and smoothed by a low-value capacitance, the arrangement here being similar to that used for e.h.t. production in ordinary television sets, but such a high potential is not needed for the vidicon, of course.

To ease the initial problem, however, the beginner to closed-circuit television would be advised to secure the various power supplies from a mains unit. This need not be very elaborate and simple, bridge, full-wave and half-wave rectifier circuits, energised from a suitable mains transformer, can be adopted.

The main factor here is to ensure that the various supplies are adequately smoothed, for mains ripple will otherwise show up on the picture as dark bands or patterns.

Power Requirements

The transistors in the video amplifier and time-base can generally run from a 25-volt source, with p-n-p transistors, the collectors being negative with respect to the emitters. Anode 1 of the vidicon can often run at a potential between 300 and 350 volts positive with respect to cathode. Anode 2 (the focus anode) can pick up a positive voltage from the same source, via a potentiometer labelled "fine focus control". The same 300/350-volt supply can also be used for energising the target of the vidicon, via the "target bias control", again a potentiometer.

For the camera tube control (grid 1) a variable negative potential (relative to cathode), from zero to about 100 volts (depending upon anode potential) is necessary. The potentiometer used here has a function similar to that of the brightness control of an ordinary television set, and on the camera is sometimes denoted "beam control".

The voltages and feeds applied to the vidicon are detailed in Fig. 8 in Part 2 of this series. In addition, of course, a supply suitable for the heater of the vidicon is needed.

An idea for a power supply providing these requirements is depicted in Fig. 19. Complex volt-

The Elements of Closed Circuit TV

BY
G. J.
KING

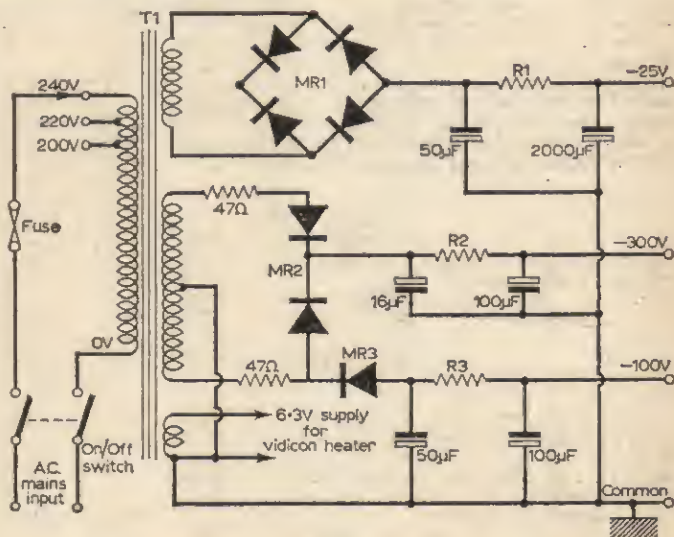


Fig. 19—Power supply circuit for transistorised camera channel.

age regulation artifices are not needed for the simple system. The mains transformer T1 has a standard mains primary, tapped as required, a 6.3-volt secondary for the vidicon heater and probably a pilot bulb and two h.t. secondaries. One of these has a 25-volt winding (or a winding to suit the power supply line of the transistor amplifiers and timebases) and the other a 250-0-250-volt winding.

A bridge rectifier MR1 is used for the 25-volt supply. A suitable rectifier here is the Westinghouse H130L9000. Two silicon rectifiers MR2 in

Band I Tropospheric Propagation

Station	Country	Notes
CHANNEL E2 Ruislede Bremen Oldenburg	Belgium W. Germany	625 possible Rare
CHANNEL F2 Caen Mt. Pincon	France	All 819 possibles Check for floaters
Limoges Les Cars Troyes Les Riceys	France France	Check on regional programmes (noon)
CHANNEL E3 Liege Ougree	Belgium	Now 625 possible Rare except in E. Anglia
CHANNEL E4 Lopik	Holland	
CHANNEL F4 Nantes Hts. Goulaine	France	819 possible vertical polarization

All the stations given in the two published lists have been received in the British Isles at various times. In addition to the stations mentioned in these lists, there is a "mystery" concerning certain Yugoslavia transmitters variously reported as being received on both channels E2 and E3.

READERS' REPORTS

Rather few station reception reports this month as most of our correspondence has been about technical matters rather than DX logs, and this of course is due to winter conditions.

Mr. A. Müller of Catterick Camp, Yorkshire, turned in an excellent log for the previous month, more than 30 stations apart from the British Isles, and including the USSR, Denmark, Sweden, Italy, Spain, W. Germany, E. Germany, Holland, Finland, Czechoslovakia, Poland, Belgium and France.

Special Request

We are hoping to start a new series of information pages which will deal each month with one particular European TV service. Each month will give all the useful data on the service being described, including details of the Test Card and opening captions. The publication of Test Card photographs is unquestionably of great importance, particularly to the lesser experienced DX'er. And this is where we appeal to everyone interested in TV DX.

To ensure we can give full and comprehensive coverage, would any readers who have really good Test Card and caption photographs please let us borrow them in order to prepare printing blocks from them? All pictures (and preferably negatives) will be returned safely after use and the owners of photographs used in the magazine will be duly acknowledged.

We would be very grateful indeed for any assistance in this direction, and we hope you will all rally round!

programmes will not be abolished... The present method of broadcasting will continue for some time". And is still doing quite nicely today despite nationwide TV coverage!

It is easy to be wise after the event, but we were diverted by an article (which, it is fair to say, had a disclaimer from the Editor) in which the author questioned whether the c.r.t. was a superior method of display. The objections lay in the future. On colour the author writes "it will always be impossible to make a fluorescent screen which will glow with different colours under the influence of an electron stream." The three-gun tube seems so obvious to us!

From overseas we read of German sets (180-line) selling at £30 and the start of experimental high-definition TV in France.

An interesting trade item told of double-track gramophone records for use by dealers to demonstrate television! The special pickup fed the respective signals to the vision and sound receivers. And, even though its days were numbered, many companies continued to advertise 30-line mechanical equipment. An average price was around 60/- for the disc receiver and 10/- for the optical unit.

Finally, from a discussion of possible nouns for TV "lookers-in" emerged, among oddities, "viewer". As for terms to be used for the actual equipment, one of them at least—Cathovisor—was registered as a trade-mark. We wonder what they would have thought of Goggle-Box?



(From "Practical Television", May, 1935)

THE headline story of April 1935 has a familiar ring. A scare campaign seems to have been launched by the newspapers to the effect that set makers would stop production of radio sets to concentrate on TV sets for the new high-definition service. One of the weapons used to counteract this damaging and ill-informed campaign was the issue of posters to radio dealers and statements in local newspapers by the radio industry. So the "your set will soon be obsolete" line we know so well goes back quite a few years!

One curious topical aspect was the fact that although the public would soon be wanting receivers, there were no regular high-definition transmissions and so the set makers had very little facility for conducting experiments and field tests.

In the leader, P.T. says "Even when the television programmes do arrive, the normal (radio)

ON THE AIR

Amateur Band Topics

J. Thornton Lawrence describes his amateur station

I NTEREST in amateur television with J. Thornton Lawrence, of Prestatyn, first started in 1951 with the construction of a simple television waveform and pattern generator for servicing purposes.

A flying spot scanner and monitor using a 931A photomultiplier and two VCR97 c.r. tubes deflected by common timebases were constructed in 1955.

A more advanced flying spot scanning system was built later using two television receiver chassis. Synchronising pulses for these were derived from another television receiver receiving the local BBC transmission.

During 1957 a complete television waveform generator and vision/sync mixer was built. This provided a U.K. 405-line standard waveform.

In January, 1958, an amateur television licence was obtained with the call sign GW3JGA/T. (In January of this year the new call sign of

GW6JGA/T was issued to conform with the new pattern of call sign prefixes for amateur television stations.)

A 70cm transmitter was constructed using an 832A valve as a power tripler in the final stage. Although this was only about 10% efficient, very good results were obtained and on April 13th, 1958, the first GW amateur television QSO took place with GW3FDZ/T* at Llandudno, a distance of 18 miles. F.S.S. pictures were exchanged.

A higher power transmitter was then constructed using a QQV06/40 power amplifier in the final stage. Using this transmitter, pictures were radiated over a 38-mile path to GW3FDZ/T, located at Nebo, in Anglesey. Portable receiving equipment was used.

*GW3FDZ/T is now in Canada.



The author in his "shack". Apart from amateur TV interest, GW6JGA/T is RSGB Regional Representative for North Wales, president of the University College of North Wales A.R.S., committee member of the B.A.T.C. and chairman of Flintshire Radio Society.

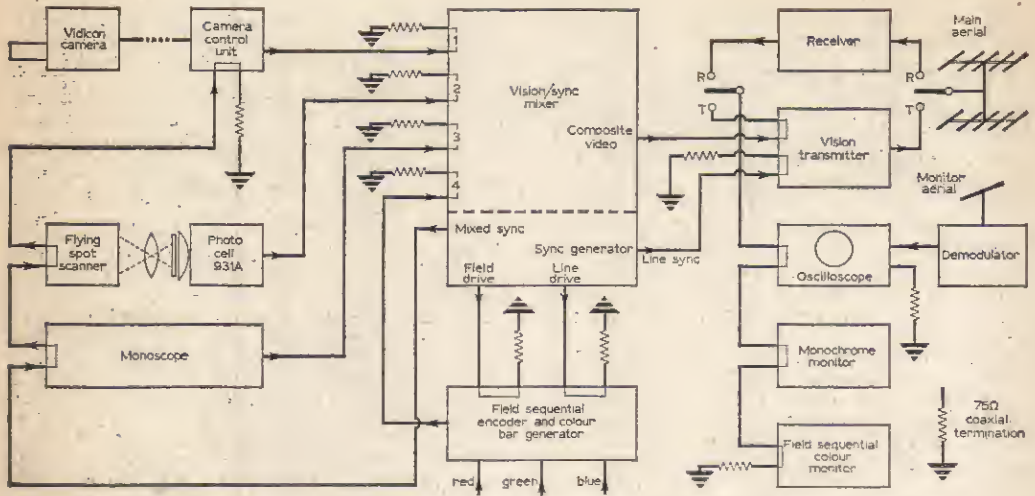


Fig. 1—This diagram represents the present arrangement of equipment at amateur TV station GW6JGA/T.

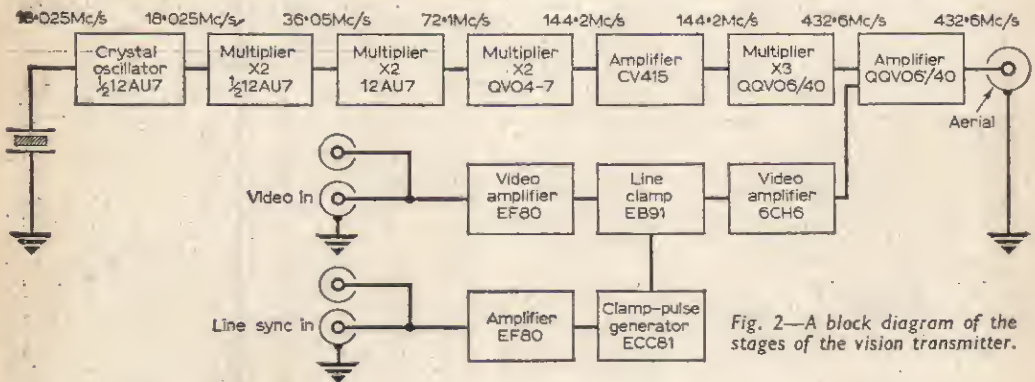


Fig. 2—A block diagram of the stages of the vision transmitter.

During 1959 a joint effort with GW3FDZ/T produced a vidicon camera using an EMI 10667M tube.

An interest in amateur colour television developed after a visit to the 1958 B.A.T.C. Convention, where amateur colour television was being demonstrated.

A small field-sequential colour monitor and colour bar generator were built during 1959-60. Closed-circuit and over-the-air transmissions to GW6PCZ/T in Rhyl, four miles away, were made using this equipment. Results were so encouraging that a larger colour monitor using a 14in. MW36-24 tube was built. This unit, which was completed in 1963, proved very reliable in use. A colour flying spot scanning unit is now under construction.

The present arrangement of equipment at GW6JGA/T is shown in Fig. 1. The waveform generator provides standard U.K. 405-line

waveform and the vision/sync mixer gives a composite video output at 1V level.

The Vidicon camera contains a 10667 tube and its associated video amplifier. Timebases and power supplies are contained in the camera control unit.

The flying spot scanner uses a 7BP7 tube in a modified Murphy V200 chassis; the 931A photo-multiplier is followed by a three-valve video amplifier and cathode follower stage.

The Monoscope camera is based on the Marconi BD617 unit and has a test card "C" display. The

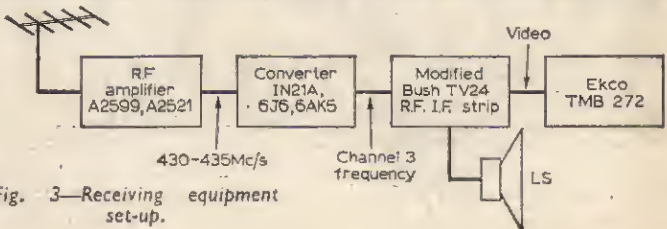


Fig. 3—Receiving equipment set-up.

outputs of all the signal sources are non-composite video at 1V level.

The monitor oscilloscope employs a VCR139A tube and the vertical amplifier has a bandwidth of 3Mc/s with three switched inputs. The monochrome monitor is a modified 9in. Ekco TMB272.

The transmitter is crystal controlled and the final stage (a QQV06/40) runs at 40W input for peak white. Grid modulation is used for television and conventional anode and screen modulation for A3 operation. The equipment is mounted in a 6ft rack.

A check of the transmitted signal is made using another aerial and a demodulator stage. The frequency meter used is a cavity type (ex W.D. TS184). The receiver set up is shown in Fig. 3.

Several types of aerials have been tried, including a yagi with mesh reflector, corner reflector and slot-fed yagis. The latter type is in use at present and is mounted at a height of 30ft.

The "shack" at GW6IGA/T is in the garage, where the space is divided equally between operating area and work benches. Test equipment includes an Avo 7, Advance signal generator, R and C bridge and oscilloscope.

