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PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR F. J. CAMM

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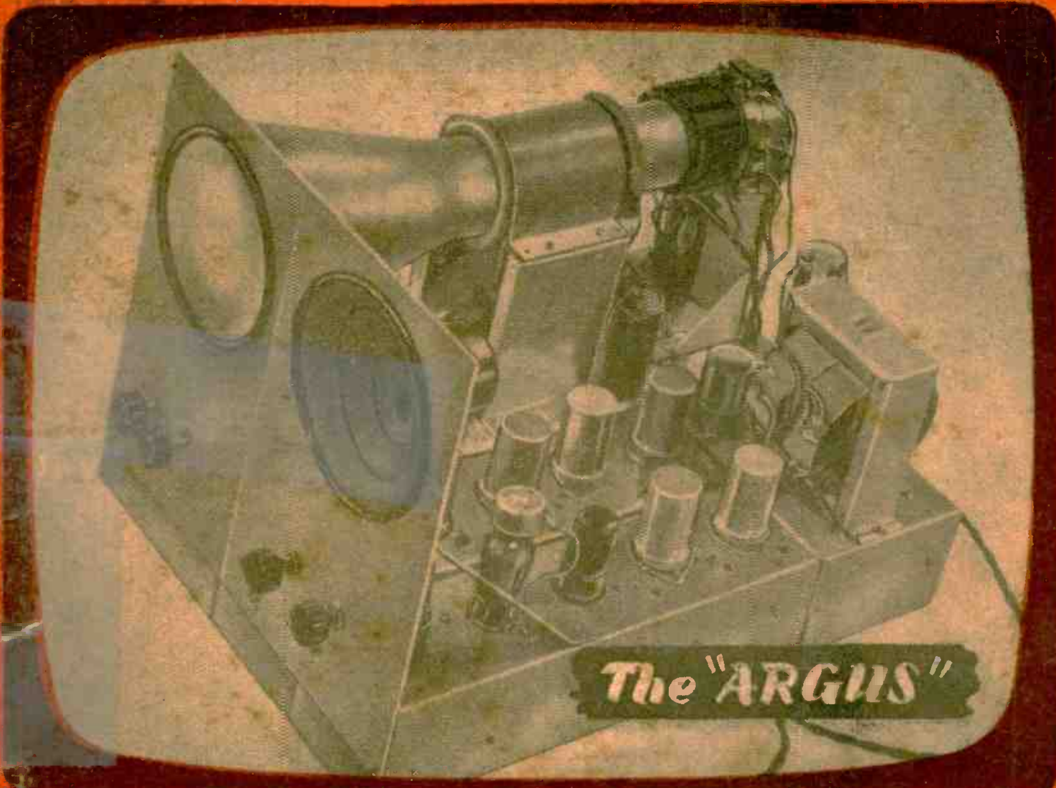

FEATURED IN THIS ISSUE

Picture Distortion Analysed
All About Filters
The Video Amplifier
TV on Low-voltage Supplies
Servicing Your Receiver
Modifying Pye Strip for Channel 2

PRACTICAL TELEVISION

& "TELEVISION TIMES"

Editor : F. J. CAMM

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Televiews

A SOCIAL REVOLUTION ?

A SUNDAY paper recently published results of its investigations into what it calls an important social revolution, namely, television, the most compelling mass-produced amusement yet devised for the home. It asks what will happen to the 2,000,000 people who will be looking in before this year is out, without reaching conclusive results. On the one hand it is regarded as a great social boon and on the other as a grave potential danger.

If it is true that TV has revolutionised home life throughout all the reception areas it has probably done so for the better, although the Sunday paper concerned thinks that it is a greater "mental drug" than either the radio or the cinema. If these three things are mental drugs, so is every other form of entertainment, such as the theatre, the concert hall or table tennis.

It is said that TV destroys conversation ; but when it is remembered that 90 per cent. of the average conversation is of the most trifling character, revolving around the weather, TV is really performing a national service. It would be truer to refer to most conversation as chatter.

Another criticism is that TV cuts off people from their friends. There is no evidence to support it. All the evidence proves that it brings them together, especially when one has television and the other has not.

It is said that children in a TV-equipped home are consistently late to bed because they sit up to watch the TV programme. That might apply for one night a week, but it is not true generally, and the newspaper concerned has no authority for saying otherwise. On the other hand TV encourages manual hobbies by televised demonstrations, improves the culinary abilities of the housewife by the cookery series, and awakens interest in Party politics by the screened discussions. We are told that in the Midlands and the South the £8/£12 a week viewer is five times more numerous that the £1,000 a year man.

It is possible that families which normally spend three hours a week at the cinema now watch TV for 12 hours a week. Bearing in mind the price of commercial television receivers this is now understandable. People cannot afford both.

According to a BBC survey out of every 100 viewers who own TV sets 86 reduced radio listening, 63 reduced picture going, 49 play fewer indoor games, 46 read less, 35 cut down theatre going, 22 do not see so much of their friends, 14 cut down their gardening, 11 spend less time on trips to the country and 9 cut their golf, cricket, tennis and football. Out of every 100 children between 5 and 7 years old, 8 stay up for an evening's show, and in the 8 to 11 group 25 stay up.

The London and South Coast Televiewers Association believes TV to be a menace to social life. It says that it is keeping the young people away from youth clubs. That may be. Youth clubs are formed to keep young people off the streets, and if TV is keeping them in their homes the need for the youth clubs vanishes.

The Marriage Guidance Council says that TV brings no relief to marriages already spoiled by selfish husbands or wives, and that it can be an added irritant.

We do not believe that TV is destroying the reading habit. The circulation of all daily and weekly newspapers and periodicals is greatly in excess of what it was pre-war, and the sales of books are equally in advance of the 1939 figure.

It is understandable that in the early days of a new science it will be attacked by those who are resistant to change. A clergyman, for example, feels that it is a danger to religion because you cannot worship sitting before a televised Church Service. Why not ? Others say that TV is causing indigestion because viewers eat their meals on their laps.

The headmaster of a London school says that there may be potential danger in TV and that it should be controlled because it will destroy creative activity in some people. Equally it may destroy destructive ability ! Still, in spite of these criticisms, TV marches on, and none of these bleatings will affect it.

HIRE PURCHASE AGREEMENTS

THE Board of Trade, following the Chancellor's statement in the House of Commons, made an order restricting the terms for initial deposit and repayment period in hire purchase and credit sale agreements.

The initial deposit on a television receiver purchased under H.P. agreements is 33⅓ per cent. and the maximum period within which the balance of the price must be paid is 18 months—F.J.C.

Converting the Pye Strip for Channel 2

HOW TO MODIFY THE POPULAR R.A.F. No. 153 UNIT FOR HOLME MOSS

By A. N. Hough

THE writer has used a highly sensitive superhet for the past two years on Sutton Coldfield, and when Holme Moss opened it was found that gain was of secondary consideration.

Upon acquiring a 3547 chassis, it was noticed that there was a "Pye" 45 Mc/s strip inside. Upon connecting up a suitable power supply, loudspeaker and aerial, the sound transmission of Channel Two was heard at good volume, without touching any of the coil cores. A bandwidth check was next taken, and it was found to extend from 41.5 Mc/s to 46.5 Mc/s.

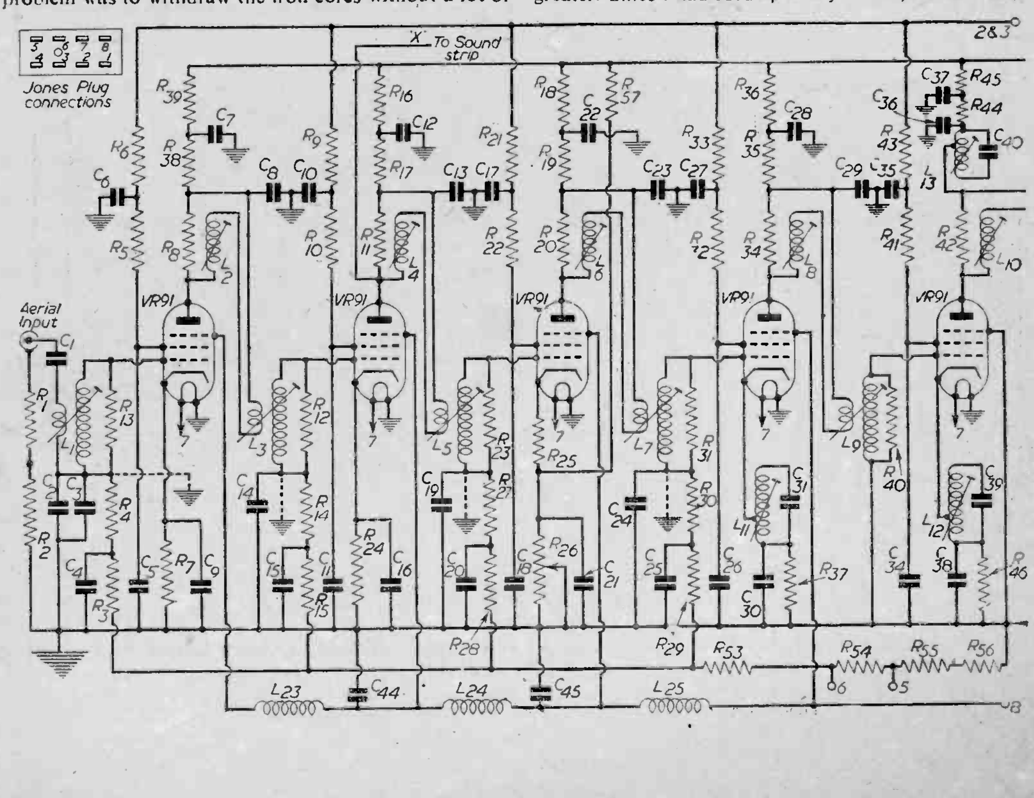
The cores were then screwed out to their full limit, and the vision pulses were heard. A second bandwidth check was taken, and it was found to cover from 46 to 49.5 Mc/s. It occurred to the writer that it should be possible to cover the full bandwidth of Channel Two, with a few modifications.

When the coils were examined they were found to contain iron-dust cores moulded on to a brass screw, some were 4BA and others 6BA. Here was the solution: substitute brass slugs for the iron because, as the majority of readers know, brass reduces the inductance of a coil, whereas iron dust increases the inductance. Now the problem was to withdraw the iron cores without a lot of trouble. The coils are covered over with a copper screening can, and this has small lugs pressed over. These were found to be very awkward to bend back, so an alternative method was evolved.

An ⅛in. pilot hole was drilled in the top of the appropriate can. A ¼in. drill was next tried. In my case I had to use a 9/32in. drill in order to make a hole large enough to withdraw the iron core. Reasonable care must be taken when drilling, otherwise the coil former will be damaged.

The brass cores must next be made, and should be physically the same size as their iron counterparts. I used some ¼in. brass pillars. The only one I had to make from scratch was made from ¼in. brass rod, drilled and tapped 6BA.

After fitting, the unit can be realigned, either on the signal, or, preferably with a signal generator. As can be seen, the sound strip is made from aluminium sheet bent over to stiffen it. The valves used in the prototype were 6AC7s. There is nothing to stop EF50s from being substituted if it is desired to keep it more uniform. If EF50s are used, a turn extra on the sound coils will probably be required, and the gain will be greater. Since I had used up all my EF50s, I used the next-



best valves left. By the way, I checked over the current consumption of the vision strip and found that the first R.F. was taking 32 mA, second R.F. 22 mA. This was much too heavy for good valve life, so the 33Ω bias resistor was taken out and a 220Ω substituted. This brought the consumption down to 8 mA, a much more reasonable figure. On the whole unit I saved 35 mA.

Sound Rejectors

A word about sound rejectors would not be out of place. If care is taken with the adjustment of these, the 2.5 Mc/s bars are clearly visible on Test Card C, without any special video compensation. If the video valve is suitably compensated the 3 Mc/s bars are clearly seen. These require a lot of patience to obtain, but it can be done. The reason I have put three sound rejectors in is

LIST OF COMPONENTS

VALVES

Six VR91 or EF50.
Two VR92 or EA50.
One VR137 or EC52.
Two 1852 or 6AC7.
One VR55 or 6R79.
One VT52 or EL32.

POWER UNIT to supply 120 mA at 250 v., and 6.3 v. at 4 amps.

RESISTORS

R1—18Ω.
R2, R4, R5, R10, R14, R17, R19, R22, R27, R30, R32, R35, R38, R41, R44, R46—270Ω.
R3, R6, R9, R15, R16, R18, R21, R28, R29, R33, R36, R39, R43, R45—250Ω.

R7—220Ω
R8—10 KΩ
R11, R12, R20—10 KΩ
R13—1 KΩ
R23—10 KΩ
R24—220Ω
R25—33Ω
R26—5 KΩ potentiometer
R31—10 KΩ
R34—15 KΩ
R37—150Ω
R40—10 KΩ
R42—15 KΩ
R47—5 KΩ
R48—5KΩ 2 w.
R49—56Ω
R50—1MΩ
R51—3.3KΩ
R52—4.7 KΩ
R53—15 KΩ
R54—15 KΩ
R55—33 KΩ
R56—15 KΩ
R57, R62, R65, R71—100 KΩ

RESISTORS (continued)

R58—1 KΩ
R59—33 KΩ
R60—150Ω
R61—1 KΩ
R63—10 KΩ
R64—5 KΩ
R66—1 KΩ
R67—.25 MΩ potentiometer
R68—.5 MΩ
R69—470Ω 1 w.
R72—150Ω
R73—33KΩ

(All resistors unmarked are ½ w.)

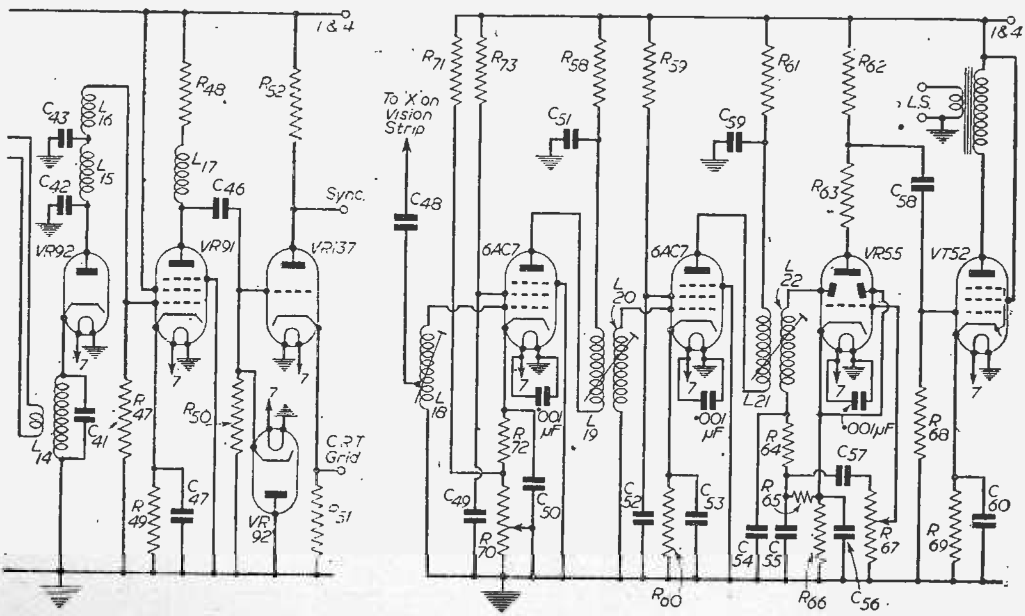
CONDENSERS

C1, C3 to C30—.001 μF
C2—10 μF
C31—40 pF
C32 to C38—.001 μF
C39—40 pF
C40—40 pF
C41—3 pF
C42, C43—5 pF
C44, C45—30 pF
C46—.1 μF
C47—.001 μF
C48—5 pF
C49 to C53—.001 μF
C54, C55—100 pF
C56—25 μF 25 v.
C57—.01 μF
C58—.1 μF
C59—.001 μF
C60—25 μF 25 v.

SOUND-COIL FORMERS

¼in. with cans and iron cores (Haynes Radio) or, as an alternative, ¼in. Aladdin Formers.

REJECTOR FORMERS—⅜in. Aladdin Formers.



Theoretical circuits of the modified vision and sound sections.

because it is better to take the rejection over three stages than to use only one or two stages. This is really a good unit and it is well worth going to a little extra trouble, for the results are equal to any commercial receiver.

Tube Feed

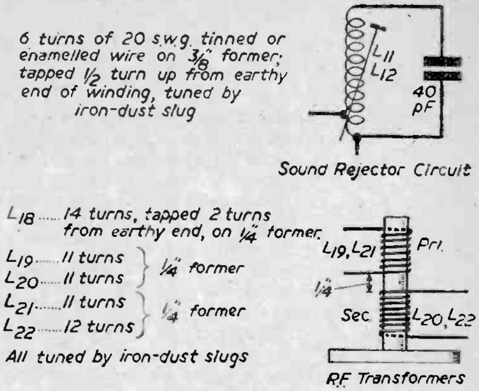
In my set I used grid modulation because I believe that this is the safest way possible for the tube to be operated. As a matter of fact the tube in use has a low heater-to-cathode insulation, and thus it would mean scrapping the C.R.T. with cathode modulation. This is the reason for the phase splitter and D.C. restorer. It means two extra valves, but this is of little consequence compared with tube life. The two extra valves are mounted on a small extension chassis, size 3½in. x 2½in., bolted on to the rear of the 153 unit.

The coils which require their cores changing are tuned anode coils, and are numbered L2, L4, L6, L8, L10. L1, the aerial coil is better with a brass core. In my model there was no core fitted. There is also a 1,000Ω resistor across the secondary of L1, and this can be removed. However, if it is found impossible to cover both sound and vision frequencies, a 4,700Ω resistor can be tried in place of the 1KΩ resistor.

In conclusion I would say that many liberties can be taken with this unit, and results should be ample up to the fringe area. If a signal generator is available the lining-up frequencies are as follows:

L3, L5, 48.5 Mc/s; L7, L9, 49 Mc/s; L2, L4, L6, L8, L10, 51.25 Mc/s; L1, 50 Mc/s.

The rejectors should be adjusted for minimum sound



Details of the coils.

at 48.25 Mc/s. This is best done at night-time when the vision transmitter has closed down, and whilst the news is being read. A pair of 'phones or loudspeaker in the video valve anode load will show when the best setting has been attained.

G.E.C. T.V. Activities in 1951

THE following brief summary gives an account of some of the G.E.C. radio and television developments in 1951.

Greater use has been made of germanium crystal rectifiers in place of thermionic valves, especially in noise suppression circuits. Other economies have been made by the development of time base circuits requiring only one valve; this principle is used for the line time base in the latest table model television receiver.

In regard to picture tubes, work on the electron gun has included investigations into the performance of an ion trap and the use of a valve type cathode heater assembly. The ion trap supplements the protection afforded to the phosphor by the aluminium layer on the screen.

Life-testing facilities have been expanded to cater for the increased production of cathode ray tubes. The range of specialised oscillograph tubes has been extended, the most important being a two-gun tube with a 6 in. diameter screen and two completely independent electrostatically focused and deflected electron beams.

The performance of the normal type of communications receiver (BRT.400D) has been further improved. This equipment has been adopted as standard by the Swedish armed forces and is also used extensively by the BBC and many Government departments at home and overseas.

The cathodes of thermionic valves are required to provide an adequate supply of electrons throughout operational life. As valves become smaller, conditions become more onerous as regards power loading of the cathodes. Intensive research has been in progress in this field, the chief purpose being investigation of cathode coatings. Other types of complex surface which are used to give high secondary emission and photo-emission have been investigated. A study of secondary emission effects has given further information about electron and ion movements in the coatings. Studies are in progress of causes of poor emission, including the effects of gases.

Another new piece of transmitting valve-test equipment is that for establishing the life of small disc-seal triodes for trunk radio apparatus. Specifications require minimum life of 10,000 hours and extremely accurate life-test evidence is necessary.

A special unit has been developed for life-testing the small high-tension rectifier valves used in television receivers.

The main development in Geiger-Muller tubes has been the adoption of a different organic quenching agent for the gas filling. High purity ethyl formate vapour has many advantages over the conventional ethyl alcohol filling; a better plateau characteristic and satisfactory operation down to −20 degrees C. Variation of operating voltage with temperature is much reduced, giving improved accuracy.

The silicon mixer crystal has been brought into use in the millimetre waveband. A new type of germanium rectifier has been produced with extremely low forward resistance. Eminently suitable as a modulator in carrier telephony, it is now replacing the copper oxide type.

Considerable progress has been made in the development of the germanium triode. A radio receiver with germanium triodes in place of thermionic valves is now possible, able to give adequate output from a loudspeaker. Although the receiver requires no filament heating power, it does need a small H.T. battery or equivalent A.C. mains rectifier unit, which may itself utilise germanium diodes as rectifiers.

Picture Distortion Analysed

AN EXPLANATION OF THE MORE COMMON FAULTS WHICH SPOIL PICTURE QUALITY

By Gordon J. King, A.M.I.P.R.E.

WHEREAS a certain amount of distortion in reproduced sound is tolerable, its equivalent in terms of the vision signal would prove very distressing, making television viewing a very tiring process. This, no doubt, is brought about owing to the fact that the faculty of seeing is much more critical than that of hearing.

Picture distortion may not be derived from video signal distortion only, however, but may also be due to distortion originating from the receiver time-base circuits, or optical distortion inherent in the reproducing system employed, and may be classified thus :

1. Distortion arising from faults or maladjustment in the video channel proper—including the R.F., I.F. or video amplifier circuits. 2. Non-linear time-base circuits, resulting in distortion of the picture form. 3. Distortion resulting from defects in the optical system e.g., the picture tube, scanning and focusing arrangements, etc.

For speedy analysis of picture distortion it is desirable to determine as rapidly as possible the stage at which the distortion originates. The following details will indicate the effect distortion may have on a picture, followed by the possible causes and suggested remedies.

A Fuzzy Picture Accompanied by Flaring

It should be noted that flaring, in this case, is used to convey the effect of a gradual tailing off of all objects on their right-hand sides, instead of a sharply defined cut-off. This is clearly distortion arising from the video channel and is usually caused by over-amplification of the lower video modulation frequencies. The length of the flare is dependent on the degree of over-amplification and in severe cases may extend for nearly an inch.

In home-constructed equipment this distortion can usually be traced to incorrect alignment of the tuned circuits, and it is desirable completely to realign the tuned circuits by means of a " signal generator " where possible.

If a signal generator is not available, however, test card " C " is a favourite and cast-iron standby, since its perusal enables the more important functions of the receiver to be correctly determined. The black rectangle within a white rectangle is provided for checking the low-frequency response of the receiver, and when correctly adjusted it should be reproduced as a rectangle of uniform brightness on a clean white background.

In order to reduce the receiver response to the lower frequencies it will be necessary to reduce the inductance of the R.F./I.F. coils. This may be achieved by unscrewing slightly the iron-dust cores. But by experience it has generally been found that adjustment to one or two tuned circuits is sufficient to balance the overall response. When carrying out these adjustments a keen eye should also be kept on the bandwidth gratings of test card " C."

Should flaring suddenly occur on a receiver that has previously been working normally, it is most likely due to a fault developed in the video amplifier. Such a fault could possibly be caused by a decoupling capacitor open circuiting, or reducing capacity in the H.T. feed to the video stage. This will have the effect of an increase of amplification to the lower video frequencies ; because at those frequencies the reactance of the faulty capacitor will be insufficient to isolate the anode load resistor. Therefore, the load will consist not only of R1, but also of R2 in series (Fig. 1). It should be noted that R2 need not be a decoupling resistor in the true sense of the word, but may represent the internal resistance of the H.T. supply.

It should be borne in mind when tracing this distortion that a reduction in the high-frequency response of the receiver will also have the effect of over-amplifying the lower frequencies. Again, this may be due to misalignment of picture signal tuned circuits, while in the video stage may be due to any of the following :—

A high-frequency correction component altered in value.

The cathode bypass capacitor open circuited.

The anode load resistor changed in value. Vision detector R.F. bypass capacitor open circuited.

Before proceeding to the next type of distortion it will be as well to consider a picture that is extremely fuzzy, but with no apparent flaring. If the horizontal scanning lines are visible on such a picture the fault is

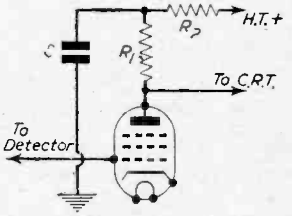


Fig. 1.—The importance of the decoupling condenser C cannot be over-stressed.

most probably due to a narrow picture signal pass band, which, of course, can also be checked with the assistance of test-card " C."

A poor high-frequency response in the video frequency amplifier can also affect the picture in this way; in fact, it has been known by the author for the anode load resistor in this stage to increase in value, with a consequent attenuation of the higher video frequencies.

Due attention should be paid to the C.R.T. while investigating for distortion of this kind—for if the tube is " soft " or contains gas, the picture appears to focus correctly though the vertical definition is poor. A faulty cathode weld within the tube produces a similar effect.

An intermittent fault of this nature was recently investigated by the author and was proved to be a high-resistance cathode connection from the picture tube to its appropriate pin on the tube base.

It has also been known for a partial heater-to-cathode short circuit in the vision interference suppressor diode to produce similar symptoms, and therefore this valve should not be overlooked when examining a receiver for a fuzzy picture.

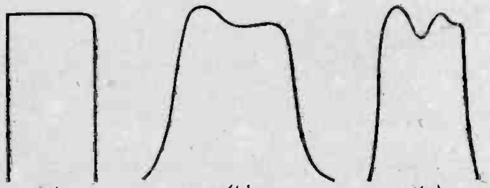
Plastic

Distortion under this term manifests itself on the screen as a reduction in the tonal value of the picture as a whole. This means that a black or dark object will be reproduced with little difference in contrast from the background ; the outline of the objects, however, will be sharply defined.

This is another type of distortion which originates from the video channel, but this time is due to an inadequate low-frequency response. Misalignment of the picture signal tuned circuits is a common cause. Sometimes, however, it can be traced to a faulty video decoupling capacitor, or even low emission of the D.C. restoring diode.

Black-after-White

This very common effect takes the form of a black line following the right-hand contour of a white object,



(a) is a picture pulse applied to an amplifier of response (b) resulting in an output such as (c)

Fig. 2.—How a picture pulse can become distorted.

or if the object is black, then the following line is white. In severe cases, several such lines alternate in black and white, progressively reducing in intensity until they eventually fade into the background.

With commercial equipment this distortion can usually be traced to misadjustment of the picture signal tuned circuits. It occurs mainly when the high video modulation frequencies are over-emphasised, or when one tuned circuit is insufficiently damped and mistuned to one side of resonance.

Where the receiver is home constructed, an incorrectly wound H.F. correcting choke in the detector or video amplifier may initiate this phenomena. Should the correcting choke be suspected a short-circuit across it will indicate without a doubt whether it is the cause of the trouble.

At this point it may be instructive to consider how this black-after-white effect occurs.

A picture signal may be analysed into a series of transient waveforms, or sudden changes in magnitude. These changes are quite often from complete black to full white. Such sudden changes in modulation level applied to a correctly designed and adjusted picture amplifier will be passed on to the video amplifier without loss of form.

Should the response of the picture amplifier be asymmetrical, or insufficiently damped, however, the picture transients will tend to make the tuned circuits "ring" and a series of damped oscillations will ensue following a sharp transition from black to white. Thus, the output from the amplifier will not follow faithfully the picture pulse, but will build up to an amplitude greater than its final value and oscillate at a reducing magnitude around the mean signal level. Fig. 2 illustrates this effect, where (a) is a picture pulse applied to an amplifier of response (b), resulting in an output such as (c). And since the picture tube beam is modulated by the pulse at (c) it is obvious how the effect occurs.

Not only are the R.F./I.F. circuits liable to such oscillation, but any tuned correcting circuit, between the aerial and the picture tube, if incorrectly designed, or insufficiently damped, will tend to "ring" when subjected to a picture signal.