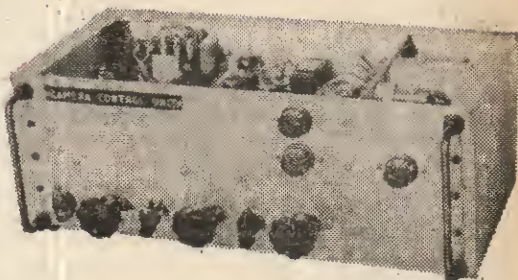
The location is about a mile inland, 100ft above sea level, overlooking the Irish Sea. This gives a line-of-site path to Northern Ireland in the west and to Blackpool in the north. The Isle of Man is included in this arc. Transmissions in all other directions are virtually impossible due to the surrounding hills.

Regular tests are being made with G6LJO/T in Poulton-le-Fylde, near Blackpool, and pictures have been exchanged over the 40-mile path.

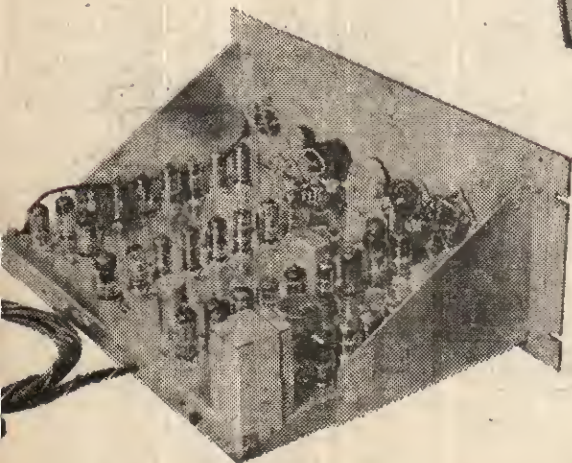
Most of the equipment employs valves but the colour monitor has some transistor hybrid circuits. A transistorised vidicon camera and waveform generator are planned for the future.



The author standing beside his rack-mounted transmitting equipment.



The vidicon camera control unit.



The waveform generator and vision/sync mixer.



The camera designed around the EMI 10667M tube.

A HIGH GAIN PREAMPLIFIER

TWO HIGH GAIN,
LOW NOISE
CIRCUITS FOR
BAND III, BASED
ON THE MULLARD
AFZ12 TRANSISTOR

by J. D. Benson

A MEANS to improving reception, whether it be radio or television, is always welcomed by the experimenter, professional or amateur. The Band III preamplifier described in this article is based on an original design developed in the Mullard Semiconductor Measurement and Application Laboratory, to whom I am indebted for the use of the data and circuits. The design is developed around the Mullard alloy diffused transistor AFZ12, which is particularly suited to working at Band III frequencies and when used in the circuits described is capable of high gain at low noise level. This last-mentioned characteristic is very important if a "clean" picture is to be obtained.

At this point it should be pointed out that experimenters who build this preamplifier would be well advised to use only the Mullard AFZ12 transistor if optimum results are to be obtained. It is tempting to use cheap substitutes but at 200Mc/s only a first-class transistor will give satisfactory results.

In developing the preamplifier ten different transistors were used in each configuration. The gain figures for each circuit represented a very good average. It will be seen also that two circuits for the preamplifier are shown, one using grounded base and the other grounded emitter. The grounded base circuit gives slightly higher gain but has a higher noise figure, i.e. 55dB, when compared with a noise figure of 3.9dB for the grounded emitter circuit. The reason for the difference in noise figures stems from the fact that in the grounded emitter model better matching is possible.

The average gain for the grounded grid and grounded emitter configuration are 12.5dB and 11.0dB respectively for nominal emitter current of 1mA. The bandwidths for the respective preamplifiers are 2.7Mc/s for grounded base and 5.0Mc/s for grounded emitter. It should be noted that these figures were taken at the lower frequencies of a number of the Band III transmissions.

The preamplifier is perfectly stable provided certain precautions are taken, i.e. the output must be screened from the input, which is the reason for the design adopted. It will be noted that the power supplies are decoupled in the interests of stability.

Construction is straightforward and should be carried out in fairly stout copper sheet where possible. The main chassis should be marked out in the flat state and drilled and then formed over

a block of wood which has been cut to the inside dimensions of the base of the chassis. Some constructors may complete the chassis by fitting sides and a lid which can be soldered in position after final adjustments have been made. The amplifier would then be protected from damage and dust.

Transistors must always be protected against heat when soldering is carried out, so in the interests of safety, where one or more components

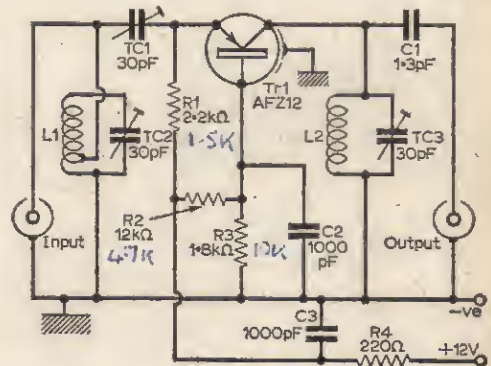


Fig. 1—The Mullard AFZ12 transistor used in grounded base mode as a preamplifier.

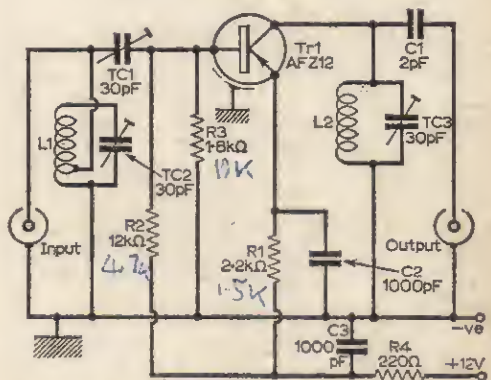


Fig. 2—The grounded emitter circuit for the preamp.

AF139 values

COMPONENTS LIST

Resistors:

- R1 2.2k Ω
 - R2 1.2k Ω
 - R3 1.8k Ω
 - R4 220 Ω
- All 10% $\frac{1}{4}$ W carbon

Capacitors:

- C1 1.3pF (Fig. 1) 2pF (Fig. 2)
- C2 1000pF ceramic
- C3 1000pF ceramic
- TC1, 2, 3 3-30pF concentric trimmers

Inductors:

- L1 2 turns. Tapped at $\frac{1}{2}$ turn from chassis
 - L2 $2\frac{1}{2}$ turns
- Both coils wound to an outside diameter of $\frac{3}{8}$ in. with 18 s.w.g. tinned copper wire.

Transistor:

- Tr1 AFZ12 Mullard

Miscellaneous:

- 3 single tag strips, 2 coax sockets, sheet copper for chassis and screen (18-22 s.w.g.) connecting wire, nuts and bolts etc.

have a common connection with the transistor, these components should first be soldered together, leaving a single joint to be made to the transistor. The last joint should be made using a heat shunt.

The coils are wound and formed so that a "foot" is made to facilitate soldering (see sketch). The coils are self-supporting and should be wound with the diameter of the wire between turns. Beehive-type trimmers are used for tuning and to ensure that they are mechanically rigid when soldered the stem should be pressed into a BA nut to form a base which is soldered to stem and chassis.

The transistor must be carefully positioned so that the screen passes between output and input. Short lengths of sleeving should be fitted to transistor leads to obviate short-circuits. The transistor holder should be carefully fitted to hold the transistor firmly under normal circumstances.

A refinement would be a simple wooden case, made to fit amplifier and supply battery with on/off switch, and since the current consumption is very low, i.e. less than 2mA, a low consumption indicator could be fitted as a precaution against the amplifier being left on overnight.

Having constructed the amplifier and checked against wrong connections and unwanted solder, tuning can be proceeded with. Starting with TC3, this should be adjusted for maximum response. TC2 should next be adjusted for maximum and lastly TC1. This procedure should be repeated until no further improvement can be obtained, after which the beehive trimmers should be sealed with wax to prevent movement.

If it is found during tuning that maximum output cannot be obtained within the tuning range of TC2 or TC3 then L1 and L2 can be adjusted by separating or squeezing the turns slightly together. Separating the turns increases the frequency range, squeezing together lowers the range. If either TC2 and TC3 is at minimum capacity (open) for maximum results then the associated coil requires slightly stretching until the trimmer will tune the signal in and out.

If these instructions are carefully carried out maximum results will be obtained. It is important that first-class components be used throughout if the best performance is to be gained.

In conclusion then the experimenter living in an area of very weak signal, together with local interference, would be best advised to use the grounded emitter circuit with its low noise level, whilst for stronger signal areas the grounded base model would be most satisfactory. If maximum gain is, however, required and the constructor is prepared to accept a slightly noisier background then the grounded base configuration is best suited. The sketch shown is for grounded emitter model. ■

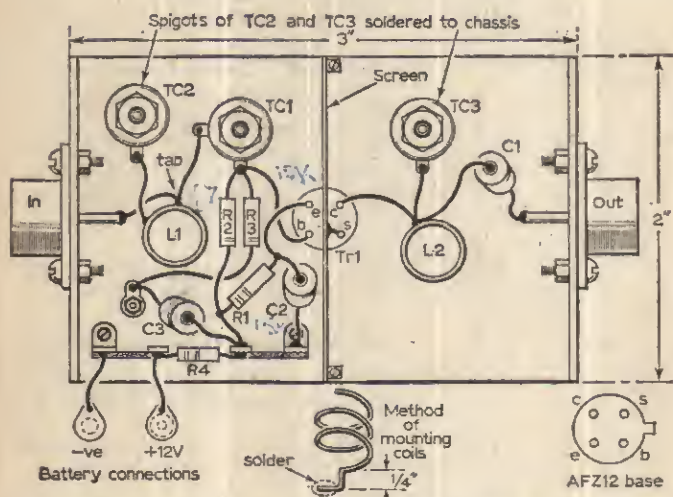


Fig. 3—A complete constructional diagram of the grounded emitter circuit (Fig. 2). The form of construction for L1 and L2 is also shown here.

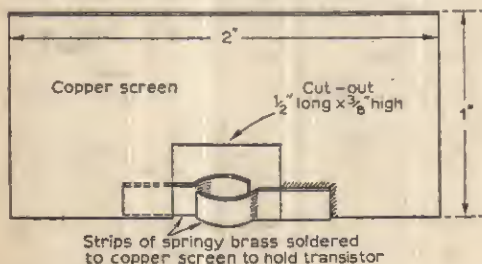
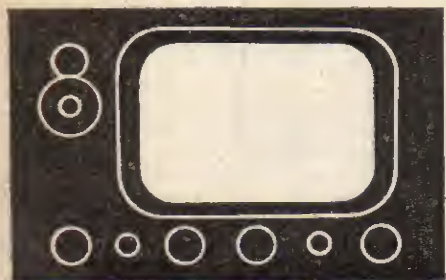


Fig. 4—Details of the copper screen and transistor clip.



THE OLYMPIC II Transistor TV

by D. R. Bowman

Part Two Tuner Coil Data and I.F. Unit

WINDING details for all the r.f. tuner coils are given in Table 1; but it should be observed that since this is an "incremental" type of tuner, with limited channel coverage, the constructor may have to do a little adjustment if the channels he requires are not those provided in the prototype. Channels 1, 3 and 5 are specified here. The primary of T1 is thus 9 turns (channel 5) padded with two auxiliary inductors (L1, L2) on the switch, each of four turns 28 s.w.g. enamelled copper wire. Similarly the oscillator inductor (L9) consists of four turns 18 s.w.g. tinned copper wire, spaced to $\frac{1}{8}$ in. length, and padded with L10 and L11, which are each of two turns 28 s.w.g. enamelled copper wire. The fine-tuning capacitor VC1 should cover the channels specified without difficulty, but in case of need the padding inductors may be adjusted by spreading out the turns. To facilitate such an adjustment the padding inductors are first wound on a $\frac{1}{8}$ in. former (a drill) and then slipped off. They are quite strong enough to be self-supporting when soldered to the switch lugs.

The Band III padding inductors consist of a $\frac{1}{2}$ in. length of 22 s.w.g. tinned copper wire formed into a hairpin and soldered direct to the centre of the switch lugs. Adjustment is by altering the position of these with respect to the switch by bending up or down. For the oscillator, smaller hairpins may be needed, and the size may be reduced by squeezing the middle of the hairpin with a pair of pliers until the correct channel coverage is retained. The prototype was designed to cover channels 9, 11 and 13. The writer has not been able to locate a suitable small turret on sale commercially to the public, but there may be one manufactured, or shortly to be introduced. If one is obtained in the near future, the r.f. tuner will be modified so as to utilise it, and a note of the design will be published. This would be much preferable to an "incremental" tuner of the type described, inasmuch as construction would be simplified and modifications (to change channel coverage) would be rendered very easy.

In due course a u.h.f. tuner will be designed for the new frequencies, using Texas GM0290 transistors.

Setting up the r.f. tuner is hardly practicable, until at least the sound i.f. amplifier has been built, and so the "drill" for these adjustments will be detailed later. As a preliminary, however, it is worth while to check that the oscillator functions on all channels—the actual frequency of operation does not matter a great deal at the moment. A very good

way of checking the functioning requires negligible apparatus and even less skill. All one needs is an OA70 diode, a multimeter capable of reading 0—50 μ A or 0—100 μ A, and a capacitor of approximately 200pF.

The diode is soldered to the two capacitor leads so as to make a loop, and the multimeter leads are connected across the capacitor as close as convenient to the body of the capacitor. This loop is now used to search for r.f. output. It may be looped round a coil, or so placed that a side of the loop runs close to the Band III main inductor L12. When the tuner is switched on, a d.c. reading should be obtained when the loop is reasonably close to L12. The same loop can readily be used to detect the presence of unwanted oscillation, and this should be done with the oscillator transistor B—lead unsoldered and the unit switched on, to check that the r.f. amplifying and frequency-changing circuits are in fact stable. Instability in these is not a problem with this tuner however, and in the prototype these particular circuits could not be induced to oscillate unless something gross were perpetrated, such as touching a collector lead with the finger.