A small degree of black-after-white is not always undesirable, however, since it can give a useful sharpening up of the picture. This is especially so if the bandwidth is rather narrow ; the effect is that the edges of objects appear much sharper although there is no more real detail in the picture.

Ghost images, due to reflections, produce very similar symptoms, and a little care should be taken to distinguish between the two.

"Ghosts" may be caused by an incorrectly matched feeder, either at the aerial or the receiver end ; or may be due to reflections of the picture signal from nearby objects, such as large buildings, aircraft or even clouds, back to the receiver aerial, with the result that a second picture, of reduced intensity, follows the first. The distance between the two pictures is dependent on the time lag between the two signals. Thus, if the time lag is very small, the two pictures will be nearly superimposed, giving an effect similar to black-after-white.

Non-linear Scan

This fault brings us from the video channel to the time-base circuits, and is a sign of non-linear deflecting voltage or current.

Generally, it is apparent by a closing of the scanning lines towards the bottom of the raster, or as a cramping of the right-hand side of the picture.

Such non-linearity in a magnetic type of scanning circuit is due, in nine cases out of 10, to general ageing

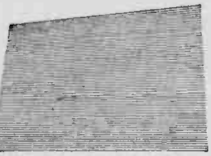


Fig. 3.—Illustrating trapezium distortion.

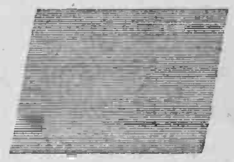


Fig. 4.—Distortion caused by twisted scanning coils.

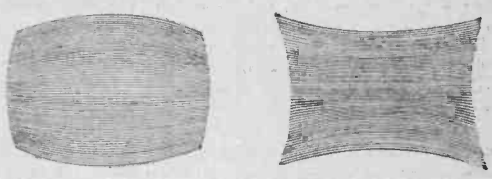


Fig. 5.—Barrel distortion and pin-cushion distortion.

of the time-base output valve. The height or width of the picture gradually reduces as the valve emission falls : this is compensated for by applying a greater sawtooth amplitude to the valve, by means of the height or width control, and a point is thus reached when the valve is over-driven, thereby resulting in a non-linear frame or line scan.

A further fall off in valve emission appears on the picture base as a "fold-over," or a bright line down the left-hand side of the picture when the line amplifier valve is at fault.

In an electrostatic type of scanning circuit, however, the output valve is not called upon to provide the same degree of deflecting power. Therefore, the valve is not run so hard and is less liable to suffer from the limitations of the former.

If the picture appears stretched towards the top or left-hand side, a fault in the linearity correcting networks is usually indicated.

Some systems embody a circuit whereby a variable degree of N.F.B. is utilised in correcting any non-linearity of the sawtooth wave-form. Others employ a variable resistor in series with a capacitor across the frame output circuit, and rely on the correcting capabilities of the damping diode in conjunction with a variable inductor for the line circuit.

In each case the variable element is termed the " form " or " linearising " control (vertical or horizontal depending on which time-base it controls).

These circuits and associated components should receive careful attention during fault investigation of this character. It has been known for the scanning lines at the top of the picture to be nearly ¼in. apart. The fault was eventually traced to an open-circuited capacitor in the N.F.B. loop of the frame output stage.

A charging or coupling capacitor that has developed a very slight leak may give rise to the same symptoms. The paradoxical situation where everything appears normal and yet the fault still exists might well be traced to a capacitor leak of this kind. It requires only a leak of 1 megohm or so across a capacitor in a critical part of the circuit to upset the linearity of the sawtooth wave-form. Needless to say, these capacitors should be of high quality and beyond reproach.

Trapezium Distortion

With distortion of this kind the raster tends to take the form of Fig. 3, but is only apparent in this form where the deflection is electrostatic.

It arises from the influence of one pair of deflecting plates on the sensitivity of the other pair. Some of the older electrostatic tubes employ specially tapered deflecting plates to combat this effect, but an alternative method is to use a push-pull deflection amplifier. Provided the system is perfectly balanced, trapezium distortion does not occur.

Since this type of amplifier is always employed for television purposes, such distortion indicates unbalance.

Where two output valves are employed, one of them giving low emission is a very common cause. A variation in component values, especially in matched pairs, often has this effect.

The use of an oscilloscope or high-impedance output indicator is desirable for checking the balance of this type amplifier.

Magnetic or electromagnetic fields in close proximity to the picture tube may produce similar distortion. This is generally the case in electromagnetic deflecting systems ; the field of a choke or transformer might well be responsible. Although a more common reason is the field from the loudspeaker magnet.

A variation of this distortion is sometimes obtained also with electromagnetic deflection, where the raster is of the form depicted by Fig. 4. This indicates that the planes of the line and frame scanning coils are not at right angles.

It will be necessary, therefore, to rotate one pair of coils with respect to the other until perfect balance is achieved.

Barrel or Pin-cushion Distortion

These distortions, depending on the shape taken by the raster, are shown by Fig. 5 (a) and (b). In most cases they are caused by non-uniformity of the deflecting fields.

Commercial receivers suffer little from this fault, though a small degree of this distortion is not unusual. For complete suppression, however, the remedy obviously lies in the construction of the scanning coils.

It may be more apparent in home-constructed receivers, where the designer has not catered for the relationship between picture tube and scanning coils. For in theory a rectangular raster is obtained only when the deflecting field is adjusted to compensate for the curvature of the tube screen. This means that if a pair of standard scanning coils are used with a flat-faced tube, the raster will tend to suffer from pin-cushion distortion. Conversely, if the coils are designed for a flat-faced tube, while the tube is of the normal type the raster will take the form of Fig. 5 (a).

Uneven Focusing

Sometimes the focus at the centre of the raster is quite sharp while it deteriorates gradually towards the edges. Quite often it is possible to procure good focusing at the edges, by means of the focusing control, but then the centre loses focus.

In this case, the position of the focus coil relative to the tube anode may be adjusted with advantage. For instance, if the coil is positioned in front of the anode, the focus at the centre of the screen will be very sharp, but will fall off at the edges. Moving the coil towards the screen will reduce slightly the overall sharpness of focus, but it will be more uniform over the whole of the screen area and, in practice, an optimum position can readily be obtained.

It should be noted, however, that adjustment in the position of the focus coil will need to be compensated for by adjustment to the focusing control.

If defocusing at the edges still persists, however, the trouble usually lies in the design of the scanning coil.

This is because the deflecting fields are not uniform and, therefore, have component fields acting along the axis of the electron beam. Consequently, they have a focusing action on the beam, which, already correctly focused, is again defocused.

The effect is more apparent towards the edges of a picture owing to the deflecting fields being less uniform away from the tube axis.

With electrostatic tubes the trouble is inherent, due to the deflecting plates acting, to some degree, as electron lenses and thus affecting the focusing.

To avoid this, the deflecting plates are sometimes given a mean potential equal to that of the electron beam as it passes between the plates. This voltage is, of course, dependent on the design of the tube, but in most cases rarely exceeds 150 volts.

Conclusion

In conclusion it should be mentioned that the less complex and more easily diagnosed picture distortions have been omitted, since their reasons are readily understood.

Distortion may take many forms, however, far too numerous to be treated in such a short article, although, quite often, they are subsidiaries of the distortions already discussed and may be treated as such under the appropriate heading.

As previously intimated it is desirable to know which stage is responsible for the distortion, and whether or not it is inherent to the type of system employed.

A Television Receiver for £9

FURTHER DETAILS OF ITS CONSTRUCTION AND SOME CORRECTIONS

By B. L. Morley

A NUMBER of queries have been raised concerning the circuit and details, which were given in the past two issues, and the following notes should clear up the doubtful points. We hope that this information will answer the various letters which we have received from readers as, in many cases, the details asked for were too involved to deal with adequately in the form of a letter.

First, as to the description of the unit, which was "An Inexpensive Unit for the Experimenter." It was designed for those people who, though possessing the necessary skill and theoretical knowledge for the job, had other calls upon their purses. It was considered beyond the scope of the very beginner and therefore certain details were deliberately missed out, including a point-to-point wiring diagram.

The object of the article was to demonstrate a working televisor which could be built for as little as £9, and this sum was the rock-bottom prices of the parts at the time. Unfortunately, the firm which originally supplied the indicators for the price quoted have now exhausted their stocks, but it is still possible to obtain used indicators at a low price. Supplemented by parts from the "spares" box it still forms a very inexpensive televisor.

Summarising the various letters we have received, here is a list of points requiring elucidation :

List of Components (page 314)

R12 (Fig. 3) should be 100 Ω and not 100 KΩ.
C35 (Fig. 3) should be 8 μF and not 230 pF.
R41 (Fig. 5) should be 47 KΩ and not 470 Ω.
R42 (Fig. 5) should be 470 Ω.
R42 (Fig. 4) should be R42a, value 10 KΩ.
C52 (Fig. 5) working voltage should be 25 v.

Coil Data

L3 (Fig. 3). Primary winding should have same number of turns as the secondary winding.

L6 (Fig. 3) has been mentioned twice. Where it is bracketed with L5 it should read L8. L5 and L8 are identical and are rejector coils. These coils are not needed for London, and can be omitted together with their associated condensers, C15, 16, 28, 29.

Paragraph 2, page 315, delete V6, and insert V5a.

L10 : for details of mounting this coil see article, "Coil Winding," by Mr. W. J. Delaney, October Issue PRACTICAL TELEVISION, page 206, Fig. 5.

L1 and L2 have been bracketed and coil-winding details given for both. With L2, the secondary (containing 4½ turns) is wired in the anode circuit of V1 (Fig. 2), and the primary connected to primary of L3.

General

V19 (Fig. 6). The cathode of this valve should be connected directly to the grid of the C.R.T. In the unit it will probably be found that the anode is strapped to the grid of the tube and anode and cathode leads will have to be reversed.

Although this valve is rated for 6.3 v. heater volts it performs its function of D.C. restorer although only fed with 4 v. from the C.R.T. supply. This method avoids using a non-standard type of transformer, or the employment of a separate filament transformer with highly insulated windings.

V14 (Fig. 4) has been left with its grid floating. A 470 KΩ ½ w. resistor should be connected between grid and earth.

The VR54 valve is an Osram D63 in some units and a Mullard EB34 in others. Either of these valves is suitable although their characteristics differ a little. A 6H6 will perform equally as well in the circuit.

C66 in the anode circuit of V16 (Fig. 4) should be C61, value as shown in the list of components.

The values given for C60, 61, 68, 74 are quite suitable to provide an adequate scan if the H.T. voltage is over 400 v. Should insufficient scan be obtained 0.1 μF condensers can be employed. Use condensers available from the unit.

Time base current. Although 6 SP61's are used (whose normal current drain is 10.5 mA each) it will be found that the actual current drawn is not 6 × 10.5 but somewhere between 20 and 30 milliamps. The reason for this is that the valves are not working under their normal conditions. Current readings taken when the time-base is in operation can be very misleading.

It has been pointed out that the efficiency of SP61's begins to fall above frequencies of 45 Mc/s. However, this fact has been taken care of by the provision of an EF50 in a common R.F. stage to boost up the signal. In places close to the transmitter this valve can be omitted.

No claim has been made for this televisor as a long-range receiver due to the fact that economy called for SP61's to be used. The sensitivity can be increased markedly by substituting EF50's for the SP61's. I believe the Indicator 62A contains EF50's in lieu of SP61's but I have no practical knowledge of this unit and am not in a position to answer questions regarding it.

Due to the fact that long leads are required to the grid caps of the SP61's it may be found that the stray capacitances necessitate some slight variation (plus or minus one turn) to the coil windings.

C58 has been made variable so as to obtain a greater control over the amplitude of the line sync pulse. If desired it can be substituted by a fixed capacity one, and the optimum value obtained during the alignment.

The pins of the VCR97 are numbered as follows : looking at the tube from the back. Observe the first pin on the right of the top projecting key at about 1 o'clock. This is pin 1 and the base is consecutively numbered in a clockwise direction from this pin.

The E.H.T. transformer has two 4 v. centre-tapped windings. Transformers of this type are readily obtainable and if a 2 v. rectifier is used (such as the 2X2) one-half of one of the windings only is used, the other lead being left free. A 4 v. valve can be used if desired. It is worth while paying a good price for the transformer, it doesn't matter if it overhangs the edge of the chassis.

ALL ABOUT FILTERS

AIDS TO PICTURE QUALITY AND THE AVOIDANCE OF EYE STRAIN

By W. J. Delaney (G2FMY)

A NUMBER of people fail to obtain a television receiver because they have been told that it is bad for the eyes. In a number of cases I have found that this claim has been made by viewers who have been running their receivers incorrectly—usually receivers fitted with an aluminised tube. It has been pointed out in these pages on various occasions that the brilliancy control and the contrast control have to be adjusted together—generally the contrast control producing the gradations in the light parts of the picture and the brilliance control the variations on the dark parts. This is not an infallible rule, however, as much depends upon the circuit which is being used. Some viewers are content merely to adjust the two knobs to produce a picture, without finding the optimum settings, and as they do not wish to lose quality, turn out the light and have the picture much too bright. This does, of course, tend to produce eye-strain, as also does an aluminised screen turned up too brightly and viewed in a darkened room or by subdued light. The picture controls should be adjusted so that there is no glaring high light and, in fact, it will generally be found that quality is improved considerably if an overall grey tone is produced. In this connection the so-called "black screen" is an advantage as it kills the white glare and produces the subdued type of picture. Before going on to the subject of the filter, however, it should be emphasised that another very prominent cause of eye-strain is a badly adjusted frame hold, or a receiver where the interlace "floats," and, as a result, the picture is flickering and continually going in and out of focus. Viewed at close quarters, the horizontal lines of the raster should be perfectly stationary and this can generally be obtained by a careful adjustment of the frame hold control.

Dark Filters

It will be appreciated that if the screen is not illuminated it presents a creamy appearance, whilst when the tube is in operation the high lights are bluish-white or whatever colour is produced by the particular tube. Thus "black" is merely the unlighted part of the tube and is only black by contrast with the lighted portion. If, therefore, a filter consisting of a dark sheet of, say, "Perspex" is placed over the screen, it will darken the tube face and produce a darker "black," and if of a suitable material the lighted parts of the screen will penetrate the filter and will not be seriously darkened. This will remove the glare and is, in fact, now a standard fitment to many commercial receivers. Whether or not to use a grey or blue filter is open to individual taste, but quite a number of viewers find a coloured filter more restful and productive of better tone quality in the picture. Separate filters have, of course, been on the market for a long time, and any dealer who stocks acetate or Perspex sheet will have a range of colours from which one can select various types for experimental purposes.

Colour Filters

The latest idea in this filter range is the combination of three colours on a single sheet, the main portion being tinted red, the top blue, and the lower part green. The sheet is not divided into three equal parts, but the top and bottom strips are about one-sixth of the total area. The effect of this type of screen is to produce over the general picture area a brownish-red tint comparable with a photogravure print as seen in certain magazines, and the top and bottom portions are coloured through the tint on the screen. With this type of filter it will be found that if the picture is made somewhat brighter than usual, the edge colours are almost reduced, whilst if the picture is darkened the central tone is richer. Thus, the user has considerable scope in producing a "restful" type of picture and it is not necessary to worry about eye-strain if one prefers to view the picture in a darkened room. There is one peculiar point about these coloured filters and that is that certain scenes appear to be in full colour, especially if one comes into a darkened room in which the filter is in use. Some viewers do not like them, but if left *in situ* for a time they do not appear to give the odd results which might at first be thought would arise due to the constant fixed colour. Best results are, of course, as with ordinary black and white pictures, obtained when the correct balance is obtained between contrast and brilliancy, and every viewer should pay some attention to these settings to find those which operate best on the particular receiver in use. Unfortunately, different viewers have different ideas as to what constitutes a good picture and therefore there can be some argument in a family, but in general an attempt should be made to obtain a picture where detail can be seen in the dark parts of the picture and also in the light parts. For instance, during a scene where a couple are dancing in full evening dress, the buttons and edging should be visible on the gentleman's suit, and floral designs, etc., should be seen on the lady's dress, and if an attempt is made to obtain this result many viewers will undoubtedly find that the overall picture brightness is very much less than that to which they are accustomed.

A point which can often be checked, but which does not necessarily apply to all receivers, is what is known as "defocusing on whites." Set up the receiver before the tuning signal comes on and adjust the frame hold to produce the raster lines clearly. Now, when the picture comes on turn up the contrast and brilliancy controls to maintain correct balance between the four shaded tones on each side of the tuning signal, but at the same time notice the lines in the top (bright) shaded area. You may find in some cases that as the controls are advanced the dark space between the lines will gradually disappear, the light from the actual lines "spreading" and not ending in a sharp edge. This is due either to overloading of the tube or poor regulation of the E.H.T. supply, and the controls should be backed off until the dark spaces between the lines are sharp-edged. If you are in doubt during a transmission, whenever a brightly lit (peak-white) area is seen on the screen, look at it closely and see whether there is any spreading of the bright lines; if so, picture quality will certainly be improved by backing off either brilliancy or contrast.

THE NORTHERN RADIO & TV EXHIBITION

List of Exhibitors in Alphabetical Order with Stand Numbers

CITY HALL, DEANSGATE, MANCHESTER 3, APRIL 23 TO MAY 3

Name	*Address*	*Stand No.*
Aerialite, Ltd. ..	Castle Works, Stalybridge, Cheshire	22
Ambassador Radio (R. N. Fitton, Ltd.)	Princess Works, Brighouse, Yorks	20
Antiference, Ltd. ..	67, Bryanston Street, Marble Arch, W.1	3
Argosy Radiovision, Ltd.	Argosy Works, Hertford Road, Barking, Essex	37
Balcombe, Ltd., A. J.	52/58, Tabernacle Street, E.C.2	15
Belling & Lee, Ltd.	Cambridge Arterial Road, Enfield, Middx	44
British Radio & Television (Publishing), Ltd.	92, Fleet Street, London, E.C.4	35
British Railways ..	The Railway Executive (Publicity Dept.), 222, Marylebone Road, N.W.1	8
Bush Radio, Ltd. ..	Power Road, Chiswick, W.4	33
Cole, Ltd., E.K. ..	Ekco Works, Southend-on-Sea, Essex	24
Co-operative Wholesale Society, Ltd.	1, Balloon Street, Manchester, 4	9 & 45
Cossor, Ltd., A. C.	Cossor House, Highbury Grove, N.5	32
Decca Record Co., Ltd.	1/3, Brixton Road, S.W.9	29
Dubilier Condenser Co. (1925), Ltd.	Ducon Works, Victoria Road, W.3	4
Edison Swan Elec. Co., Ltd.	155, Charing Cross Road, W.C.2	43
English Electric Co., Ltd.	Queens House, Kingsway, W.C.2	42
Ferguson Radio Corporation, Ltd.	105, Judd Street, London, W.C.1	25
Ferranti, Ltd. ..	Hollinwood, Lancs	30 & 40
General Electric Co., Ltd.	Magnet House, Kingsway, W.C.2	31
Goodmans Industries, Ltd.	Axiom Works, Lancelot Road, Wembley, Middx	47
Gramophone Co., Ltd.	Advertising Division, Hayes, Middx	23
Hobday Bros., Ltd.	21/27, Gt. Eastern Street, E.C.2	5
Invicta Radio, Ltd.	Radio Works, Parkhurst Road, N.7	41
J. B. Mfg. Co. (Cabinets), Ltd.	86, Palmerston Road, E.17	2
Kolster - Brandes, Ltd.	Footscray, Sidcup, Kent	18
McMichael Radio, Ltd.	190, Strand, W.C.2	19
Marconiphone Co., Ltd.	Advertising Division, Hayes, Middx	17
Mullard, Ltd. ..	Century House, Shaftesbury Avenue, W.C.2	26
Multicore Solders, Ltd.	Melher House, Albemarle Street, W.1	39
Murphy Radio, Ltd.	Broadwater Road, Welwyn Garden City, Herts	13
National Provincial Bank, Ltd.	Premises Department, 15, Bishopsgate, London, E.C.2	7
Newnes, Ltd., Geo.	**Tower House, Southampton Street, Strand, W.C.2**	1
Peto Scott Electrical Instruments, Ltd.	Addlestone Road, Weybridge, Surrey	34
Philips Electrical, Ltd.	Century House, Shaftesbury Avenue, London, W.C.2	11 & 12
Pilot Radio, Ltd. ..	31/37, Park Royal Road, N.W.10	28
"Practical Television" and "Practical Wireless"	**Tower House, Southampton Street, W.C.2**	1
Pye, Ltd.	Radio Works, Cambridge	10
Regentone Products, Ltd.	Eastern Avenue, Romford, Essex	27
Stella Radio & Television Co., Ltd.	Oxford House, 9/15, Oxford Street, W.1	46
Telegraph Construction & Maintenance Co., Ltd.	22, Old Broad Street, London, E.C.2	38
Trader Publishing Co., Ltd.	Dorset House, Stamford Street, S.E.1	21
Ultra Electric, Ltd.	Western Avenue, Acton, W.3	14
Vidor, Ltd. ..	West Street, Erith, Kent	16
Wolsey Television, Ltd.	75, Gresham Road, London, S.W.9	36

SERVICING TELEVISION RECEIVERS—NEW SERIES

4.—"Invicta"—Models T101/4

TECHNICAL DETAILS OF FOUR MODELS

By G. E. Beeby

THE T101 Console has a 9in. tube, and is for use on A.C. mains and on the Alexandra Palace transmission only.

Power Supply

The power supply for the receiver is obtained from a heavy-duty mains transformer giving 6.3 volts for valve heaters, 350-0-350 volts for a conventional full-wave rectifier supplying the main H.T., and 6.2 Kv. (after rectification) for the second anode of the C.R.T. The power unit is a very solid and reliable job, and no trouble should be experienced with it.

The Vision Receiver

V1 to V4, four high-slope R.F. pentodes, form a T.R.F. amplifier at vision carrier frequency. V5 is the vision detector and noise limiter, and V6 a video amplifier. L6 and L11 are tuned to 45 Mc/s; L3, L4 and L5 to 47 Mc/s; L8, L9, L10 to 43 Mc/s. L7 and L18 are sound rejectors tuned to 41.5 Mc/s. The receiver will give a black-and-white picture with only 75μvolts signal input at the aerial, so in strong signal areas it is possible to improve the picture by increasing the bandwidth. The anode coils can be tuned to 48 Mc/s and the grid coils to 42.5 Mc/s. This is not advised in weak signal areas as this operation decreases the gain of the receiver. Intermittent vision is a fault which sometimes occurs and is very difficult to trace. This fault is invariably due to one of the .001μF decoupling condensers in the screen grids or cathodes of the R.F. valves going "open circuit."

The Sound Receiver

V7 and V8, two high-slope R.F. pentodes, form a T.R.F. amplifier at sound carrier frequency, V9 is a diode detector—triode L.F. amplifier and V10 the pentode output valve. R2, W1 and C21 form a noise-limiting circuit. Intermittent sound is sometimes experienced with this receiver and, as in the vision receiver, replacement of screen and anode decoupling condensers will effect a cure. Some prefer the tone of the receiver with the feedback network C15 and R27 omitted. A very slight residual hum may be noticeable to a sensitive ear. This can be reduced considerably by removing T1 from the power unit chassis, and remounting it at the side of the speaker. This eliminates any possibility of coupling between T1 and L13 and L14.

The Sync Separator (V11)

This interesting circuit is worth a brief study as to how it functions. V11 is an R.F. pentode with no cathode bias. The sync pulses from V6 are positive-going and applied to the grid of V11 causing grid current to flow. This charges C54 and the time constant of C54 and R85 is long enough to ensure that a steady negative bias is maintained on V11 grid. Thus, only the sync pulses of the applied signal cause V11 to conduct and appear at the anode and suppressor grids as negative-going pulses. Line sync pulses appearing at the anode are differentiated by C50 and trigger the line oscillator valve V13. Frame sync pulses are integrated on the suppressor grid by C58 and fed to a third winding on T6 to synchronise the frame oscillator. Line pulses of small amplitude also appear on the suppressor grid These are reduced to a minimum by the action of W2.

If V11 has to be replaced it may be difficult to obtain correct interlace owing to differing suppressor grid characteristics of the EF50 used in this position. This may be overcome by altering the time constant of C58-R59 slightly. If "pulling on whites" is noticeable on the picture this may be due to local conditions such as reflections, or it may be due to the sync separator. If it is due to the sync separator, reducing R85 to, say, 1 megohm will effect a cure.

The Frame Time Base

V12 is a double triode with one section acting as a blocking oscillator generating a saw-tooth voltage at its anode and the other section as amplifier or output. If the time base ceases to function completely, a quick check can be made as to whether oscillator or output sections are at fault by applying the 6.3 volts A.C. heater supply to the grid of the output section, and noting whether there is any vertical deflection on the C.R.T. If there is no deflection the output stage is at fault, and if there is deflection the oscillator stage is at fault. The brightness of the C.R.T. must be kept at a very low level in checks of this nature with only one time base running, or the screen will be burnt. Insufficient picture height with the control at maximum can be overcome by reducing R57 to a slightly lower value, say, by 10 per cent.

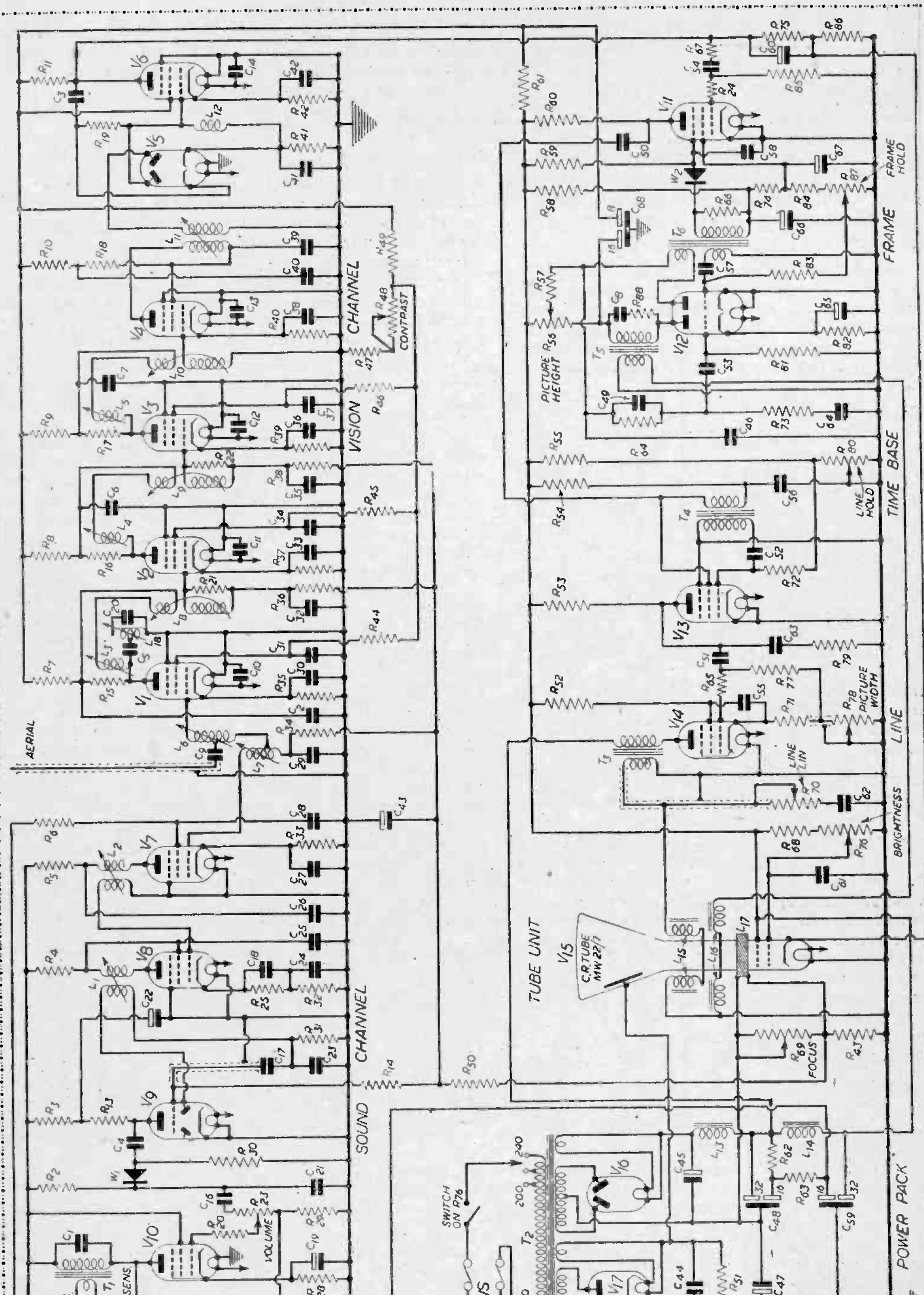
If V12 has to be changed it may be difficult to get a linear frame scan. A linear scan can be obtained by making slight adjustments to the value of R63 and R73 in conjunction with adjustments to the width of the air gap in the frame output transformer T5.