I.F. VIDEO AND AUDIO STAGES

The two i.f. amplifiers required for the 405-line standards are both arranged on a laminate board measuring 12 x 6 in. With these amplifiers are associated—on the same board—their respective sound output and video amplifying stages. Separation of the synchronising signals from the vision signal is accomplished in a separate unit to be described later.

In the prototype, the printed circuit board was finally mounted by the use of metal brackets. These are not shown in the diagrams, but may be made to any reasonable dimensions from 20s.w.g. aluminium and bolted to the printed circuit in any convenient position.

In order to obtain good output with thermal stability it is necessary to mount the sound output transistors on heat sinks. These are cut from 20s.w.g. aluminium sheet 2 $\frac{1}{2}$ " square and are mounted on the circuit board as shown. They may be earthed if the LFH3 package is used, as the casings of the transistors are not connected to the transistors electrically. Cooling clips to mount these transistors are obtainable from Radiospares Ltd.

TABLE I

R.F. Tuner Inductors All on formers of bakelite or polystyrene 0.3in. diameter (as obtained with the popular canned assembly).

Band I

Oscillator: L9 (Channel 5) 4 turns 18 s.w.g. bare wire spaced to $\frac{3}{16}$ in. length. V.H.F. iron dust tuning core (slug.)

Padding inductors L10 (Channel 3) L11 (Channel 1). Both, 2 turns 28 s.w.g. enamelled copper wire wound on $\frac{1}{16}$ in. dia, drill shank and slipped off. Adjust by spreading the turns.

R.F. Inter-stage: T1 (Channel 5). Primary 9 turns of 28 s.w.g. enamelled wire close-wound. V.H.F. iron dust tuning core.

Secondary, 7 turns of 28 s.w.g. enamelled wire close-wound, spacing $\frac{1}{16}$ in. from primary. V.H.F. iron dust tuning core.

Padding inductors L1 (Channel 3) 5 turns 28 s.w.g. enamelled copper wire wound on $\frac{1}{16}$ in. dia. drilled shank and slipped off.

L2 (Channel 1) 5 turns wire as above.

L5 (Channel 3) 4 turns, 4 more turns for L6 (Channel 1) as above.

Inductances wired on the switch wafers to be adjusted by spreading the turns. Fixed inductors L9 and T1 (primary and secondary) are tuned by the iron dust cores.

Band III

Oscillator: L12 (Channel 13) $1\frac{1}{8}$ in. length of 22 s.w.g. tinned copper wire, two strands parallel and touching. Adjust by spacing the strands of wire.

Padding inductors L13 (Channel 11) L14 (Channel 9) $\frac{1}{2}$ in. length of 22 s.w.g. tinned copper wire formed into a 'loop' and soldered to centre of switch lugs.

R.F. Inter-stage: T2 (Channel 13) Primary $3\frac{3}{4}$ turns 18 s.w.g. tinned copper wire spaced to $\frac{1}{16}$ in. Brass tuning core.

Secondary $2\frac{1}{4}$ turns 18 s.w.g. tinned copper wire spaced to $\frac{1}{16}$ in. Brass tuning core.

Note: The space between the primary and secondary windings of T2 must be $\frac{1}{8}$ in. and must be located so that the primary (connected to S1A) is above the upper circuit board level, and the secondary below.

Padding Inductors L3, L7 (Channel 11) L4, L8 (Channel 9) $\frac{1}{2}$ in. length 22 s.w.g. tinned copper wire formed into a 'loop' and soldered to the centre of the switch lugs.

(a) oscillator—adjust the positions of these hairpin loops by bending up or down bodily; squeeze centre to shorten wire if necessary.

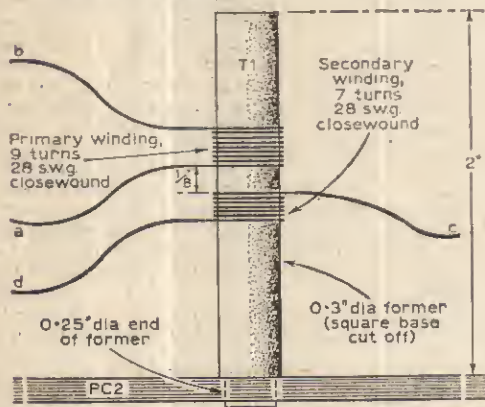
(b) others—adjust position on switch by bending up or out bodily. In extreme cases adjust length by squeezing centre as above.

I.F.T.I. Frequency-changer collector transformer (Tunes to 27.5 Mc/s).

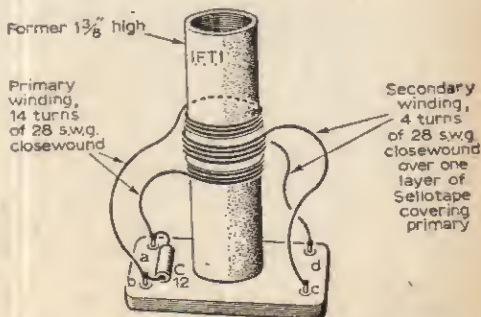
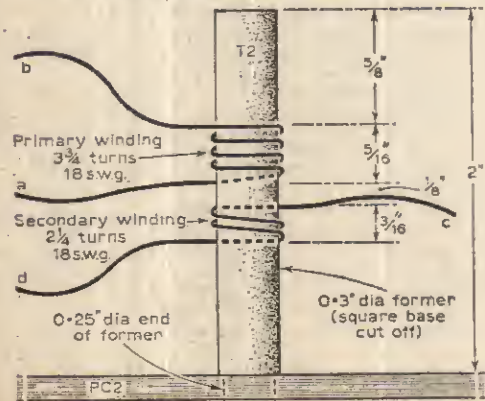
"Short" can assembly ($\frac{3}{8}$ in. \times $\frac{3}{8}$ in. \times $1\frac{1}{8}$ in. long).

Primary 14 turns 28 s.w.g. enamelled copper wire, close-wound.

Secondary 4 turns 28 s.w.g. enamelled copper wire, close-wound, wound centrally on above, spacing—one layer Sellotape. One V.H.F. iron dust tuning core.



Above—Winding details of T1.



Above—Details of IFT1, and left—T2. Note: C7 should be wired across T2 "outers" (b and d).

All i.f. screening cans must be properly earthed (to chassis +ve) and if the method for mounting as shown in the inset to Fig. 12 is used, no trouble will be experienced. It will be necessary however, to use $\frac{1}{2}$ in. lengths of 6BA studding (or 6BA grub screws). Bolts can be used, if fitted from the inside of the former.

The Sound I.F. Amplifier

The first sound i.f. amplifier stage is very loosely coupled to the i.f. output from the frequency-changer, and consists of a two-stage configuration of high gain in which five tuned circuits are incorporated. During the design stage it was found not a simple matter to obtain a sufficient degree of coupling in the two double-tuned transformers; if the capacitance used for tuning was such that the correct bandwidth was achieved, the coils themselves became so small physically, that differences in spacing them, hardly detectable to the eye had marked effects on the degree of coupling achieved. This was, of course, due to the low input resistance of the transistors. Tapping-down was tried but again difficulties of reproducibility appeared. Finally it was realised that by introducing a controlled measure of positive feedback in each stage, the damping could be much decreased. This would enable the tuning capacitance to be decreased, the coil thus physically comprising more turns, and in addition, gain and selectivity would be increased.

This was not found to be difficult to arrange over the two stages which were now all that was required.

The prototype receiver uses an OC75 audio pre-amplifier following the detector stage, but gain is so high that the output transistors are well loaded with noise alone, at maximum gain—even though the noise level of this receiver is no more than half that of a valved receiver of equal sensitivity. In fact the pre-amplifier stage could well be omitted if desired. The facility is left in however because even when no picture at all can be resolved sound comes through loud and clear, and this is often all that is necessary for long-distance reception.

In the input stage (L23) matching to the input resistance of Tr9 is accomplished by a capacitive tap comprising C47 and C48. Neutralising is by means of a variable air-spaced trimmer, TC2, which is adjusted in the early stages of setting-up. The collector circuit of this transistor is coupled to the base of the next by the double-tuned transformer i.f.t.3, in which coupling is arranged to be about 0.9—a little less than "critical". The secondary is tapped for the base of Tr10 to improve impedance-matching.

A similar transformer couples Tr10 to the detector; the only difference between these transformers is that a tapped secondary winding is unnecessary.

The working-point of the sound i.f. transistors is such that compared with those in the vision i.f. amplifier the input resistance is higher. This is accomplished by a small change in the base bias voltage, caused by using a different value resistance network. Adequate d.c. stability is obtained; the receiver has been tested only to 45°C (113°F) but stability is good. The lowest temperature at which it has been tested is 0°C, and it works quite well at this temperature also.

The detector is of perfectly conventional design, as is the noise limiter. The latter does not appear to be quite so effective with transistors as with valves, but little annoyance is caused by what motor-car ignition interference still "comes through". An i.f. filter is also provided.

The sound amplifying stages are also purely conventional and the output is the usual class B with driver. About 6dB of negative feedback is applied, with beneficial results, but the driver and output transformers specified will enable some 20dB to be applied without instability if desired. At least 1W output is obtained. The distortion level is some 5–6% with 6dB negative feedback, and would decrease considerably with more. Plenty of gain is available should this be desired. The reader will observe that the writer is not a "hi-fi" enthusiast!

The receiver is set up in the usual way, using a signal generator tuned to 38.15Mc/s. The neutralising capacitors TC2 and TC3 are both set at minimum to begin with. As the tuned circuits are brought into alignment these should be adjusted upwards in value, until, with the receiver fully tuned it is on the verge of oscillation. Then the neutralising capacitors should be unscrewed a little—about 10% capacitance reduction—and the tuning adjusted again. This should be repeated until reasonable noise output is obtained with the volume control at maximum and no signal input. The noise current in a 3Ω speaker should be about 10 to 20mA r.m.s. as measured with a GEC Selectest meter set to the 75mA a.c. range—connected in series with speaker and output transformer.

The Vision I.F. Amplifier

It was in the vision i.f. amplifier that serious problems began to arise in the development of the receiver. The "tailoring" of the response curve itself presented no great difficulty, although at an early stage it was realised that double-tuned transformers would raise problems. There are many means of accomplishing the inter-stage coupling; apart from tapped secondary and separately-damped primary to obtain the proper bandwidth a combination of tuned transformer with π -coupling is possible. This had already been used in the r.f. tuner, and was not difficult to adjust, but in fact it was yet another adjustment to carry out and to be avoided if possible. Besides, the possibility of conversion for 625-line transmission had to be kept in mind, and if the same inductors could be made to do duty for the present and the future, so much the better as this would ease the conversion task.

It was calculated that a minimum of five tuned circuits would be necessary to obtain an appropriate shape of response curve over the whole receiver, and that because of the bandwidth required the gain would be such as to need three i.f. stages. With the frequency-changer collector circuit already decided, this left four more; so that if the experimental and theoretical work had been done properly (as was hoped!) the right response would be achieved if one entire tuned circuit could be fitted in somewhere.

It was when the problem of the sound rejector was being mulled over that one possible solution occurred to the writer. As will be realised, the low impedance at which transistors operate implies that

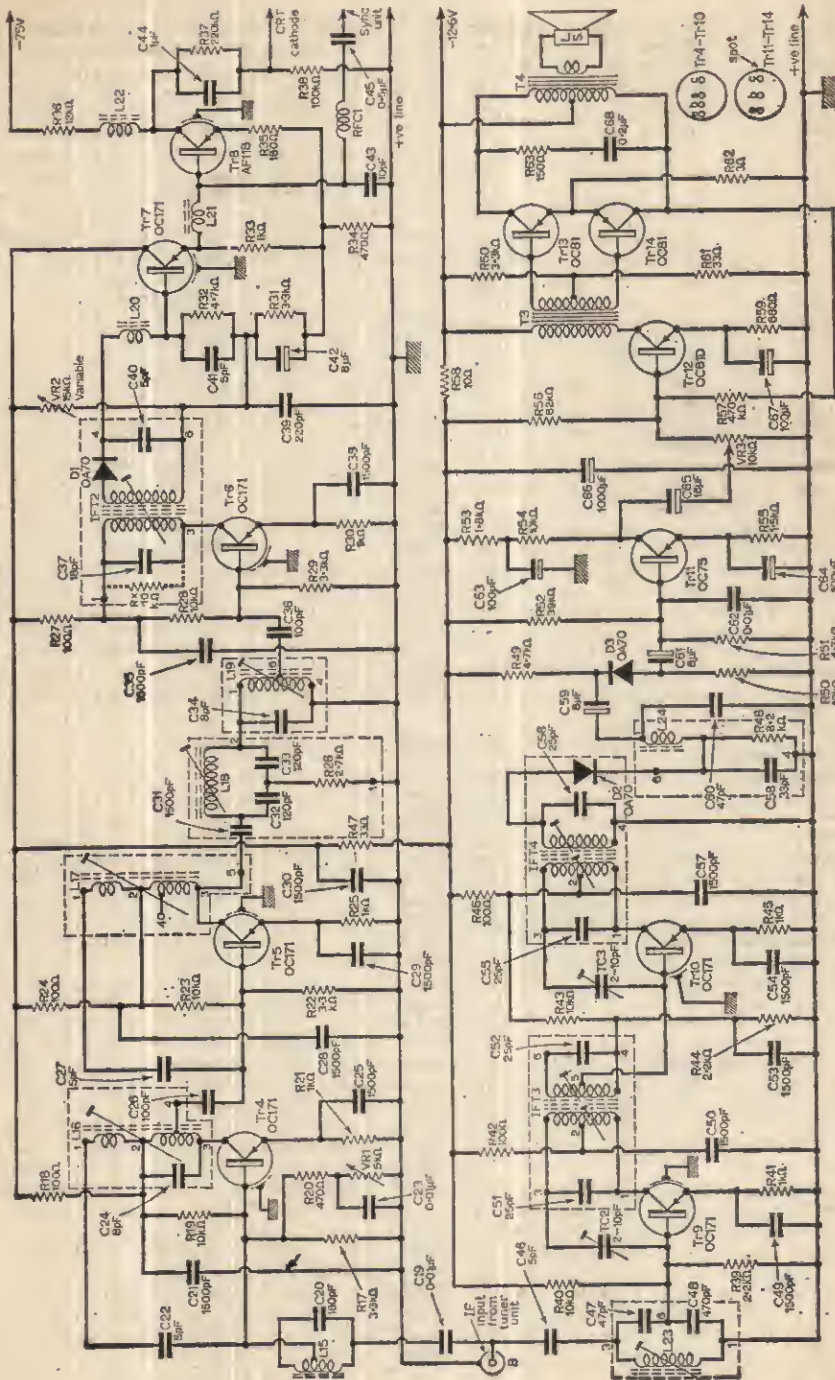


Fig. 10—The theoretical diagram of the i.f. video and audio stages. Rx (contained within the can of IFT2) is a 10kΩ, 5% ¼W damping resistor.

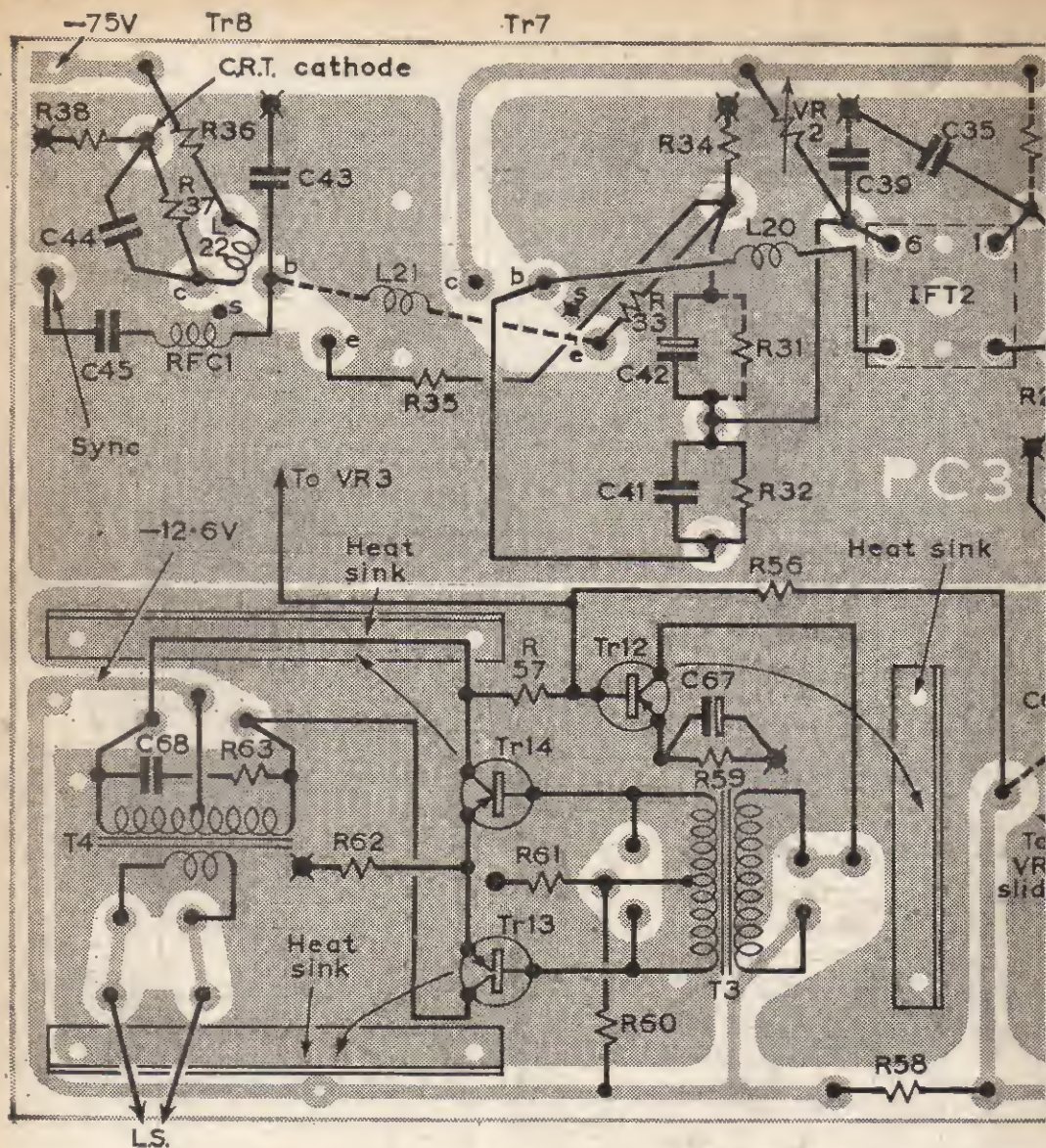
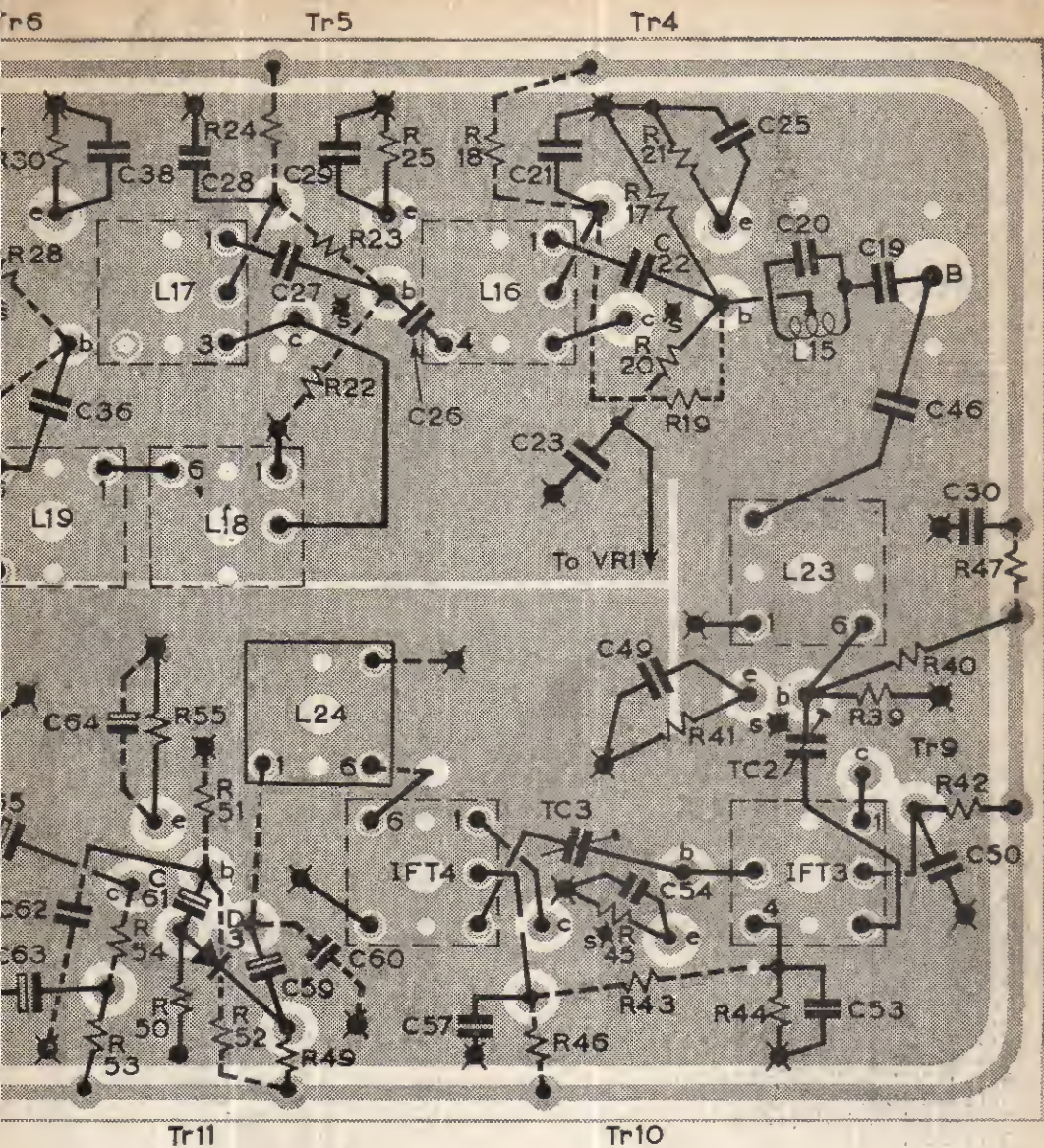


Fig. 11—PC3 printed circuit board drawn full scale (copper parts shaded). Components are mounted on one side of the board, except those shown dotted and T3 and T4 (see Fig. 12). Drilling dimensions for the transformers should be checked against individual components. The boxolin should be allowed to be approx. $\frac{3}{8}$ in. either end of the above template, to allow for mounting brackets. All points marked (which should include the left-hand side of R61 and the lower end of R50) are soldered connections to the +ve foil.

sound traps will have to work at relatively low impedance, and this usually involves tapping well down on a coil, especially if it is in a base circuit. When a coil is already down to four turns or so, an appropriate tap is hard to secure, and in any case coupling is then so low that the resulting rejector has little effect. The way out seemed to be to raise the impedance level at which rejection of the sound i.f. would take place, and this involved fitting the rejector in a collector circuit, where the impedance level is relatively high.

An infinite-rejection type of circuit proved to be very effective, and when used to couple a collector tuned circuit to a base tuned circuit not only resulted in a maximum rejection of some 50dB (using 5% preferred-value capacitors and resistor) but allowed the entire tuned circuit to be fitted in nicely. In fact, to obtain the necessary bandwidth in the rejector its rejection capability had to be reduced to some 38dB, which is not enough; so a further rejector is used, in the input circuit to the amplifier, of the simple tuned-



tapped circuit variety already mentioned. The latter gives about 10-12dB only, but the total rejection in the receiver thus amounts to better than 47dB, which is plenty.

The arrangement finally decided upon is seen in Fig. 10 at L17, L18 and L19 with associated components. The rejector is placed at this point in the receiver, because to put it in the detector stage, where the signal is of greater amplitude, would invite cross-modulation between sound and vision signals (which could never be removed) because of non-linearities in the working characteristics of the transistors. To put it in an earlier stage would have interfered with the layout envisaged for the 625-line

convention, but had cross-modulation become evident in its present position this could not have been avoided. In fact, cross-modulation is negligible with the present circuit arrangement, probably because the input rejector L15 attenuates the sound i.f. signal appreciably and eases matters to some extent.

Fixed neutralisation is practicable and convenient in the vision i.f. amplifier, and no adjustment is called for.

Conventional detection is employed, and the diode D1 is followed by a video amplifier in the usual way. In order to obtain effective detection a moderate value of diode load resistor is required,

and this means that the input resistance of the amplifying stage should be at least equal to the diode load resistance required. However, it is much less when used in the common emitter configuration, and this is therefore an impracticable arrangement.

Consequently, the detector is followed by Tr7, a transistor in the common collector arrangement, which provides for a much higher input resistance. Its output resistance is of course very low, but matches well enough into the base of the second video amplifier Tr8 which is arranged to deliver

the necessary voltage drive to the cathode ray tube.

Tr8 is a high-voltage high-frequency transistor. Because of its low collector capacitance, and the low input capacitance of the cathode ray tube, a relatively high value of collector load resistance may be used provided high-frequency compensation is used. In this circuit, the compensation is wholly in the collector circuit and consists of an inductance L22 in series with the load resistor. This is perhaps not the best system to employ, but it suffices for the 405-line transmissions which use a video signal of 3Mc/s bandwidth.

COMPONENTS LIST FOR I.F., VIDEO & AUDIO STAGES

Resistors:

R17	3.3k Ω	R41	1k Ω
R18	100 Ω	R42	100 Ω
R19	10k Ω	R43	10k Ω
R20	470 Ω	R44	2.2k Ω
R21	1k Ω	R45	1k Ω
R22	3.3k Ω	R46	100 Ω
R23	10k Ω	R47	33 Ω
R24	100 Ω	R48	8.2k Ω
R25	1k Ω	R49	4.7k Ω
R26	2.7k Ω	R50	10k Ω
R27	100 Ω	R51	4.7k Ω
R28	10k Ω	R52	39k Ω
R29	3.3k Ω	R53	1.8k Ω
R30	1k Ω	R54	10k Ω
R31	3.3k Ω	R55	1.5k Ω
R32	4.7k Ω	R56	82k Ω
R33	1k Ω	R57	470 Ω
R34	470 Ω	R58	10 Ω
R35	180 Ω	R59	680 Ω
R36	12k Ω	R60	3.3k Ω
R37	220k Ω	R61	33 Ω
R38	100k Ω	*R62	3 Ω
R39	2.2k Ω	R63	150 Ω
R40	10k Ω	All	10% $\frac{1}{4}$ W carbon

* Three 10 Ω in parallel

Potentiometers:

VR1	5k Ω wirewound (contrast control)
VR2	15k Ω miniature carbon pre-set
VR3	5k Ω carbon (volume control)

Transistors:

Tr4	OC171	Tr8	AF118
Tr5	OC171	Tr9	OC171
Tr6	OC171	Tr10	OC171
Tr7	OC171	Tr11	OC75
Tr12	OC81D	} LFH3 package	
Tr13	OC81		
Tr14	OC81		

Diodes:

D1	OA70	D3	OA70
D2	OA70		

Miscellaneous:

T3	Driver transformer WO1806 (R. F. Gilson Ltd.)	...	2
T4	Output transformer (3 Ω speaker) WO 929/6V (R. F. Gilson Ltd.)	...	7
PC3	Printed circuit board (copper clad laminate) 12 x 6in.	...	11
	Long can assembly (0.3in. dia. former)	...	4
	Short can assembly (0.3in. dia. former)	...	4
	V.H.F. iron dust slugs (purple)	...	4
	Standard iron dust slugs	...	4
	0.3in. dia. polystyrene formers	...	4
	Quantity of 6BA nuts, bolts and washers.	...	4
	Connecting wire. Two coaxial sockets, etc.	...	4

Capacitors:

C19	0.01 μ F paper
C20	180pF silver mica
C21	1500pF tubular ceramic
C22	5pF silver mica
C23	0.01 μ F paper
C24	8pF silver mica
C25	1500pF tubular ceramic
C26	100pF silver mica
C27	5pF silver mica
C28	1500pF tubular ceramic
C29	1500pF tubular ceramic
C30	1500pF tubular ceramic
C31	1500pF tubular ceramic
C32	120pF silver mica
C33	120pF silver mica
C34	8pF silver mica
C35	1500pF tubular ceramic
C36	100pF silver mica
C37	18pF silver mica
C38	1500pF tubular ceramic
C39	220pF silver mica
C40	5pF silver mica
C41	5pF silver mica
C42	8 μ F electrolytic 15V
C43	10pF silver mica
C44	1 μ F paper
C45	0.5 μ F paper
C46	5pF silver mica
C47	47pF silver mica
C48	470pF silver mica
C49	1500pF tubular ceramic
C50	1500pF tubular ceramic
C51	25pF silver mica
C52	25pF silver mica
C53	1500pF tubular ceramic
C54	1500pF tubular ceramic
C55	25pF silver mica
C56	25pF silver mica
C57	1500pF tubular ceramic
C58	33pF silver mica
C59	8 μ F electrolytic 15V
C60	47pF silver mica
C61	8 μ F electrolytic 15V
C62	0.01 μ F paper
C63	100 μ F electrolytic 15V
C64	100 μ F electrolytic 15V
C65	16 μ F electrolytic 15V
C66	1000 μ F electrolytic 15V
C67	100 μ F electrolytic 15V
C68	0.2 μ F paper

Variable Capacitors:

TC2	2-10pF air spaced trimmer
TC3	2-10pF air spaced trimmer

TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS TRADE NEWS • TRADE NEWS

Semiconductors for TV Receivers

TWO new semiconductors, recommended for use in transistorised television receivers, are available from Mullard. They are the AU103 television line output transistor and the BY118 silicon efficiency diode—both intended for use in conjunction with the A28-13W 11in. television tube.