The Line Time Base

This is the conventional two-valve combination of blocking oscillator and output stage (V13 and V14). In the event of a complete breakdown (vertical line on screen), as in the frame time base a quick check of whether oscillator or output stages are at fault can be made by applying the 6.3 volts A.C. to the grid of the output section and noting whether there is any deflection on the C.R.T. If there is insufficient picture width, R53 should be reduced to 400 KΩ. Critical line hold may sometimes be experienced. To overcome this, remove R54 from the circuit and connect the line oscillator transformer direct to the H.T. line. If the line linearity control will not bring the left-hand edge of the picture to its correct proportions, an adjustment to the value of C62 should be tried. If, however, the linearity of the right-hand side of the picture is at fault, this indicates that C63 or R79 are open circuit or wrong value.

The Cathode Ray Tube

There is an average D.C. voltage on the cathode of the C.R.T. of 100 volts, and occasionally a breakdown occurs in the insulation between cathode and heater which is at zero potential. This causes uncontrollable brilliance and loss of picture. Increasing R75 to 100 KΩ, and thereby reducing the average D.C. voltage at the C.R.T. cathode, may effect a cure for this trouble in some cases. But where there is a complete breakdown in



Theoretical circuit of the complete model T101 "Invicta" receiver.

the insulation between cathode and heater, a separate transformer (6.3 volts) to heat the C.R.T. or a new C.R.T. are the only answers.

Models T102, 103 and 104

These have 9in. cathode ray tubes, and are for use on A.C. mains in either the London or Birmingham areas. They all have the same basic chassis, the T102 being a table model and the others consoles. Fixed tuning is used in these T.R.F. receivers, so it is not possible to change from London to Birmingham or vice versa without considerable modification to coils, etc.

Power Supply

The valve heaters (all 0.3 ampere) are wired in series with an adjustable voltage dropping resistance and supplied direct from the mains, with the exception of the main H.T. rectifier and the cathode ray tube, whose heaters are supplied by a separate transformer. The main H.T. rectifier is connected in a voltage doubling circuit, giving 350 volts D.C. at its second cathode. One-ampere fuses are normally fitted, and where the mains supply is inclined to fluctuate these may blow frequently and can safely be replaced by 2-ampere fuses. It is not advisable to run the receiver with a valve removed from the heater chain, as this causes the voltage across C58 to rise above the rated voltage for that condenser. When investigating faults in the heater chain, first remove V18 (main H.T. rectifier). A low H.T. line voltage can be caused by one diode of V18 faulty, R76 open circuit, or C63 faulty. No voltage at all from the rectifier, assuming all the valve heaters are alight, can be C63, V18 faulty, R75 open circuit, or a short-circuit somewhere on the H.T. line. The last fault will usually cause the fuses to blow. The smoothing choke L23 is tuned by C61, and if a slight hum is noticeable on the picture, C61 may be open circuit.

The E.H.T. Supply

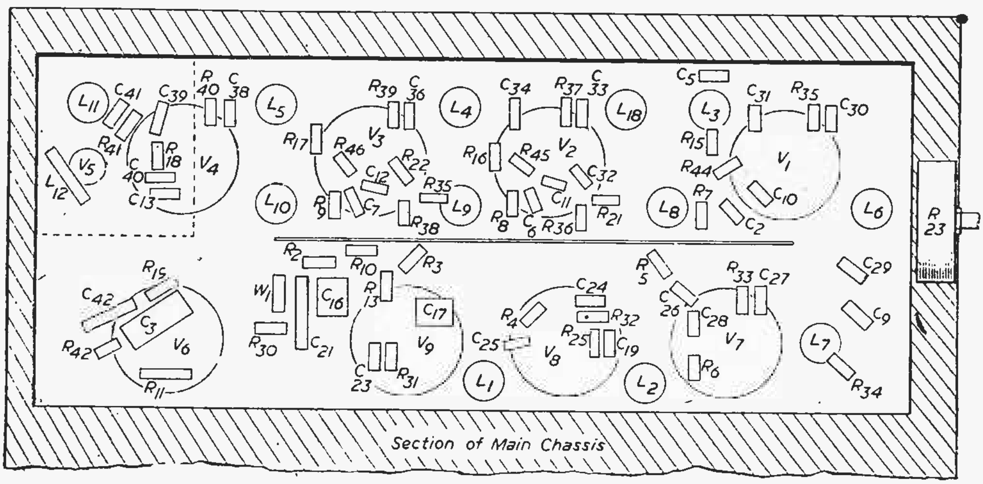
A part of the saw tooth voltage at line frequency generated by V14 appears on the cathode of V15, and is used to drive V16, the E.H.T. generator. The saw tooth voltage developed at the anode of V16 shock excites T5, the E.H.T. transformer, into oscillation at approximately 150 kc/s. This transformer generates 6.2 kilovolts (after rectification) for the C.R.T. second anode. A separate winding on T5 supplies the heater current for the E.H.T. rectifying valve (V17). An increase in the E.H.T. voltage can be obtained if required by reducing R49 to 15 KΩ. An improvement in the regulation of the E.H.T. supply may be effected by increasing C55 to 0.1 μF (7 kilovolts working voltage).

The Vision Receiver

This unit is very similar in design to the T101 vision receiver, except that the first two R.F. stages also amplify the sound signal. L6 and L8 are the sound rejector coils. The anode coils L2 and L7 are tuned to 47 Mc/s, the grid coils L3 and L9 to 43 Mc/s and the R.F.transformers L1, L5 and L10 to 45 Mc/s. As in the T101, an improvement in picture quality can be effected by increasing the receiver bandwidth in strong signal areas by tuning L2 and L7 to 48 Mc/s and L3 and L9 to 42.5 Mc/s. In the case of receivers in the Birmingham area it is not advisable to alter the tuned circuits. The Birmingham transmission is single sideband, and the receivers have to be tuned to receive the lower sideband only. An additional inductance L27 in the Birmingham models is the upper sideband rejector. This has to be tuned very accurately or the bandwidth response of the receiver will be impaired, and sound breaking through on vision may be experienced. L27 is tuned to 63.25 Mc/s for a minimum output from the vision receiver. As in the T101, intermittent vision is invariably due to one of the screen grid or cathode bypass condensers (.001 μF) going open circuit. If this occurs in conjunction with intermittent sound, the first three R.F. stages are suspect. If the sound is normal the last two R.F. stages should be examined.

The Sound Receiver

V7 and V8, two high-slope R.F. pentodes, form a T.R.F. amplifier at sound-carrier frequency. No sound gain control is used, as a delayed A.V.C. voltage is applied to V7 grid. V9 is the sound detector and noise limiter, and V10 the pentode output. As the R.F. valves age, or if a new valve is fitted, an improvement in sound can be effected by retuning L14, L15 and L16. Poor quality of sound is usually due to one of the high resistors in the A.V.C. line (R29 or R30), or R32, R33 in the noise limiter circuit, going open circuit or high in value.



Vision and sound chassis viewed from below—Model T101.

The Video Amplifier

AN EXAMINATION OF THE "OUTPUT" STAGE OF THE VISION RECEIVER

By Gordon J. King, A.M.I.P.R.E.

WITH a few exceptions the video output stage of a television receiver corresponds to the output stage of an ordinary sound receiver. In the latter case, its function is to supply power to the loudspeaker, as opposed to a voltage output required from the former. Further, the sound output stage is intended to amplify frequencies within the audio spectrum only, whereas all frequencies of the 2.75 Mc/s video (vision) signal, including D.C., should be amplified equally by the video output stage. In practice, however, the frequency response is usually modified, in order to compensate for other circuit deficiencies.

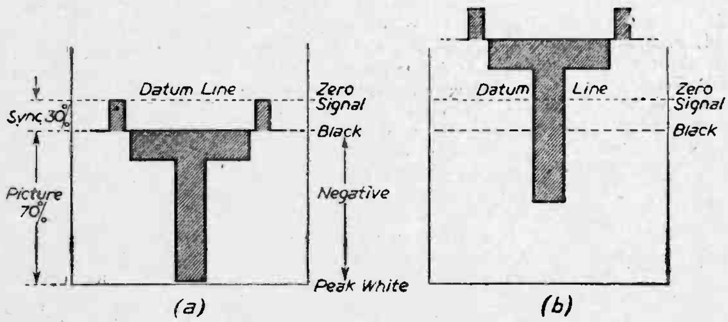


Fig. 1.—Composite vision and sync signal showing importance of black level.

The D.C. Component

Fig. 1a shows a composite vision and synchronising signal, which may be expected from the output of the video amplifier. It will be noted that the datum line (dotted) corresponds to zero signal, and the voltage across the amplifier load resistor increases in a negative direction dependent on the instantaneous signal magnitude. The D.C. component of the video signal is thus retained, and is fed in this form to the picture tube. Fig. 1b shows how the signal, lacking a D.C. component will settle down in relation to the datum line. After a period of time, the signal will enclose equal areas either side of the datum line, and if the signal magnitude is reduced it will collapse to this zero level. This will affect the picture inasmuch that a change of mean brightness at the studio will not be indicated by the picture tube. Each scene will, therefore, appear to contain the same average brightness value. Further, separating the sync pulses from the picture will prove very difficult, and synchronising the time bases will be almost impossible. The easiest method of retaining this D.C. component is by employing direct coupling from the vision detector onwards. This means, of course, the video amplifier must be a direct-coupled circuit, for if coupling capacitors are employed the D.C. component is lost.

Modulating the Picture Tube

In the earlier receivers grid modulation was frequently employed, but unfortunately this method is beset with difficulties. First, should the video valve fail, the anode will assume the H.T. line voltage, and if direct coupling is employed the grid of the picture tube will go heavily positive, which obviously is detrimental to the tube. Second, a larger video valve is necessary, since the valve is running towards cut-off on peak whites, and consequently it has to be run at a higher anode current for no-signal conditions. Third, difficulty is encountered in separating the sync pulses from the picture signal. In order to solve the above problems, some receivers use grid modulation but employ capacitive coupling to the picture tube. The D.C. component is restored by the inclusion of a small diode connected in shunt with the grid of the picture tube.

It is becoming progressively more popular to employ direct coupling from the detector valve to the video amplifier, and from the video amplifier to the picture tube, in order to handle the D.C. component without the need for D.C. restorer circuits. Connection is made from the anode of the video valve to the cathode of the picture tube, although sometimes the design incorporates a series-peaking coil, but in any case the D.C. connection still exists.

Modulating Voltage

The voltage needed fully to modulate a picture tube, of course, depends on its characteristics; modern tubes require between 25 to 35 volts peak-to-peak, although the earlier type required peak-to-peak voltages between 55 to 65 volts, for the same contrast ratio.

Unless special voltage-doubling detector circuits are employed, the output from the vision detector valve rarely exceeds 5 to 6 volts peak-to-peak. The video output stage is, therefore, required to amplify this voltage to a level suitable for application to the picture tube.

It should be noted that the above-mentioned voltage magnitude includes not only the active picture signal, but also the sync pulses, which are preserved throughout amplification and applied to the tube together with the

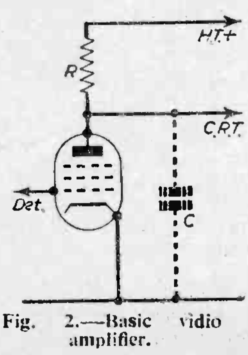


Fig. 2.—Basic vidio amplifier.

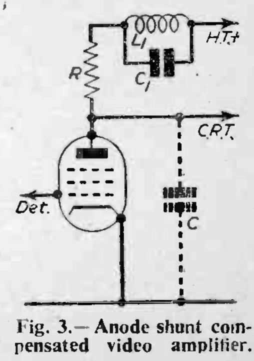


Fig. 3.—Anode shunt compensated video amplifier.

picture signal. It will be obvious that the value of signal equivalent to black must correspond to the cut-off of the tube. The 30 per cent. of signal from black to zero modulation contains the sync pulses, which are usually conveyed direct from the output of the video valve to the sync separator. Thus, the output from the video stage consists of 70 per cent. picture signal and 30 per cent. sync pulses. It follows that only 70 per cent. of the video voltage contributes to the peak-to-peak voltage needed by the tube. For instance, if 25 volts peak-to-peak are needed fully to modulate the tube, it will be necessary for the video output stage to deliver

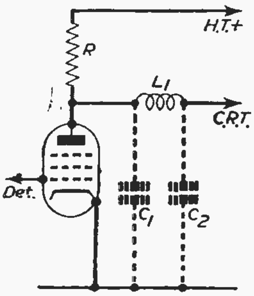


Fig. 4.—Series compensated video amplifier.

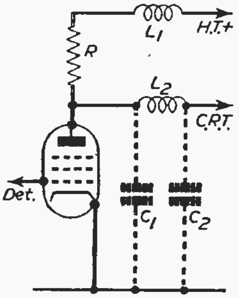


Fig. 5.—Series-shunt compensated video amplifier.

25/0.7 or a little over 35.5 volts. 10 volts of which contribute to the sync signal. If the output from the detector valve is 5 volts, the amplification required from the video stage to fully modulate the tube will be 35.5/5 or 7.1 times.