The transistor has a collector emitter voltage rating of -155V and collector current rating of 10A with fast turn-off characteristics. The diode has a reverse voltage rating of 300V and current rating of .14A associated with fast switching characteristics and a low forward voltage drop. Mullard Ltd., Mullard House, Torrington Place, London, W.C.1.

Baird 23in. Group Viewer

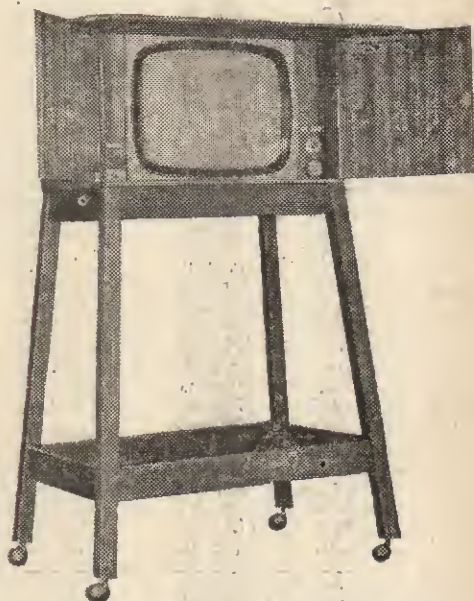
BAIRD TV DISTRIBUTORS LTD. announce the release of a 23in. television receiver for group viewing. Ideal for schools, lecture halls, hotels and clubs, etc., model 638 has full dual-standard facilities for reception of both 405 and 625 line transmissions and covers Bands I, III, IV and V. Flywheel sync is standard for both 405 and 625 line operation and full a.g.c. is provided on all channels. There is a forward facing high quality 8in. x 5in. elliptical loudspeaker and a power amplifier giving 5W output for large halls is provided as an optional extra.

A mains indicator in the form of a red warning light indicates that the receiver is on, even with the doors shut, and an implosion guard is fitted, giving full protection. The tube face and the controls are completely protected by the front cabinet doors,

which can be locked. The chassis is fully isolated from the mains and connected to the earth lead as an extra safety precaution.

A screen shields against light from above, behind or either side of the receiver and is a permanent fixture inside the cabinet. The truncated trolley provides complete stability against accidental knocks and the receiver is located by blocks inside the top edge of the trolley. Large spherical castors allow easy transport over all types of surface.

Model 638 is priced at 97 guineas, including purchase tax of £14 1s. 7d. and is offered to dealers through Baird TV Distributors Ltd., 414 High Road, Chiswick, London, W.4.

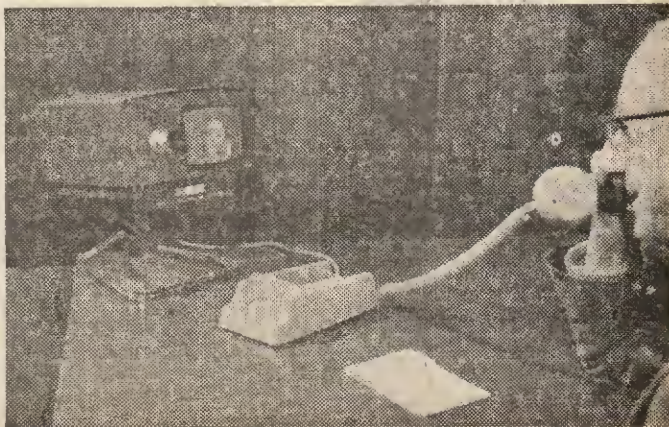


The Baird Group Viewer

Two-way TV Telephone

FROM Horton's Electronics comes the Television Interphone, which is a simultaneous audio and visual closed-circuit intercommunication system consisting of telephone, television camera and television receiver.

Power consumption is 40W, weight is 19.8lb. and the dimensions of each unit are 6.6 x 9.6 x 8.8in. For further information contact Horton's Electronics Inc., Lombard House, Great Charles Street, Birmingham 3.



Two-way TV telephone from Horton's Electronics Inc.

A Do It Yourself Series

A VIEWER'S GUIDE TO TV SERVICING

by H. Peters

PART 3 LOCATING THE FAULT

IN the previous two articles we have discussed the equipment and circuits which are desirable before beginning to work on a faulty television receiver. Now we assume that a fault has developed, and that you are about to track it down. As you will see, the advice is given in tabular form for quicker reference, but before you refer to it we would like to emphasise a few precautions which must be taken when handling television receivers.

Precautions

Most receivers are connected directly to the mains, and unless the wiring is correct the chassis can be "live". Always ensure that the chassis is connected to the neutral side of the mains before handling, but if this is not possible, work on a dry, well insulated floor, and keep away from all earthed objects.

Never check around a working line output stage with a meter or neon tester, as peak voltages are liable to damage both the instrument and its user. Always make sure the e.h.t. has been fully discharged before handling a cathode ray tube. Some tubes can hold their charge for a whole weekend.

Make sure that a dismantled chassis is perfectly secure before working on it; it is very uncomfortable to prevent it from falling when it is running—and dangerous, too.

Using the Table

In the first column of Table 2 appears the symptoms as seen by the viewer. The second column gives simple observations which may be made at the time of the fault, normally without having to remove the back or dismantle the set in any way. The third column indicates the stages of the receiver in which to check for the fault. The fourth and final column gives a list of probable causes of the fault based upon experience.

There is always the chance that the trouble you are trying to cure will turn out to be a "sticky fault", and this is something we do not expect you to tackle.

Intermittent Faults

Most intermittent faults are of a thermal nature, and the time which elapses from switch-on until the start of the fault can often give a clue as to its location.

Trouble within the first twenty minutes is nearly always due to faulty valves; up to an hour for resistors; and longer for capacitors. To localise a thermal fault, you can heat up or cool down small sections of the chassis with the family hair dryer. A soldering iron can be laid across resistors suspected of changing value with temperature, but with capacitors this is usually impossible due to the melting of the outer coating. You can instead try melting the earthy end solder connection.

Physical intermittents normally yield to gentle disturbance by an insulated probe.

Voltage Readings

The intelligent interpretation of electrode voltages can give valuable clues as to where the trouble lies, and we have prepared Table 1 for easy reference.

If you are an avid reader of *Your Problems Solved* or use our queries service, you will have noticed that you are frequently advised to "check R62 and its associated capacitor", and you may be asking yourself: "How on earth do I check R62 with the tools in my kit?" The next and final article in this series may help you in this respect.

TABLE 1 INTERPRETATION OF ELECTRODE VOLTAGES

Electrode	Indication	Notes
Anode	No h.t.	Short to chassis within valve or capacitor. Anode load O/C
	Low h.t. reading	Anode load high, leaky coupler to next stage.
	High h.t. reading	Valve not conducting, anode load low
Screen Grid	No h.t.	O/C feed resistor, S/C decoupler
	Low h.t. reading	Feed resistor high. O/C anode load.
	High h.t. reading	Screen feed resistor low (PL81 favourite)
Control Grid	Heavily negative	Drive to stage satisfactory Stage oscillating (if timebase) Stage unstable (if i.i. stage)
	Positive reading	Leaky coupler. "Soft" valve
Cathode	High reading	Valve conducting too heavily
	No reading	Bias capacitor shorting. Valve not conducting at all

TABLE 2

SYMPTOMS	OBSERVATIONS	CHECK AROUND	CHECK PARTICULARLY
No picture, No sound	No valves light Except for e.h.t. rectifier all valves light normally Some valves light brightly, others remain unlit	Heater chain, valves and c.r. tube heater H.T. supply Heater chain	Mains lead, mains ballast resistor, fuses, on-off switch, TV/f.m. switch if fitted. H.T. fuse, h.t. rectifier, main smoothing electrolytics. If still in trouble look for burned out resistors. Try disconnecting the various h.t. feeds systematically. Heater-cathode leak in the last lit or first unlit valve in the chain
Picture satisfactory No sound	Screwdriver touched on centre tap of volume control produces no clicks or hum in speaker Screwdriver touched on centre tap of volume control gives audible results in speaker, but no clicks are heard when channel is changed	A.F. and sound output stages Sound i.f. and detector stages	Sound output valve. O.C. loudspeaker, o.c. sound output transformer primary winding Sound i.f. valves, detector valve or diode, screen grid decoupling capacitor on i.f. valves
Picture satisfactory, Distorted sound	Distortion varies with volume Distortion does not vary with volume	Sound output stage Interference limiter stage	Sound output valve, loudspeaker, grid coupling capacitor, cathode bias bypass electrolytic Resistor from h.t. to upper end of limiter diode. Capacitor from lower end of diode to chassis.
Sound satisfactory, No picture	No raster, line whistle, or e.h.t. No raster or e.h.t. Line whistle audible. No raster, line whistle and e.h.t. present Raster present, varied by brightness control Raster present, but not varied by brightness control	Line oscillator and output stages Line output transformer and e.h.t. circuit C.R. tube Video amplifier Vision i.f. and detector C.R. tube and brightness circuits	Line oscillator valve, line output valve, efficiency diode, h.t. fuse to timebase where fitted E.H.T. rectifier, efficiency diode capacitor, line output transformer, scancolls, E.H.T. smoothing capacitor if fitted. C.R. tube, ion trap magnet (may be loose), boosted h.t. line, brightness control. Video amplifier valve, vision detector, vision i.f. valves. Check that h.t. is present at anode and screen grids of all vision i.f. valves. C.R. tube for inter-electrode shorts. Open circuit video amplifier anode load or chokes. Unstable vision i.f. stages due to inadequate decoupling.

Screen lights, but no picture or sound	Rotating channel selector produces clicks and flashes	Tuner unit	Mixer valve, local oscillator anode load resistor high, broken tuner contacts. Faulty common i.f. stage (if fitted).
	Rotating channel selector does not produce clicks or flashes	Tuner unit and i.f. strip	Tuner valves, common i.f. valves, H.T. feeds to tuner and i.f. strip.
Sound satisfactory, picture negative	Hiss in sound and "snow" on screen	R.F. stage of tuner, aerial	R.F. amplifier valve, aerial coil in turret tuners, aerial downlead, plug and socket, components at rear of aerial socket (especially after thunderstorm).
	Picture dim, controls have little effect	C.R. tube	C.R. tube with disconnected cathode
Picture distorted	Picture bright, buzz on sound	A.G.C. circuits	A.G.C. and sync valves. Valves controlled by a.g.c. Diodes on a.g.c. line.
	Brightness normal, no buzz on sound	Limiter stages	Limiter valve or diode, limiter control open circuit
	Bottom of screen cramped or folded	Field output stage	Field output valve and cathode bias capacitor and resistor
	Top of screen cramped or distorted	Field output stage	Field output valve, field output transformer, grid coupling capacitor. Low boost volts.
	Insufficient height	Field output stage	Field output valve, low boost volts
	Insufficient overall width	H.T. supply	H.T. rectifier, line output valve, screen grid feed resistor on line output valve
	Insufficient width at left	Efficiency diode	Efficiency diode valve and its associated capacitor
	Insufficient width at right	Line output valve	Line output valve and cathode resistor if fitted
	Bright band of cramping at left	Line output stage	Low line drive from oscillator. Efficiency diode capacitor "brushing" in e.h.t. circuits.
	Vertical lines bend or curve	Sync and timebase stages	Heater-cathode leak on sync separator or line oscillator valve. Faulty electrolytic smoothing capacitors.
Corner shadow, picture off centre	Picture tilted	Scanning assembly	Scancoils need turning slightly around neck of c.r. tube
	Corner shadow, picture central	Scanning assembly	Scancoils not fully forward. Displaced ion trap magnet. Faulty c.r. tube gun assembly (take tube out and refit upside down).
	Corner shadow, picture off centre	Scanning assembly	Positioning magnet maladjusted, focus or ion trap magnets displaced

continued on the following page

continued from the previous page	Line and field hold controls need constant adjustment.	Sync stages	Sync separator valve, coupling capacitor from video amplifier
	Picture rolls or judders	Sync stages	Field sync or interface valve or diode, faulty screen grid decoupling capacitor on sync separator
Picture will not hold still	Parts of the picture more left or right as bright objects near the edge of the screen.	Sync, video, and aerial stages	Sync separator valve and coupler. Resistor from h.t. to video amplifier cathode, vision detector diode, aerial picking up multiple (ghost) images (repair or reposition).
	Little control over brightness	C.R. tube	Low emission c.r. tube
Dull picture	Brightness control causes picture to enlarge and go dim	E.H.T. supply	E.H.T. rectifier valve, faulty line output valve or transformer.
	Brightness satisfactory, but control poor	C.R.T. video and r.f. stages	C.R. tube, video amplifier, vision detector diode, r.f. amplifier valve.
Sound and picture take a long time to appear	Picture comes up small	Power unit	Low h.t. rectifier (favourite PY32 fault)
	Sound and picture arrive together suddenly	Tuner unit	Local oscillator valve and anode load
Pictures low to appear	Sound arrives as normal	Line output stage	Slow heating efficiency diode valve

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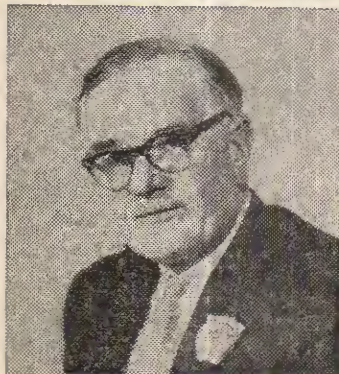


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UNDER NEATH



THE DIPOLE

WITH apologies to W. Shakespeare, Esq.:

To mime or not to mime!

That is the question?

Whether it is nobler in the mind

To stay in sync—

To expand in full your lungs—

To suffer the slings and arrows of outrageous fortune

Or to take arms against the seething critics by opposing them?

Ready, Steady, Go!

To mime! that, indeed, is the question which has faced directors of many musical numbers in both films and television. There is no doubt at all that a far better musical balance can be achieved by pre-recording



The central control desk for the telecine area at the BBC Television Centre. Communication and monitoring facilities give access to the 24 telecines in the area, and to the studios to which they are routed. (See "Telecine and the Future".)

sound by modern methods, compounding the efforts of orchestrators, orchestras, conductors, artistes and technicians. Seven or eight or more microphones plus acoustic effects can be used to great advantage.

This is what is done by the producers of recordings for discs, whether they are pops or operas. It is more difficult on films or television to record directly the vocalists at their best, especially where they are displaying attractive smiles, moving about with appropriate department and looking as though they understood what they are talking about, "backed" by loud noise from the orchestra which is visually shot and sound recorded all at the same time.

Frustrated Goldfish

This is, of course, what should happen if all the participants in this type of musical venture did their jobs in a professional manner, by efficient pre-recording and by miming to playback in a realistic manner when the visual is being shot. It is useless to mouth words without singing properly, with face, throat and chest muscles co-ordinating with the mouth. Otherwise, the effect is reminiscent of the dead-pan expressions of a frustrated goldfish.

I think that the decision of the executive producer of *Ready, Steady, Go*, Elkan Allan, was correct; he is against miming—especially for this programme. Unprofessional pop groups have not been long in show business and it takes time to acquire the art of presentation, movement, development of personality and magnetism. Those youngsters who have it stay the course and find a star place somewhere in show business, in the theatre, music hall, cabaret or even in television.

To acquire professional touch, hard coaching, training, dancing and department has to be undertaken, as it is not possible to survive only on the screams of impressionable teenagers. The real test of these people is what they look like if you turn the sound off their television performances. Some of them, without sound, look more like sleep-walking eels or delirious lobsters than frustrated goldfish. Remember! *To sleep! Perchance to dream—Ay! There's the rub!*

For the future reference of pop singers *Hamlet* will provide them with inspiration more appropriate than *Much Ado About Nothing*. Before long, these hints and tips in PRACTICAL TELEVISION may result in a top of the pops screamline songeroo *All that Glitters is not gold* with words by W. Shakespeare. Alas, poor Yorrick!

Sound Balancing

The accurate balancing of complicated musical backgrounds behind dialogue or "songwords", which is Lionel Bart's name for lyrics, has never been easy for steam radio or for gramophone recording. The use of multiple microphones and acoustic separation between participants has made a great improvement in the "presence" of featured instrumentalists and vocalists, particularly if the singer's voice is weak and diction poor.

It is all the more difficult on television or film if attempted without showing microphones within the frame of the picture. Intelligibility is also lost if, on a domestic television set, the sound reproduction is below par. The knack of the sound balancer (sometimes called a "mixer") is empirical.

tempo strictly from the artiste and making sure that the orchestral accompaniment was subservient to him. Louder passages occurred at the ends of lines, when brass or percussion effects made a colourful punctuation or were reserved for the final chorus.

Future of Telecine

It is pleasant to comment upon the contributions made by various members of the BBC Engineering side, sound or television to the activities of the British Kinematograph Sound and Television Society. The steady growth of the importance of telecine equipment at the BBC was stressed at a recent lecture on *Telecine Facilities for Broadcasting* by Mr. D. P. Leggatt, B.Sc., who reviewed the film

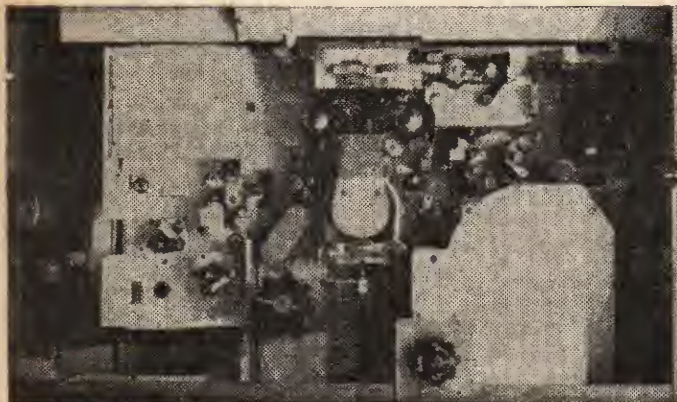
film photography and prints of imported material, especially that which is telerecorded in the USA (known there as "kinescoping") by setting up a motion picture camera in front of a TV monitor.

A particularly poor example of a print from America was seen in a recent *Danny Kaye Show* which provoked many viewers into desperate adjustments to the contrast and brilliance knobs on their home sets. In one of the episodes, long shots of this superb artiste in silhouette were ringed with haloes. Close-ups were most unflattering, introducing facial wrinkles which it would be impossible to retouch by spot-wobbling!

I believe that the original show was made on 35 mm colour film for American colour television from which was derived a black and white duplicate negative, which was, in turn, reduced to a 16 mm print. Just how many duplicate transfers had to be made, I don't exactly know, but the final results were almost disastrous, even when viewed on a good domestic TV receiver.

This particular programme was immediately followed by a telecine transmission of *Voyage into England*, a documentary film about England's canals produced by Peter Bale on 16 mm film. In this case, photographic quality was superb and continued to look good even when the TV receiver was intentionally mal-adjusted. The programme itself was a very well edited version of a series previously shown in the summer of 1964, expertly reassembled to one fifty minute length, with an excellent commentary by Macdonald Hastings in addition to the many comments made in the original scenes.

This is just the material for a reissue on a cold night in the winter, when spring is not far behind. Remember the title of that best selling novel of thirty years ago *If Winter Comes*? Let us hope the BBC give us similar fresh-air and sunshine film documentaries for the miserable freezingly cold nights of next winter.



The film traction section of a 35mm twin-lens flying-spot telecine.

He may refer to the quivering needle of his programme volume meter as a general reference, but he mainly listens subjectively. This is as it should be. But the trend of styles of modern orchestrations has been towards loud, busy and obtrusive backgrounds, with little thought of their interference with the "songwords".

With a microphone about six inches (or less) away from an artiste, this is simplified, but the results are often disastrous when the voice is good and also powerful. Music hall conductors used to keep a close watch upon the vocalist on the stage, taking the

transmission facilities dictated by modern television programme requirements. It was interesting to hear that in the London area alone, the BBC possesses no less than thirty-three telecine play-offs, of which twenty-three are for 35 mm film and ten for 16 mm film, and that, excepting for news items, all make use of the flying spot method.

US Kinescoping

The immaculate transmission of film on the BBC is sometimes blurred by the quality of the

Iconsos



LETTERS TO THE EDITOR

P.W. AND P.T. ISSUES

SIR,—I shall be going abroad at the end of May or June and I am willing to offer my issues of *Practical Wireless* and *Practical Television* of the last four years and certain issues of *Radio Constructor* to other readers of your magazine.

I must stress, however, that ample postage and a stamped, addressed envelope must be sent with requests for copies. First come will be first served and postage will be returned if the copy is not available.—4200894 SAC. WHITE, R.W. (Fire Station, R.A.F. Ballykelly, Limavady, Co. Derry, Northern Ireland).

TAM AND BBC-2

SIR,—The BBC are worried—because of low TAM ratings—about their second channel. The public's refusal to become excited about a high-brow alternative programme I can understand (after all who raves about the Third Programme?), the BBC cannot. I don't know why the BBC are worried. The set manufacturers are the ones who should be pulling in their belts as a lean time pervades the retail trade because the public won't buy the new 625-line receivers that the Corporation says they should.

So what a waste this third TV programme has become. What a waste of a channel, what a waste of equipment and staff and what a waste of programme material so badly needed to fill the two existing programmes. How much better it would have been to have used this extra material and personnel to improve BBC-1 programmes and the equipment to improve reception in the remaining fringe areas and to extend the coverage to those areas still without TV transmissions.—P. R. ROGERS (Croydon, Surrey).

CANNED TELEVISION

SIR,—Seeing the article "Canned Television" (P.T., March, 1965) reminded me of a similar article I saw in another magazine of about 1934 vintage. The receiver in this instance was rather a "Heath Robinson" affair which was driven by the radiogram turntable via a small rubber-tyred wheel which in turn revolved a disc with 30 1/50in. square holes on the outer perimeter forming a spiral aperture. One had to peer through this to view the picture.

The light source was provided by a neon lamp which produced an orange glow. This lamp was in turn connected to the loudspeaker of the radiogram. The linearity control was a piece of string

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

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

wound around the disc spindle which acted as a brake. Even so this disc used to travel pretty fast and I often wondered what would happen if it flew off—but such were the hazards of us pioneers!—J. J. DONALD (Wickford, Essex).

UNUSUAL TV FAULT

SIR,—A Pye VT4 receiver, recently fitted with a new cathode ray tube, gave an increasingly dull and fuzzy picture, although the sound remained normal. All other functions, such as synchronisation and contrast control, were normal. It was guessed, therefore, that either the line output valve or the booster diode had become "l.e." (the h.t. and e.h.t. were found to be low, 385V and 8.0kV at nominal mains voltage).

A new PL81 happened to be handy, so this was inserted with the following unexpected result:

The picture was now of normal size and brilliance and the h.t. and e.h.t. were 430V and 10.8kV respectively, but on the test card the verticals appeared bent.

It was concluded that 50c/s was leaking into the video circuit at some point (there was no hum on the sound).

All decoupling capacitors on both anode and cathode circuits of the video chain, right up to the PL81, were tested by connecting an equivalent known capacitor in parallel with each in turn. There was no hint of trouble at any of these points. It was therefore concluded that 50c/s *must* be leaking through the filament/cathode insulation of the PL81 itself, because this valve is at the "high" end of the filament chain. The internal resistance of this new PL81 was then measured on a valve-voltmeter bridge with the following curious result:

I.R. of	Fil. to cathode	To G1	to G2 or G3	To anode
new valve, cold	150MΩ	13MΩ	30MΩ	∞
new valve, hot	5MΩ	13MΩ	23MΩ	∞
old valve, hot	200MΩ	200MΩ	200MΩ	∞

With a second new PL81 the receiver gave a test card picture of excellent linearity. There would appear to be at least two faults in the offending PL81—filament/cathode insulation poor and "tracking" from filament wires to G1, etc., within the envelope. Not a bad record for a new valve!—G. W. SUTTON (Cranleigh, Surrey).

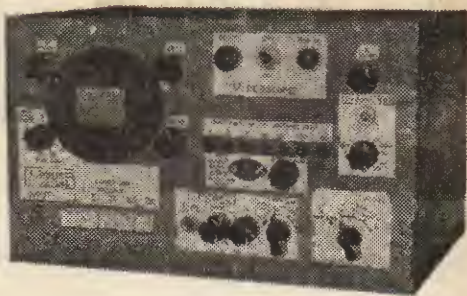
VIDEOSCOPE MODIFICATIONS

Improvements to this
P.T. oscilloscope design

THE *Videoscope** was primarily devised for using the cheap surplus c.r.t. VCRI39A. This tube has several shortcomings, the published circuit being specially matched to these to give a very reasonable and useful performance in a straightforward circuit of low cost.

We have received many enquiries regarding possible improvements with a more expensive commercial tube. The Mullard DG7-32/01 is eminently suitable for the *Videoscope*. It costs about five pounds but brings many advantages to the circuit. It is nearly the same size as the VCRI39A, so no major structural changes are required, and the operating voltages are so similar to those provided for the VCRI39A that only minor changes of some component values are needed. Apart from its superior brilliance and focus, the DG7-32/01 has about 50% more Y-deflection sensitivity than the VCRI39A, so that appropriate reductions in the anode load resistor values in the Y-amplifier become possible, increasing the level response up to some 1.7 Mc/s and the range of usable gain up to 3 Mc/s, the lower limit remaining at about 5c/s as previously.

It is the purpose of this article to sketch the necessary alterations involved in this conversion and to give details of modifications to the sync-circuits for obtaining improved lock at r.f. signal frequencies in keeping with the increased bandwidth obtainable. Whilst maintaining adequate sync rigidity down through the audio range and right down to well below the power mains frequency, the modified sync-circuit still gives rigid lock on a sine wave signal at 3 Mc/s fed into the Y-amplifier from an ordinary r.f. signal generator, even with the otherwise unmodified *Videoscope* still using the VCRI39A tube.



by
**Martin L.
Michaelis**

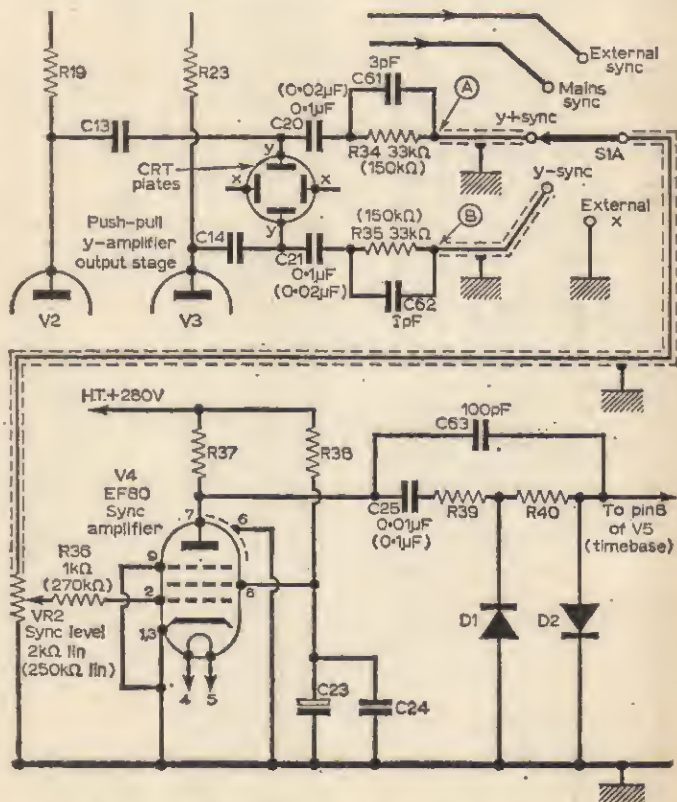


Fig. 1—Modifications to the *Videoscope* sync circuits for obtaining uniform sync action for audio and r.f. frequencies. Bracketed component values are those for the original circuits.