High Frequency Considerations

The basic video amplifier circuit may be shown in the form of the simple resistance coupling (Fig. 2). Its limitations to the higher video frequencies arise from the inevitable shunt capacitance C. This capacitance is comprised of a number of smaller capacitances, and each contributes to the total value of C, as shown below:

Anode to cathode capacitance of video valve, approximately	8 pF
Picture-tube input capacitance, approximately ..	7 pF
Circuit wiring and valve holder capacitance, approximately	9 pF
Sync. separating circuit capacitance, approximately	8 pF
Total capacitance C, approximately	32 pF

From the video frequency aspect, the H.T. positive line is in connection with the cathode; therefore, C is virtually in shunt with R. The video amplifier valve is usually of the high mutual-conductance (gm) pentode type, and its A.C. resistance is very large compared with R. Therefore, the amplification (A) of the stage, at zero frequency, may be expressed thus: gm.R. . . . (1). At the higher video frequencies, however, the capacitive reactance (Xc) of C must be taken into consideration. The attenuation due to C may be expressed as a function of R/Xc, where Xc equals $1/2\pi fC$. Therefore, the following formula may be used to calculate the amplification of the stage at any frequency:

$A = gm.R/\sqrt{1+(R^2/Xc^2)}$ ....(2)

At this point it will be instructive to calculate the loss in dbs. at 2.7 Mc/s relative to zero frequency, which may be expected from a circuit such as Fig. 2. Suppose, for instance, a stage gain of 7 is required. Assuming the gm of the valve to be 7 mA/V, and the total shunt capacitance C to be 30 pF. To find R at zero frequency formula (1) is used, or R = A/gm; remembering that gm is in mA/V, R will therefore be in K ohms, thus R = 7/7 = 1 K ohm.

Substituting this value in formula (2), also the value of Xc at 2.7 Mc/s, this works out to be approximately 2 K ohms, therefore: A at 2.7 Mc/s $= 7\sqrt{1+(1^2/2^2)} =$ approximately 6.27 times.

Now the gain of the stage at zero frequency may be expressed as 16.9 db, whilst at 2.7 Mc/s the gain is just over 15.9 db, thus the loss at 2.7 Mc/s relative to zero frequency is about −1 db.

Anode-compensated Video Output Stage

The only drawback in using a low value for R, apart from the low gain viewpoint, is the high maximum current needed by the valve. For instance, suppose the tube needs 35 volts peak-to-peak for full modulation, and R is 1 K ohm, a peak-to-peak current swing of 35 volts/1 K ohm, or 35 mA, must occur through the valve. Further, the valve must be allowed a certain minimum current, a typical figure being 15 mA, therefore, for peak white, the valve will need to pass 50 mA!

Fig. 3 shows a video stage which is now in general use. By the inclusion of L1 and C1 in series with R, an extended higher frequency response is possible. The value of R may, therefore, be increased, thereby reducing the valve current and increasing the amplification of the stage. C1 is usually comprised of the self capacitance of L1, and the relationship between the components for a fairly flat response is: $L1 = 0.25CR^2$ Under these

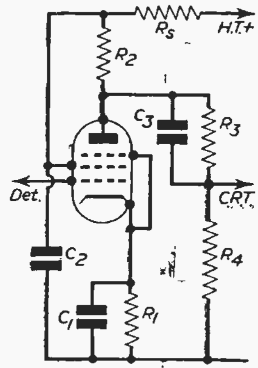


Fig. 6.—A typical video output stage. Values must be chosen according to the valve and other circuit characteristics.

conditions, R may be three times that required for the uncompensated stage of Fig. 2, for the same loss at 2.7 Mc/s.

Sometimes the circuit is arranged as in Fig. 4, and in this case the capacitance C is divided into two parts, thus forming C1 and C2. The relationship between the components for an extended linear response is: C1 equals 0.1C. C2 equals 0.9C. and L1 equals $0.375CR^2$. This circuit shows a small improvement over that of Fig. 3, but it has the disadvantage of needing C divided to form a certain ratio, which in practice is not easy to achieve unless external capacitors are employed.

A combination of the two circuits is sometimes employed (Fig. 5). This enables R to be increased to 4.5 K ohms for a −1 db loss at 2.7 Mc/s. The components are related thus: C1 equals 0.2C; C2 equals 0.8C; L1 equals $0.062CR^2$, and L2 equals $0.39CR^2$.

It should be noted that, due to the inclusion of the inductance, the above circuits are of an oscillatory nature. Therefore, unless well designed they may tend to " ring " thereby producing the well known " black after white " phenomena, associated usually with mistuned R.F. or I.F. stages.

Polarity of Output Voltage

In the foregoing circuits the cathode bias resistor has not been shown. Such a resistor is usually included, but its value is dependent on the polarity of the output voltage. If the output signal is applied to the cathode of the picture tube, the video valve may be biased near cut-off and driven positive by the detector signal. If a positive output is needed, however, the valve may be biased just clear of grid current and driven negative. As is well known, an unbypassed cathode resistor will result in applying negative current feed-back to the stage, with a reduction in the effective value of gm.

Cathode Compensation

Use is occasionally made of this effect to procure compensation for the high-frequency components. The cathode resistor is shunted by a small capacitor, a usual value being about 470 pF. The cathode resistor provides degeneration over the lower end of the video spectrum, while the high-frequency end being effectively by-passed by the capacitor is not affected. Resulting in the lower end of the response curve being reduced to the level of the high-frequency end, high-frequency compensation is thus accomplished.

Fig. 6 depicts a typical cathode-compensated video stage. The resistor R2 is the anode load, while C2 is the H.T. smoothing capacitor. The resistor Rs represents the H.T. source resistance, which in a video amplifier is an important factor. For instance, the effective load resistor for the higher frequencies is R1; at the very low frequencies, however, C2 is ineffective, and the load resistance becomes R2 plus Rs. The very low frequencies including D.C. is thus overamplified. This will result in the changes of mean brightness of the picture becoming excessive and, therefore, fading caused by aircraft will appear accentuated.

To reduce this phenomena R3, R4 and C3 are included in the picture-tube feed circuit, in the form of a frequency-correcting network. The resistor values are arranged so the voltage change across R4 is approximately the same as that across R2. For the higher frequencies capacitors C2 and C3 by-pass Rs and R3, which results in R2 being shunted by R4. In practice R3 and R4 are usually equal, a typical value being about 100 K ohms. A step down of 50 per cent. at D.C. modulation is thereby achieved.

Improved Studio Acoustics

In view of the importance of sound quality reproduction in television, it is thought that the following notes on some recent BBC experiments would be of interest, as they may, no doubt, eventually be incorporated in the Lime Grove Studios.

The results achieved by the recent modifications made at Maida Vale with the object of improving the acoustic qualities of the BBC's No. 1 orchestral studio have been praised by conductors, players and listeners alike.

This studio, the BBC's largest, has a volume of 213,000 cu. ft. and was built in 1934 inside a former roller-skating rink. The walls were covered with building board and the floor carpeted except for the area actually occupied by the orchestra.

Until after the war the studio remained in its original form except for the introduction of the organ and a raised platform for the orchestra. The acoustics were never entirely satisfactory, being boomy in the bass and dead at the higher frequencies.

During recent years engineers of the BBC's Research Department have made a study of the acoustic qualities of a number of concert halls to obtain information upon which new designs might be based. New methods have been developed and applied to reverberation time measurement and to the study of structural vibration. A new technique has also been developed which enables permanent photograph records to be obtained of the behaviour of a studio over the desired frequency gamut. The acoustic qualities of each hall were first assessed by careful listening tests, after which more detailed study was made to ascertain the causes of any effects noticed.

Diffusion

From the data collected it was deduced that a combination of good tone and good definition can only be achieved when the sound field in the hall or studio is well diffused, and sound striking walls should be so scattered as to arrive at the listener's ear, or at the microphone, from many different directions rather than being reflected from only a few surfaces. To meet these requirements the surfaces need to carry numerous scattering elements to assist diffusion. Rectangular shapes are the most effective.

From test data it was considered that the appropriate reverberation time for Maida Vale Studio No. 1 should be about 1.8 seconds with the orchestra present, while the reverberation-frequency characteristic should be level up to about 3,000 c/s. Any steep rise of reverberation time in the extreme bass was to be avoided as it causes bass masking of the orchestra by the tympani. For the same reason hard reflecting surfaces immediately behind the orchestra were considered undesirable. An acoustically absorbent background such as a choir or part of an audience has been found to improve definition by avoiding reinforcement of the tympani and heavy brass which tend to mask the less powerful instruments.

In 1948 the Acoustics Committee of the BBC decided that the retreatment of the Maida Vale Studio No. 1 was a necessity and since this studio was for large orchestras, in many cases joined by a choir, it was decided to attempt a reproduction of the natural acoustic setting for such combinations, namely the concert hall. It was agreed that the retreatment should embody the findings and recommendations of the Research Department.

Designs were prepared by the Building Department of the BBC which included the provision of roofing-felt membrane absorbers covering almost the whole area of the side walls and varying in depth from 3in. up to 18in. These serve to reduce the reverberation time in the extreme bass where it was previously excessive. They also act as scattering elements at all frequencies above about 90 c/s. No absorbent materials were used on the ceiling, but the highly reflective surface was broken up by introducing a large number of scattering elements consisting of flat, rectangular plates supported on pedestals at distances varying between 1ft. and 3ft. from the ceiling. Composite absorbing units, making use of both porous and membrane absorption were installed in front of the rear end wall over the balcony. These units present a serrated wall form thus preventing the sound from being reflected as a strong echo. The wood block apron in front of the orchestra was extended by 15ft. and the orchestra risers mounted on solid concrete.

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Operating Televisors from Low-voltage Sources

THE USE OF BATTERIES AND CONVERTERS

By F. G. Rayer

IT is possible to operate a standard or experimental television receiver from accumulators almost as readily as mains-type broadcast receivers may be powered from such sources. This brings the possibility of television within the reach of a large number of families where no mains supply is available. In country areas, home-generating plants are quite extensively used, and often it does not seem to be understood that mains-type receiving apparatus can be used with a suitable convertor. It is therefore proposed to set out the considerations which must be kept in mind if satisfactory results are to be obtained. Further employment for such circuits can be found in portable public-address apparatus to be used in the open air where no mains are available, the use of a small mains-type receiver as a car radio, and other fields of utility.

Type of Receiver

All plants using storage batteries deliver direct current, and the usual type of rotary convertor gives a direct current output. This means that A.C./D.C. type apparatus will be required, though the constructor who builds his own receiver can employ a circuit especially for D.C., thereby achieving some economy in first cost. The advantage of purchasing an A.C./D.C. type receiver lies in the fact that it can be used with ordinary mains. This is particularly convenient when it is known that mains power will eventually be installed, or when the apparatus may occasionally be used where mains are available. (As with an amplifier used for entertainment, etc., or a receiver which is only wanted in a car during the summer months.)

An A.C./D.C. type televisor is not necessarily inferior to an A.C. model, and many A.C./D.C. type sets are available from reputable manufacturers, offering various picture sizes. The lower is the consumption of the set, the more economical will be its operation, and it may be necessary to keep this in mind when the plant is small. An average figure for a domestic televisor would be about 100 watts. For the purposes of calculation, the convertor may be assumed to have an efficiency of about 50 per cent. Consumption would thus be 200 watts, or 10 amps, from a 20-volt supply.

The A.C./D.C. type of receiver is therefore recommended. A.C. receivers *must* be operated from an alternating current source—which would require a convertor running at a certain speed, within limits (to maintain the frequency of supply), in addition to providing suitable current.

Some rotary convertors are marked with current output ratings. If the consumption of the receiver is indicated in watts only, the current consumption can be found by dividing the wattage by the operating voltage. For example, a receiver consuming 60 watts at 220 volts has a consumption of .27 amps (approximately). This is 270 milliamps.

The Convertor

The secondary, or output, side of this should have a voltage and current rating large enough for the receiver. The voltage will normally be within the 200 to 250 volts limit. An output as high as 500 mA (.5 Amp.) may be required to operate a large receiver. With smaller receivers the consumption will be much less and a smaller convertor can be used. When the circuit is first operated, the output of the convertor should be checked with a voltmeter. Most receivers have a link, plug, or other means of adjusting to voltages between the 200 to 250 volts limit, and this can then be set at a position which is suitable for the actual voltage obtained from the convertor.

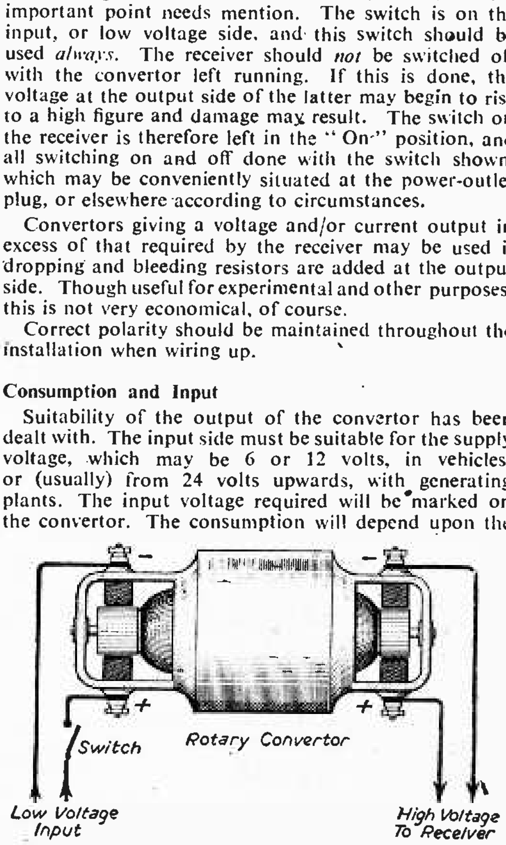
The diagram illustrates connections, and one very important point needs mention. The switch is on the input, or low voltage side, and this switch should be used *always*. The receiver should *not* be switched off with the convertor left running. If this is done, the voltage at the output side of the latter may begin to rise to a high figure and damage may result. The switch on the receiver is therefore left in the "On" position, and all switching on and off done with the switch shown, which may be conveniently situated at the power-outlet plug, or elsewhere according to circumstances.