*October, November, December, 1964, issues, "Practical Television."

Increasing the Bandwidth of the Sync-Circuits

We will treat these modifications first, as they may even be useful if keeping the VCR139A tube when waveforms at particularly high frequencies are to be 'scoped'.

The following simple changes of component values are required. C20 and C21 should be changed in value to 0.1μF each. R34 and R35 should be reduced in value to 33kΩ each, and a 3pF ceramic, 500V capacitor should be wired in parallel with each of these resistors. The sync level potentiometer VR2 should be exchanged for a linear 2kΩ potentiometer and R36 reduced to 1kΩ.

In the anode circuit of sync amplifier V4, C25 should be reduced to 0.01μF and a 100pF 500V tubular ceramic capacitor bridged from one end of R39 to the far end of R40 (i.e. effectively between V4 pin 7 and V5 pin 8).

The modified circuit gives excellent and uniform sync of all signal frequencies from the lowest audio right up to several Mc/s, but somewhat less effective than the audio frequency sync obtained with the original circuit which, for its part, does not work above the highest timebase frequency provided, i.e. above about 50kc/s.

Increasing the Bandwidth of the Y-Amplifier

The original *Videoscope* has level Y-gain from 5c/s to 1Mc/s and usable gain up to 2Mc/s. The following modifications to the Y-amplifier, if used with the DG7-32/01 raise these upper frequency limits by about 50% for the same effective sensitivity in volts/cm as previously obtained.

The component changes are: Reduce R9 and R23 each to 6.8k 1W and L2 and L3 each to 575μH. Increase R43 to 4.7k ½W.

Modifications to the C.R.T.-Network (or using the DG7-32 tube

Fig. 2 shows the optimum circuit for operating the DG7-32/01, a high-intensity low-voltage tube in which the cathode and final anode currents are high. Four Zener diodes, D11 to D14, are used to

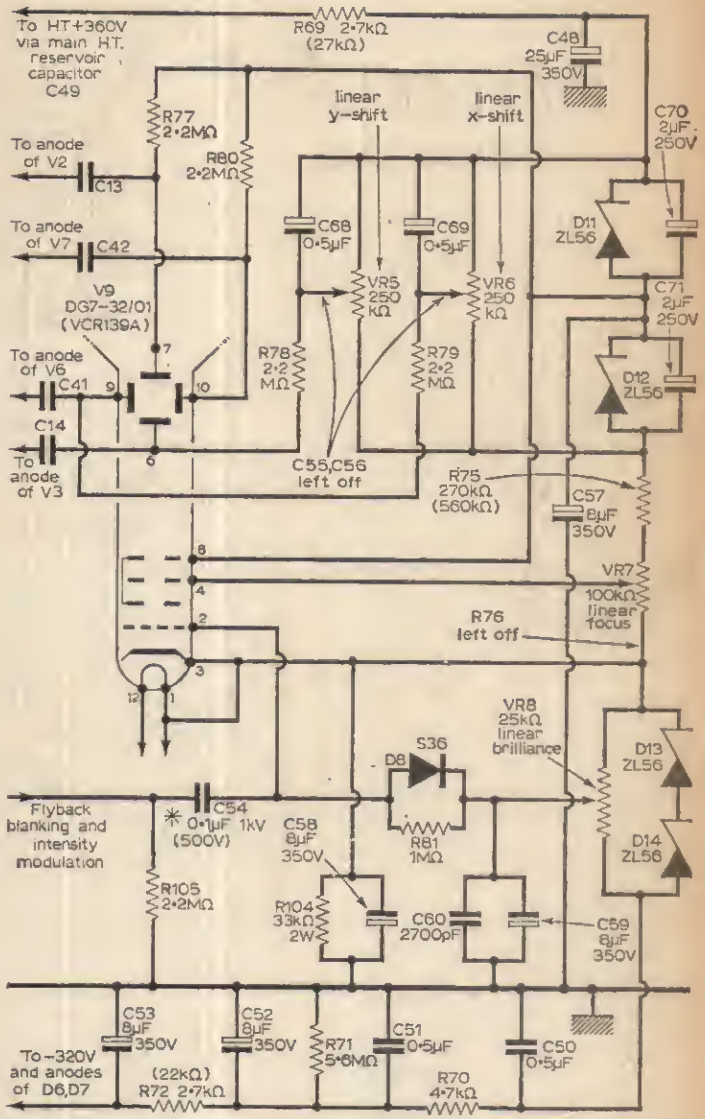


Fig. 2—A stabilised e.h.t. network and optimum circuit for operating the Mullard DG7-32/01 c.r.t. in the *Videoscope*. It is important to change the heater tapping on the mains transformer to 6.3V, since the previous connection for the VCR139A was 4V. C54 should have the higher working voltage when used with an intensity modulation amplifier.

stabilize the e.h.t. bleeder potentials against variation with brilliance setting.

D11 and D12 replace R73 and R74 to keep the shift control voltages independent of the brilliance setting. D13 and D14 maintain a constant voltage across VR8, the brilliance control, and therewith reduce the extent of interaction of focus and brilliance controls. R104 has been added to main-

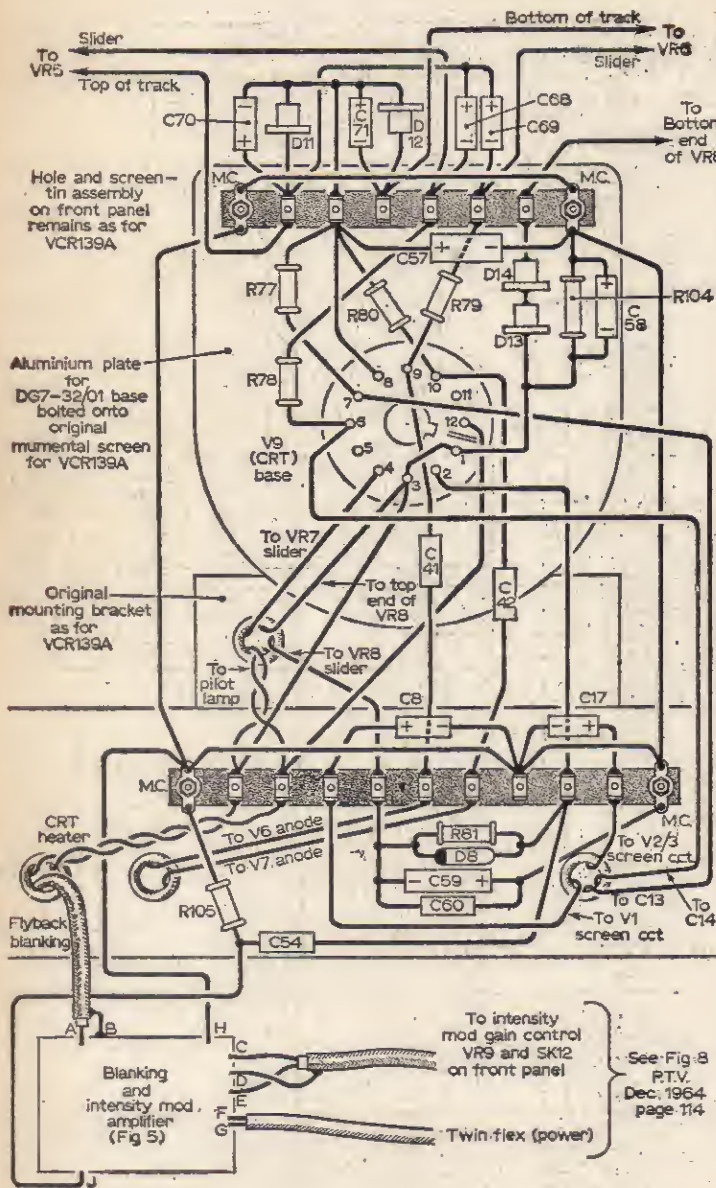


Fig. 3—Connections for the DG7-32/01. The physical details of the hole and screen-mask assembly on the front panel remain as for the VCR139A, however the mounting bracket is moved forward by 0.8 in.

tain sufficient standing current through D13 and D14. All four Zener diodes are type ZL56.

Such stabilisation was not found to be required for the VCR139A but it can be tried if some specimens of this tube should draw higher anode current.

To cater for the higher total current of the DG7-32/01, R72 and R69 are reduced to 2.7k Ω . This leads to somewhat poorer smoothing on both positive and negative e.h.t. feeds, and the disposition of decoupling and smoothing capacitors around the shift controls had to be altered as shown in Fig. 2. This is important, since the DG7-32/01 is marked by particularly fine trace focus in conjunction with high trace intensity, requiring good e.h.t. smoothing.

Finally, to bring the point of true focus into about the centre of the track of VR7, R75 had to be reduced to 270k Ω in this circuit, and R76 had to be discarded.

This circuit permits operation of the DG7-32/01 up to a very high trace intensity without undue loss of focus so that a standard TV picture raster may be built-up at sufficient intensity and with adequate focus for displaying a CCTV picture for setting-up purposes (viewfinder for a CCTV camera) in addition to normal oscilloscope work.

If TV picture display is not required, and if one is satisfied with moderate trace intensity for normal oscilloscope work, a simpler circuit can be used. Compared with the original circuit this involves only the following modifications: Shunt R73 with a 56V Zener diode and increase VR8 to 100k Ω lin.; shunting the new potentiometer with a 68V Zener diode. The respective polarities of the diodes are the same as in Fig. 2. Reduce R75 to 470k Ω .

Structural Changes in C.R.T. Circuit

The DG7-32/01 is about an inch shorter than the VCR139A, but the dimensions at the screen end are virtually identical. Thus no changes are required in the hole and mask arrangement on the front panel, but the whole assembly must be moved forwards about 0.8 to 1.0 inches, according to exact thickness of the c.r.t. base.

If the base-plate on the end of the numeral screen assembly of the VCR139A is removed and a new plate cut from sheet aluminium, mounting

COMPONENT VALUES FOR VIDEOSCOPE MODIFICATIONS

Altered values of components existing in original design:

R19 now 6.8k Ω 1W	R43 now 4.7k Ω 1/2W
R23 now 6.8k Ω 1W	R69 now 2.7k Ω 1/2W
R34 now 33k Ω 1/2W	R72 now 2.7k Ω 1/2W
R35 now 33k Ω 1/2W	R75 now 270k Ω 1W
R36 now 1k Ω 1/2W	VR2 now 2k Ω lin.
C20 now 0.1 μ F paper 500V	
C21 now 0.1 μ F paper 500V	
C25 now 0.01 μ F paper 500V	
C54 now 0.1 μ F paper 1kV.	
L2 now 575 μ H	L3 now 575 μ H
V9 now DG7-32/01 (Mullard)	

Components in original design now discarded:

R73, R74, R76, C55, C56

Additional Components:

R92 100k Ω 1W	R99 100 Ω 1/2W
R93 4.7k Ω 1/2W	R100 1M Ω 1/2W
R94 10M Ω 1W	R101 1.5k Ω 1/2W
R95 1M Ω 1/2W	R102 10k Ω 1W
R96 10k Ω 1/2W	R103 4.7k Ω 1W
R97 1k Ω 1/2W	R104 33k Ω 2W
R98 2.2k Ω 1/2W	R105 2.2M Ω 1/2W
VR9 5k Ω lin.	V10 ECC81
C61 3pF ceramic	C63 100pF ceramic
C62 3pF ceramic	
C64 100 μ F electrolytic 30V	
C65 0.15 μ F paper 500V	
C66 0.15 μ F paper 500V	
C67 16 μ F electrolytic 350V	
C68 0.5 μ F electrolytic 250V	
C69 0.5 μ F electrolytic 250V	
C70 2 μ F electrolytic 250V	
C71 2 μ F electrolytic 250V	
Tr1 2N1613 (General Electric) or other silicon n-p-n transistor 30V/ $\beta \geq 30$	
D9, 10 12V zener diodes (Z12, Brush Crystal Co.)	
D11, 12, 13, 14 56V power zener diode (ZL56, Brush Crystal Co.)	
SK12 Coaxial panel socket	

this on to the mumetal screen with the same three rocker screws and bolting the base for the DG7-32/01 on to the new plate in the correct orientation (Fig. 2) it will be found that the new c.r.t. fits exactly. No changes are therefore required to the chassis-fixture bracket except to drill three new holes in the bottom flange in order to move the whole assembly about an inch forward.

It is advisable to elongate the new base-plate upwards as shown in Fig. 3, mounting an 8-way ragstrip along the top. The new c.r.t. network of Fig. 2 can then be wired-up as shown in Fig. 3, although slight departures in layout are tolerable.