Convertors giving a voltage and/or current output in excess of that required by the receiver may be used if dropping and bleeding resistors are added at the output side. Though useful for experimental and other purposes, this is not very economical, of course.

Correct polarity should be maintained throughout the installation when wiring up.

Consumption and Input

Suitability of the output of the convertor has been dealt with. The input side must be suitable for the supply voltage, which may be 6 or 12 volts, in vehicles, or (usually) from 24 volts upwards, with generating plants. The input voltage required will be marked on the convertor. The consumption will depend upon the



Arrangement suggested for low-voltage operation.

size of the convertor (e.g., the output required to operate the receiver), and the input voltage. In a specific installation fitted as in the diagram, the consumption was 8 Amps at 24 volts. Had 12 volt operation been necessary, a suitable convertor would have consumed approximately 16 amps. This is a large figure, for continuous use, but the receiver was of rather large type.

The approximate current consumption may be found as described ; measurement with a suitable meter can subsequently be used as a check to operating conditions. If the accumulators are in somewhat poor condition it will probably be desirable to run the generating engine while the receiver is in use, if the latter is large. However, it is likely that most viewing would take place in the evening, when the generator would in any event be in use, for lighting purposes. Accumulators in poor condition, or of small capacity, are not able to stand a load of the proportions mentioned unaided, and the voltage will drop. This will be indicated by the convertor losing speed, and the receiver showing the usual symptoms of failing voltage.

The high consumption on the input side of the convertor makes it necessary to avoid excess voltage-drop between supply source and convertor. In a specific installation fitted up, the resistance (primarily of house wiring) was approximately .2 ohm, between supply and convertor. With 8 Amps flowing, this caused a voltage drop of 1.6. With the usual 200-250 volt supply, this would have been so small as to be immaterial, but with the 24 volt supply in question, it constituted a drop of 7 per cent., which is fairly serious. It is, therefore, necessary to employ stout gauge wire on the input side, to keep wiring reasonably short, and to assure that switching or connectors do not present excessive resistance. The convertor may conveniently be situated at some distance from the receiver, and current led from the high-voltage side by suitable conductors. This will avoid the sound of the convertor running proving troublesome. A voltage drop is less likely to arise in the high-voltage leads, as the current flowing is fairly small. Furthermore, any drop arising will form a smaller proportion of the total voltage, and therefore be unimportant. (For example, the drop of 1.6 volts mentioned would only constitute 0.7 per cent. at the high-voltage side of the convertor.)

The main requirements, therefore, are to keep resistance on the input side down, in order that the convertor may receive its proper voltage, and to see that the input rating of the convertor is suitable for the supply.

Interference Suppression

This requires special note because the generating plant will often have an electrical ignition system, and interference may be carried through the wiring to the receiver. If interference arises, the engine may be switched off to determine whether this is indeed the cause of the trouble. If the interference continues, its source must be sought elsewhere. If it ceases, then the engine was responsible. A suppressor should be added in the sparking-plug lead.

Further benefit can be obtained by erecting the aerial as far as possible from the engine, as the latter may radiate interference over a radius of several yards. When these points have been attended to, results would normally be satisfactory.

The receiver itself will probably be fitted with some kind of filter to combat mains-borne interference. If not, suppressor chokes can be added between convertor and receiver, with condensers of about .25μF connected from either end of each choke to a good earth. In bad cases, four condensers may be used, one wired to each end of each choke, and all returned to earth. Similar condensers can also be included on the input side of the convertor, from brushes to earth. (No chokes can be used here in view of the voltage drop.)

Basically, then, suppression lies in two requirements : (1) keeping radiation of interference down, by suppression at the generator plant, and (2) assuring that the current fed to the receiver is interference-free, by including suitable filter circuits. When these points are remembered, interference need not exceed that suffered with conventional mains operation. It may be less, due to the absence of interference sources present in towns.

Radio Exports Up

EXPORTS of British radio equipment of all kinds in November last were valued at £2,235,367—as much as in a year before the war—bringing the total for 11 months of 1951 to £20,446,795, compared with £17,750,000 for the whole of 1950.

A Radio Industry Council spokesman, commenting on the figures, said :

"On the basis of the Customs and Excise figures for the first 11 months of 1951, it is apparent that the total British radio exports for 1951 will have exceeded £22,000,000, over £4,000,000 more than last year's all-time record.

Receivers

"A striking feature is that the exports of radio receivers, which declined after the post-war peak period, have increased in value in 1951 to about £5,000,000, the highest figure yet, countries taking increased quantities including Egypt, Turkey, South Africa, Malaya, Thailand and Brazil. The year was also notable for the first exports of television receivers—only a few hundred sets so far, but a beginning.

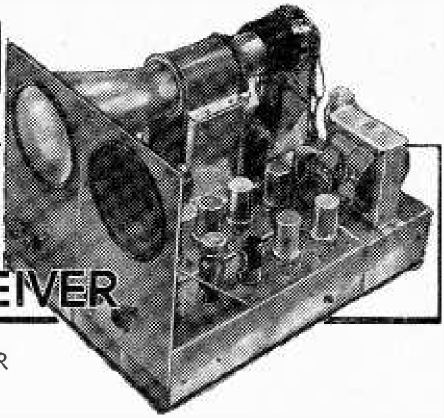
Valves and Components

"British valves, it is estimated, were exported to the value of £3,755,000 last year, a record, and components to the value of more than £7,000,000 compared with a record figure in 1950 of £5,300,000. Ten per cent. of the components went to dollar markets.

"Exports such as broadcast transmitters, communication equipment, radar and other navigational aids, and electronic industrial equipment, although likely to be valued at about £5,820,000, not including equipment exported as installations in ships and aircraft, are down a little, no doubt because of the heavy demands of the defence programme on this section of the industry."

The "ARGUS"

BUILDING OUR *Free Blueprint* TELEVISION RECEIVER



A 21-VALVE 6IN. C.R. TUBE UNIT-BUILT TELEVISOR FOR THE AMATEUR

ALTHOUGH this televisor costs less than £20, it does not involve the conversion of ex-Government units, but has been designed for construction by the novice. The circuits have been kept straightforward and devoid of "frills," though nothing has been sacrificed which would assist in its efficient and stable operation.

The cathode-ray tube used is a VCR97. This 6in. tube was chosen as it is readily available at a low cost, and is capable of providing pictures of very good quality. The trace is green, but one soon becomes accustomed to the colour, and it is very restful to the eyes.

The chassis is divided into five separate units, which makes for ease of construction ; the units are : vision receiver ; sound receiver ; time base ; E.H.T. supply and C.R.T. network ; and power unit. Each unit is complete on its own chassis, and when finished all units are bolted together to form the complete televisor.

Aluminium sheet is used for chassis construction ; this material is readily obtainable and is easy to work. Details of the construction of each chassis will be given later.

By using separate units the work can proceed in planned stages, each stage being complete in itself. It is not strictly necessary to construct the units in any particular order, but the newcomer is recommended to follow the method given.

The overall dimensions of the chassis are 13in. wide by 18in. long by 3in. deep.

Although no ex-Government parts were used in the original, ex-Government components and valves can be employed provided they are in good order. Particular care should be taken to check any condensers obtained from this type of equipment.

The Vision Receiver

The circuit of the vision receiver is shown in Fig. 1. It has four R.F. stages, which feed into the EA50 diode detector. The rectified output is fed into the video valve V6.

The coil data is given in Fig. 5 and all the coil formers are $\frac{3}{8}$in. diameter with the exception of the rejector coils, which are wound on $\frac{1}{4}$in. formers ; spacing between turns should be approx. 2 mm. Tuned-anode circuits are used. The sound receiver feed is taken from a coupling coil wound on L2.

The contrast (gain) control is obtained from VR1, and R4, which is not by-passed by a condenser, and

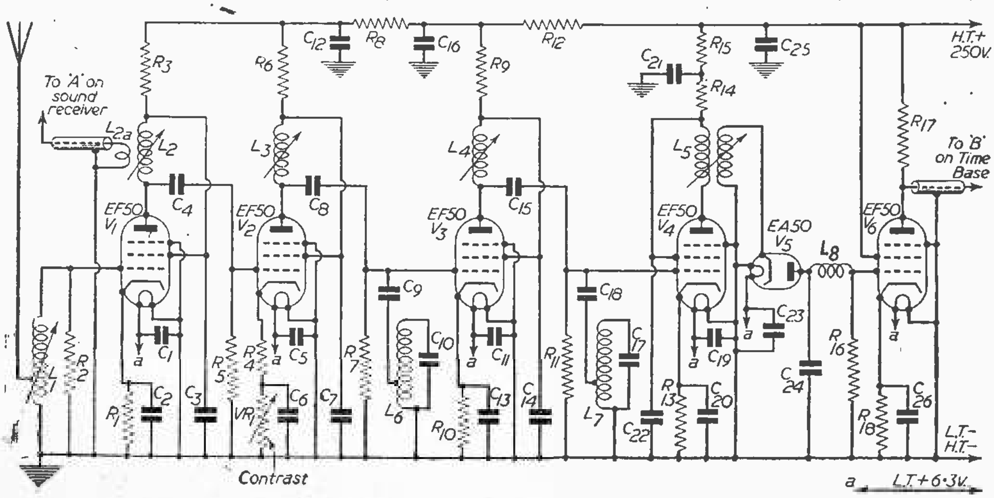


Fig. 1.—Circuit of the vision unit.

provides a small degree of negative feed-back, which helps to counteract the de-tuning effect of VR1.

The rejector coils should be wound with 22 S.W.G. wire, and spacing should be approximately 1 mm. between turns.

The earth wiring is completed in bare wire, but the other wiring should be covered with insulated sleeving. All wiring should be kept as short as possible, the ends of the wires should be wrapped round the tags, and make good electrical contact *before the solder is applied.*

It is a good idea to tick off each wire on the diagram as it is connected, and each wire should be soldered as it is terminated.

Building the Vision Receiver

When the chassis have been made up and the holes drilled, the valveholders should be fitted in position and the filaments wired, including the diode detector V5. The earthed side of the filaments is connected by running one end of the wire under the bolt which holds the valveholder to the chassis.

Commence the work by winding L1 (Fig. 1). The tap is made by twisting a small loop in the wire no more than ¼in. long and applying solder. The earthy end of the wire is wound round the bolt, which fastens the coil former to the chassis. The top end of the coil goes to grid of V1. Spacing between the turns should be approximately 2 mm.

The tap is left unconnected at this stage, but R2 should be wired in across the coil. R1 and C2 can be connected now and the remaining earthed pins of the valve wired as shown in the diagram. The first screen can be erected and work can proceed on the second half of V1 and the first half of V2.

L2 coil is bolted in position and the secondary is wound with bare wire (22 S.W.G.) by connecting one end of the wire to the anode of V1, winding it round the coil for the appropriate number of turns and taking the other end to G2. The primary is now wound on top of the secondary, using insulated wire; the bottom end is connected to one of the bolts holding the coil former and the other end is left free at this stage. Fig. 5 shows the method of winding the coil.

The remainder of the components are wired in. One end of R4 is connected to the cathode of V2, the other end being left free at this stage. When the wiring is completed the second screen should be erected and work commenced on the second half of V2 and the first half of V3.

L3 should now be fitted and should be wound in a similar manner to L2 except that this time there is no coupling coil.

L6 is now wound and fitted in position, the bottom end of the coil being earthed under one of the coil former retaining bolts. A tap is made for connection to C9 in a similar manner to the tap on L1, it being made at the

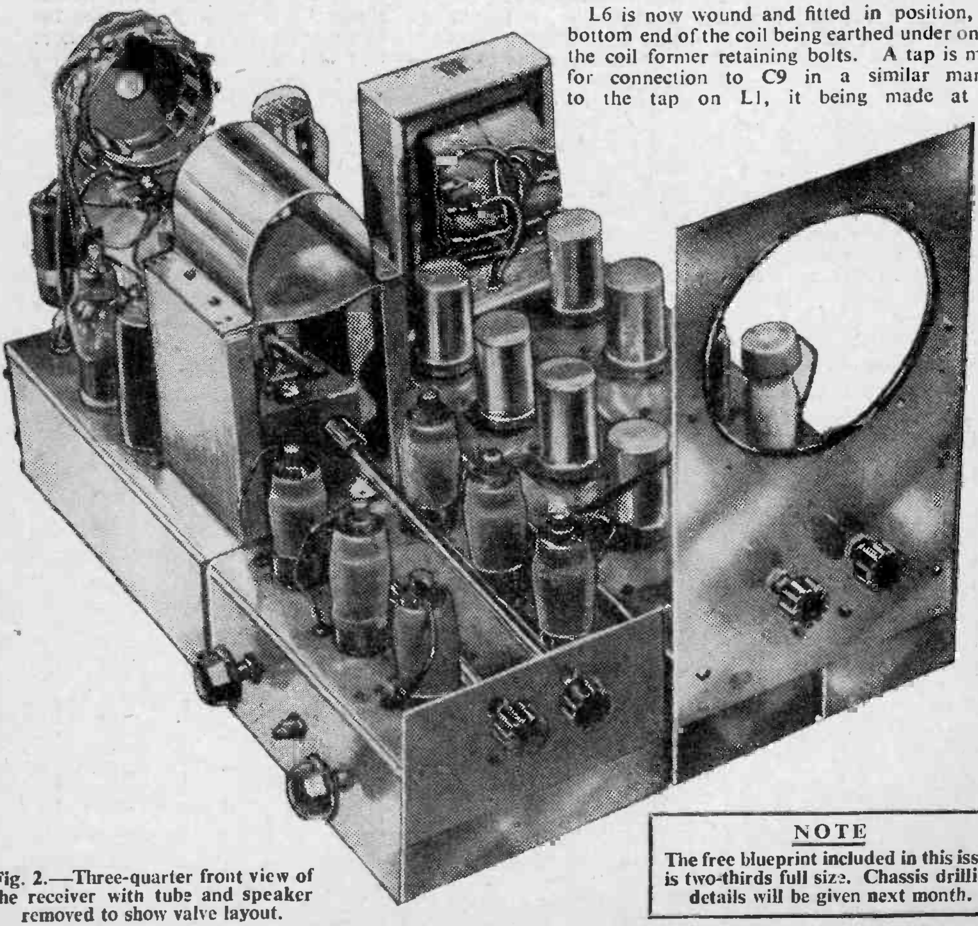


Fig. 2.—Three-quarter front view of the receiver with tube and speaker removed to show valve layout.