Timebase Range:

The X-sensitivity of the DG7-32/01 in the circuit (Fig. 2) is identical to the original circuit with the VCR139A where the Y-plates were used for X-deflection, so that no changes to the time-

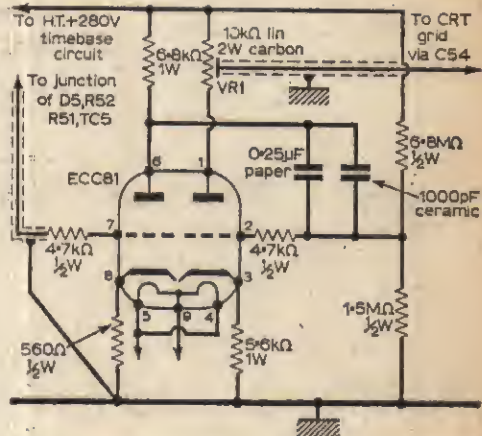


Fig. 4—A suitable circuit for a flyback blanking amplifier when using other c.r.t.'s requiring greater blanking drive. Observe that the mains transformer has sufficient rating to provide the additional 0.3A, otherwise use an additional subminiature 0.3A heater transformer on the bracket chassis. R54 should be duplicated with another similar resistor in parallel when using the blanking amplifier.

base circuit or its calibration are required. For the same reasons, no changes are required to the X-amplifier or its calibrations.

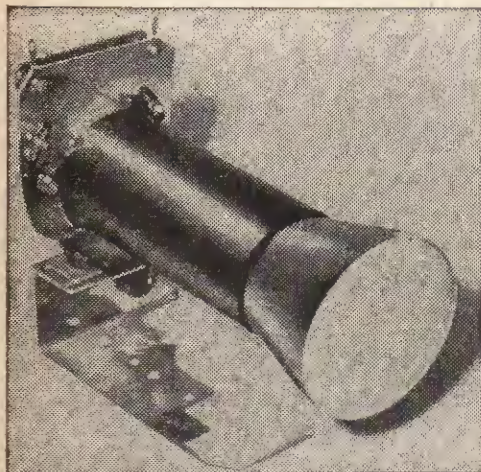
Modifications to the Flyback-blanking Circuits

The DG7-32/01 requires a greater flyback-blanking amplitude than the VCR139A, and the most convenient method of achieving this is to place a suitable blanking amplifier between the junction of R52, R51 and the line to the c.r.t. grid. Fig. 4 shows a suitable circuit which can be wired-up on a miniature bracket chassis screwed to the wooden cabinet base behind the main chassis and beside the c.r.t. network. The preset potentiometer VR1 in Fig. 4, should be set for smooth flyback blanking at all timebase speeds.

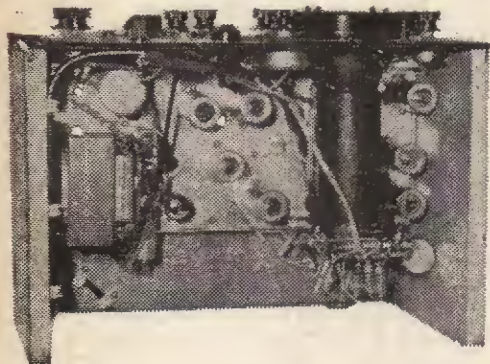
General Remarks

Although these notes are intended for those whose primary interest is not cost but in performance similar to the average portable TV-servicing oscilloscope of commercial manufacturer, those with a smaller purse should nevertheless not be discouraged from building the *Videoscope* around the surplus VCR139A. Performance is adequate for most ordinary TV servicing, and indeed the author used the VCR139A version very successfully for closed-circuit television design work, before embarking on the DG7-32/01 conversion.

The original X-amplifier gives very good performance up to 1Mc/s (with X-gain full up). A sensitive test satisfactorily passed was to connect the X-amplifier input and the Y-amplifier input (via the probe) each to respective medium wave tuned circuits both excited by being placed close to a grid-dip meter running at 1Mc/s. The two



The DG7-32/01 tube is mounted in the same assembly (above) as used for the VCR139A. Below is the modified Videoscope with new tube but without the blanking/intensity modulation amplifier.



tuned circuits were tuned off a little in opposite directions so that the signals were 90° out of phase with each other. An almost perfect circle of more than an inch in diameter could be traced on the c.r.t. screen.

The geometric accuracy of such a circular trace is a sensitive test for any distortion in the 'scope (or signal-generator for that matter). Any 'scope which will "write the 1Mc/s circle" is capable of very useful work on amateur television equipment and domestic TV receivers, whereas further bandwidth in the Y-amplifier such as is provided in the modified version using the DG7-32/01 tube is very useful for special work and more detailed observation of pulse-flanks in television and other circuitry.

A Y-bandwidth greater than 5Mc/s, which the modified Videoscope will approach, is hardly ever required for normal television work, as higher-frequency transients cannot be accommodated in the normal TV waveform anyway. But for special CCTV or colour systems using increased numbers of lines per frame, bandwidths of up to 20Mc/s or more can be very useful.

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a full-wave circuit are used for the 300/350-volt supply. Silicon rectifiers can be used as an alternative, the major requirements being 300/350 volts with a peak-inverse voltage rating in the order of 800 volts. For the 100-volt supply an ordinary 125-volt selenium rectifier is suitable, such as the Radiospares REC.0. This is MR3 in the circuit.

The voltage rating of the electrolytics should suit the line voltage, but should not be rated too high above the line voltage and, of course, never below. The ripple current rating is not very important in this application. The smoothing resistors R1, R2 and R3 can also act as voltage droppers if needs be.

Thus, their value will be chosen to provide the required volts drop at the operating current. That is, to provide the supply line voltages required under load. The 47-ohm resistors in MR2 circuit act simply as surge limiters.

Focusing Adjustments

It will be recalled from an earlier article that the vidicon has two means of electrical focusing. One is by an electrostatic field within the tube and the other is by a magnetic field round the tube neck. The former is provided by the focusing anode (anode 2) while the latter calls for the use of a focusing coil through which is passed an adjustable current via the focusing control.

One way by which the focusing current can be obtained is shown in Fig. 20. Here the coil is connected in series with a preset focus control and a fixed resistor, the whole then being connected across the low-voltage transistor supply. The actual values for the resistors will depend upon the type of focus coil used and the supply voltage.

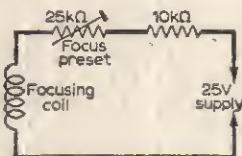


Fig. 20—A simple circuit of this kind is often used for energising the vidicon focusing coil.

It is usually necessary to obtain a field strength in the centre of the focusing coil in the order of 40 gauss (but this will depend upon the first anode voltage), and with the standard type of focusing coil available for the Mullard vidicon the resistor values shown are typical.

The focusing coil and its resistors provide a means of "rough" focusing, hence the preset resistor. Fine focus is accomplished by varying the volts on the focusing electrode. The circuit in this respect is shown in Fig. 8 of Part-2.

With the camera providing some sort of picture on the monitor set and with the focus coils set properly on the vidicon and the fine focus control at range centre, the rough focus control (preset) should be adjusted to secure a resemblance of focus on the picture. This will almost certainly be well removed from the ideal focus at this stage, but by adjusting the preset a few times over its range the best position will be established. The fine focus control may now be employed for normal adjustment of the electrical focus.

One should ensure that the monitor set is accurately focused. This will generally be observed by the picture lines being sharply defined, taking no notice at this stage of the picture detail. It now remains to focus the camera optically, and this is performed, of course, by adjusting the position of the lens in front of the vidicon. After the correct optical focus has been established, the fine electrical focus control setting should be finalised.

Focusing often causes a bit of confusion to beginners in closed-circuit television, but this can be expected since there are four focusing adjustments to contend with. One on the monitor and three on the camera, of the latter three one is optical and two are electrical, as we have seen.

Variation of Frequency

At this juncture it should be mentioned that the monitor focusing can sometimes be affected by the camera's line timebase frequency. The reason for this can be understood when it is appreciated that the line timebase frequency of the monitor set is under the control of the camera timebase, by reason of the timing or line sync pulses derived from the camera timebase.

Thus, if the camera line frequency is altered, that of the monitor set will endeavour to alter correspondingly. For this to happen properly, adjustment to the monitor's line hold control may be necessary.

It is easily possible, therefore, for the line frequency eventually to differ considerably from 10,125 c/s (405 lines) or 15,625 (625 lines). Provided the timebase frequency is the same on both camera and monitor the picture will lock. However, on some monitors and many domestic sets working as monitors, a deviation from the correct line frequency will increase or reduce the e.h.t. voltage on the picture tube.

This will affect the potential on both the first and second anodes and, in the case of certain sets with electrostatic focusing, on the focusing anodes. The result will then be a deterioration of monitor focus.

The lesson here is that every now and again the monitor should be checked for adjustment on a standard BBC or ITV signal, and the camera timebase adjusted to suit that setting established on the monitor.

Target Potential

The voltage applied to the vidicon target has a bearing on the light sensitivity of the camera. For badly lit scenes more target voltage will be needed than for well lit scenes. However, if it is endeavoured to make the camera too sensitive, grain and other shortcomings will appear on the picture. If under this sensitive condition the scene illumination is suddenly increased the picture will probably go completely white or, at least, turn negative.

For the best depth of focus, of course, maximum sensitivity (consistent with minimum grain, etc) should be given to the camera, and the light input reduced by stopping down the lens. This follows normal photography practice, an exposition of which falls outside the scope of this article.

Before the target control is adjusted, the monitor's brightness control should be adjusted on zero signal for a very slight raster illumination. This sets the black level. From thereon the picture should be improved by adjustment to the target control, the contrast control on the monitor and the lens aperture.

It is always best to ensure that the monitor is set up to some definite standard, such as a BBC or ITV test card, and then adjust the camera in relation to this without altering the controls on the monitor. Slight compensating adjustments may be necessary, but these should not be excessive.

Scan Adjustments

The timebases usually feature adjustments for varying the amplitudes of scan and (sometimes) the

Adding Sound

On camera systems which utilise an r.f. oscillator tuned to a Band I channel (see Part 3, last month) upon which the composite video is modulated, the resulting r.f. signal is of the double sideband characteristic. This does not matter very much since the fine tuning control on any domestic set employed as a monitor can be adjusted to provide reasonable compensation within the limits of the type of system under discussion. However, if now the sound channel is turned up the buzz of the vision signal will be heard from the speaker.

Again, this is usually of no consequence since the set is required only as a vision monitor. However, there will come a time when sound as well

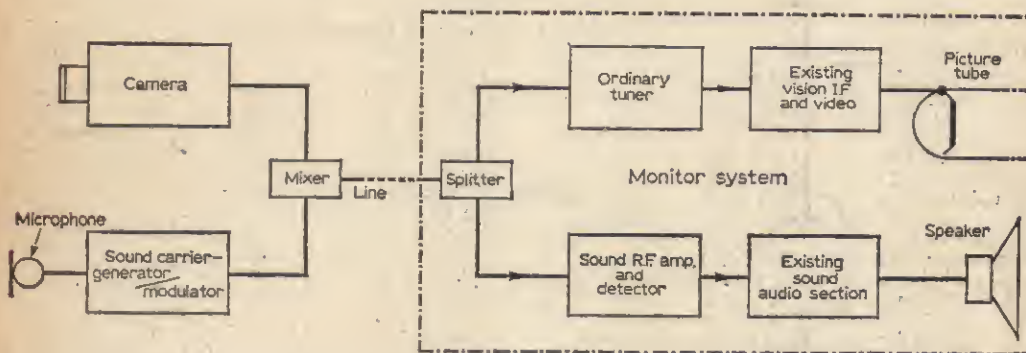


Fig. 21—Block diagram showing how sound may be added to vision on the common signal line.

linearity. The area of the photoconductive layer in the Mullard vidicon is 9.6 x 12.8 mm, and the timebases should be arranged to fully scan this area.

This is best done by first ensuring that the monitor is correctly adjusted scanwise and then adjusting the camera timebases for an overscan condition. This is revealed by the edges of the sensitive area showing round the display on the monitor screen. The scans can then be reduced in amplitude until the picture as a whole just fits the monitor screen.

At this stage the linearity controls, if fitted, should also be adjusted. These are in correct adjustment when there is no change in geometrical form of an object which is moved within the field of view.

Note that maximum signal/noise ratio and maximum resolution are obtained only when the vidicon scanning is correct. Underscanning here can destroy that area of the vidicon photoconductive layer which fails to be embraced by the scanning beam. For the same reason, a camera with lack of line or field scanning should never be operated.

It certainly pays to check the camera timebases with an oscilloscope before the vidicon is actually put into service. One must always have in mind that the vidicon is an extremely sensitive device and it should always be treated as such.

as vision is required by the experimenter and enthusiast! The author has conducted a series of tests to discover whether it is possible or not, easily, to add sound to the vision on an r.f. camera system.

To employ the sound channel of the monitor set requires the r.f. signal from the camera channel to be tailored to resemble that of a standard transmission. While this is possible, rather complex filters are necessary and unless these are accurately designed and the r.f. output stages of the camera considerably improved over the normal arrangements it is virtually impossible to delete vision buzz while retaining a reasonable standard of definition.

L.F. Carrier

Ultimately this method of feeding sound was abandoned in favour of a far less complex system. Instead of using a Band I sound carrier frequency, the sound is modulated onto a relatively low-frequency carrier (2 Mc/s was employed by the author). The sound r.f. signal is then mixed with the vision r.f. signal at the camera control and sent over the coaxial to the monitor receiver.

The monitor in this case was an ordinary domestic set with the existing sound channel rearranged. The sound i.f. channel was disconnected from the tuner (or common i.f. amplifier) and one of the then redundant EF80 valves

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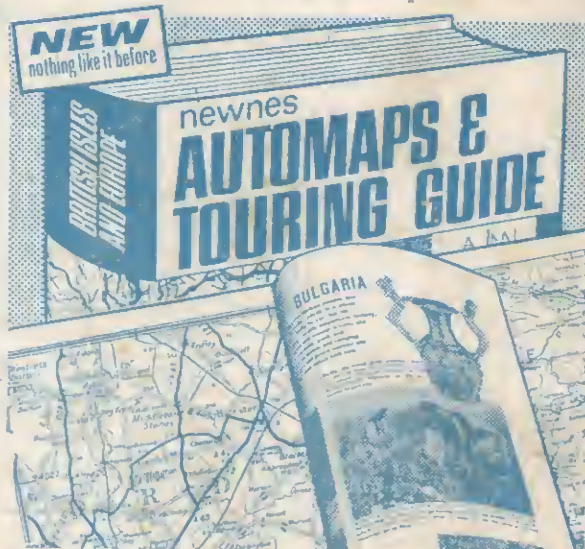
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