NOTE

The free blueprint included in this issue is two-thirds full size. Chassis drilling details will be given next month.

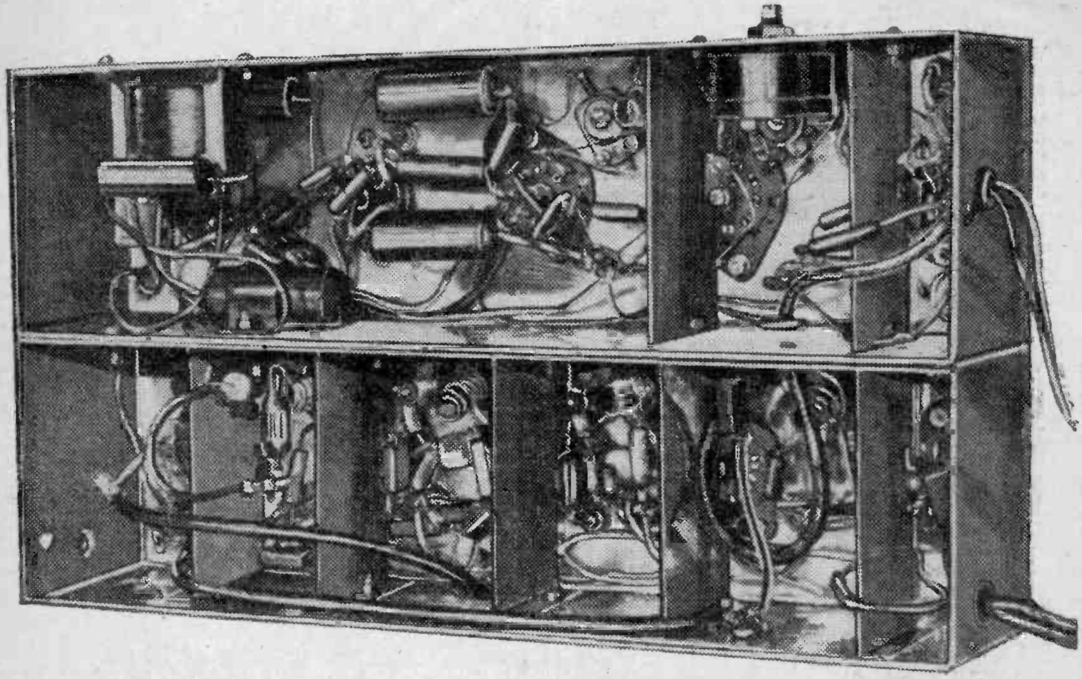


Fig. 3.—Under-chassis view of vision and sound chassis, bolted together.

earthy end of the coil. C10 and C9 can now be wired in. In addition to the capacitative coupling provided by C9 there will be a certain amount of inductive coupling directly between the two coils.

The remainder of the components can be connected and the screen erected. The next stage is dealt with in a similar manner.

L5 has two coils. The primary (anode) coil is wound first and the secondary is wound above it. The two coils are separated by approximately 2 mm., and the first turn of the secondary is covered with insulated sleeving to prevent contact between the two coils. Fig. 5 shows winding details.

Wiring should proceed and L8 can then be wound. This coil is wound with 34 S.W.G. enamelled silk and cotton-covered, wire on a former comprising a 1 megohm 1 watt resistor. The method of winding this coil is shown in Fig. 5.

The wiring of V6 is then completed. The value of the condenser in the cathode circuit of V6 depends upon the amount of gain versus quality required from the valve. For maximum quality the value should be low. The gain can be increased by increasing this to 0.01 μF or even 0.1 μF. In very weak signal areas, where maximum gain is required, it can be increased to 25 μF, but in this case C25 should be increased to 8 μF. This latter condenser should be connected across C25 and be in addition to it.

The coaxial cable link to the time base can be connected as shown in the blueprint and the coaxial cable links from L1 and from L2 can be wired. A piece of flex is taken from the L.T. common and from the H.T. common as shown in the diagram.

Finally check all the wiring thoroughly.

The Sound Receiver

The circuit is shown in Fig. 4. It comprises 2 R.F. stages which are transformer coupled, followed by the Osram D63 (or 6H6) detector and interference limiter; this feeds into a high-slope pentode (EF39), the output of which is fed to the 6V6 power output tetrode. A sensitivity control VR2 is provided to pre-set the gain in areas of high signal strength. Once it has been set there should be no need for readjustment. R21 in the cathode circuit of V8 is not by-passed by a condenser. This helps to overcome the detuning effect of VR2.

C39 is for tone correction. It is useful in weak signal areas and its value can be increased (if desired) to 0.01 μF to reduce the mush. Where adequate signal strength is available it can be omitted.

V10 has a top cap grid connection and the feed to this point should be made in screened wire, a screened cap being provided.

The tuning coils are tuned by the 0-30 pF postage stamp type trimmers. The use of these trimmers allows the sound signal to be located quickly, the final tuning being completed by the iron cores of the coils.

Input to the receiver is taken from the anode coil of the first vision receiver R.F. valve V1. The actual connection (made in coaxial cable) should be left as the last job.

The use of H.F. transformers allows maximum voltage to be applied to the anodes of the R.F. valves, the decoupling resistor being common to anodes and screens and thus effecting a saving in components and complication in the wiring.

The number of turns for the coils is given on the blueprint. The wire used is 22 S.W.G., but the primaries are insulated with sleeving. If plastic sleeving is used, care

LIST OF COMPONENTS AND PRICES

VISION RECEIVER

Condensers

C1—500 pF.	C10—10 pF.	C19—500 pF.
C2—500 pF.	C11—500 pF.	C20—500 pF.
C3—500 pF.	C12—500 pF.	C21—500 pF.
C4—100 pF.	C13—500 pF.	C22—500 pF.
C5—500 pF.	C14—500 pF.	C23—500 pF.
C6—500 pF.	C15—100 pF.	C24—15 pF.
C7—500 pF.	C16—500 pF.	C25—500 pF.
C8—100 pF.	C17—10 pF.	C26—500 pF.
C9—5 pF.	C18—5 pF.	

Resistors

R1—220 Ω.	R7—5.6 KΩ	R13—220 Ω
R2—4.7 KΩ	R8—3.3 KΩ	R14—4.7 KΩ
R3—4.7 KΩ	R9—4.7 KΩ	R15—1 KΩ
R4—33 Ω	R10—220 Ω.	R16—2.7 KΩ
R5—5.6 KΩ	R11—5.6 KΩ	R17—5 KΩ
R6—4.7 KΩ	R12—1 KΩ	R18—60 Ω

All resistors ½ watt. Control—VR1 2.5 KΩ carbon.

Valves

V1—EF50.	V3—EF50.	V5—EA50
V2—EF50.	V4—EF50	V6—EF50

Costs :—

Valves	£1 12 6
Condensers	13 0
Resistors	6 0
Sundries	13 0
TOTAL	£3 4 6

SOUND RECEIVER

Condensers

C27—500 pF.	C32—.01 μF.	C36—.5 μF.
C28—500 pF.	C33—.001 μF.	C37—.05 μF.
C29—500 pF.	C34—25 μF.	C38—50 μF.
C30—500 pF.	C35—.5 μF.	C39—.001 μF.
C31—35 pF.		

Resistors

R19—220 Ω	R24—4.7 KΩ	R29—750 KΩ
R20—4.7 KΩ	R25—2.2 MΩ	R30—50 KΩ
R21—33 Ω	R26—470 Ω	R31—500 Ω
R22—4.7 KΩ	R27—20 KΩ	R32—500 Ω
R23—2.2 MΩ	R28—250 KΩ	

(R31 and R32 1 watt ; the remainder ½ watt.)

Controls—VR2=2.5 KΩ carbon. VR3=500 KΩ carbon.

Valves

V7—EF50.	V9—EB34.	V10—EF39.
V8—EF50		V11—6V6.

Costs :—

Valves	£1 7 0
Condensers	6 0
Resistors	4 9
Potentiometers	3 0
L.S. and transformer	1 0 0
Sundries	10 6
TOTAL	£3 11 3

TIME BASES

Condensers

C40—.01 μF.	C47—.1 μF.	C54—.1 μF.
C41—.1 μF.	C48—.1 μF.	C55—.1 μF.
C42—.1 μF.	C49—.001 μF.	C56—100 pF.
C43—.5 μF.	C50—.001 μF.	C57—100 pF.
C44—.05 μF.	C51—.1 μF.	C58—0-30 pF.
C45—.1 μF.	C52—50 pF.	C59—.005 μF.
C46—8 μF.	C53—50 pF.	C60—.01 μF.

All 450 v. working.

Resistors

R33—1 MΩ	†R42—120 KΩ	R50—47 KΩ
R34—3 KΩ	*R43—56 KΩ	R51—10 KΩ
*R35—10 KΩ	R44—47 KΩ	*R52—56 KΩ
R36—1 MΩ	R45—4.7 KΩ	*R53—120 KΩ
*R37—100 KΩ	R46—2 MΩ	*R54—120 KΩ
R38—10 KΩ	†R47—120 KΩ	R55—2.2 MΩ
*R39—50 KΩ	*R48—56 KΩ	*R56—56 KΩ
R40—10 KΩ	R49—2.2 MΩ	R74—33 KΩ
R41—1 MΩ		

* = 1 watt. † = 2 watt. Rest = ½ watt.

Valves

V12—EA50.	V15—SP61.	V17—SP61.
V13—SP61.	V16—SP61.	V18—SP61.
V14—SP61.		

Potentiometers

VR4—2 MΩ carbon. VR6—25 KΩ 2 watt.
VR5—2 MΩ carbon. wirewound.

Costs :—

Valves	£1 4 0
Condensers	8 0
Resistors	8 0
Sundries	14 0
TOTAL	£2 14 0

C.R.T. NETWORK AND E.H.T. SUPPLY

Condensers

C61—0.03 μF 2.5 Kv.	C63—0.1 μF 2.5 Kv.
C62—0.1 μF 2.5 Kv.	C64—0.1 μF 450 v.

Resistors

R57—2.2 MΩ	R62—100 KΩ	*R67—180 KΩ
R58—2.2 MΩ	†R63—100 KΩ	*R68—500 KΩ
R59—2.2 MΩ	R64—1 MΩ	*R69—500 KΩ
R60—2.2 MΩ	R65—2.2 MΩ	*R70—500 KΩ
R61—100 KΩ	*R66—500 KΩ	*R71—500 KΩ

* = 1 watt. †=2 watt. Rest=½ watt.

Valves

V19—EA50. V20—2X2.

Controls

VR7—100 KΩ carbon.	VR9—100 KΩ carbon.
VR8—100 KΩ carbon.	VR10—500 KΩ carbon.

Costs :—

E.H.T. transformer	£2 0 0
C.R. Tube	1 15 0
Valves	8 6
Condensers	5 3
Resistors	7 6
Potentiometers	6 0
Sundries	7 0
TOTAL	£5 9 3

POWER PACK

Costs :—

Mains Transformer 425-0-425 200 mA., 6.3 v. 4 A., 6.3 v. 4A., 5 v. 3 A.	£2 11 0
V21 5U4G	9 0
Choke 3H 250 mA.	6 0
C65 and C66 16+16 450 v. } C67 and C68 8+8 450 v. }	7 6
Resistors R72 2.5 KΩ 10 W., R73 2.5 KΩ 15 W.	4 0
TOTAL	£3 7 6

Vision Receiver	£3 4 6
Sound Receiver	3 11 3
Time Base	2 14 0
C.R.T. Network	5 9 3
Power supply	3 7 6
Hardware, etc.	18 0
Grand Total	£19 5 0

must be taken when soldering as the plastic covering is liable to peel off if heated. This applies wherever plastic sleeving is used in the televisor.

Building the Sound Receiver

Two screens are required but should not be fitted at this stage, but later as the wiring proceeds. All holes should be drilled and rubber grommets fitted where required.

The valveholders are first fitted on the chassis and the filaments can be wired. The earthy side of the filaments are connected by running a wire directly under the fixing bolt of the valveholder(s).

The first coil (L9) can now be wound. The tap is made and the coil is wound in a similar manner to L1 (see Fig. 1). The earthy end of the coil is wound round the bolt fastening the coil to the chassis. All the coils are wound on ⅜in. formers. The method of winding the coils is shown in Fig. 5. Spacing between turns is approximately 2 mm. The primaries of L10 and L11 are covered with insulated sleeving and are wound on top of the secondaries. After L9 is fitted in its place the top end of the coil is connected to grid of V7. The trimmer is bolted to the chassis using a strip of insulating material between it and the chassis and it is wired in. The cathode resistor R19 and its associated condenser C27 are wired directly across the valveholder. Pin 9 is earthed in the manner given previously and the other earthed pins are wired as shown in the diagram.

The screen can now be erected and wiring can proceed on the next section.

Firstly the coil secondary is wound, the earthy end of the winding being slipped under the bolt holding the coil former and the grid end being left free. The primary (insulated wire) is now wound on by wiring it first to anode of V7 and taking the wire round the coil (2 turns) in the direction indicated in Fig. 5 and soldering the top end to grid 2 V7. The free end of the secondary can now be wired to grid of V8. Trimmer T2 should be fitted in a similar manner to T1 and wired in. The tag strip (2 point) is bolted on the chassis and the wiring can proceed as indicated in the diagram.

VR2 should be fitted after the rest of the wiring has been completed, and the screen can then be erected.

The coil L11 should be dealt with in a similar manner to L10, but in this case the "free" end of the secondary goes to anode of V9. Wiring can proceed as shown in the diagram. Two wires are taken through the chassis for connection to VR3, the volume control, though the control is not fitted at this stage.

The final job is to fit the loudspeaker transformer and to take two wires through the chassis for connection to the speech coil when the loudspeaker is fitted.

Two wires are now taken from the L.T.— and H.T.— respectively and taken out through the chassis.

At this stage the sound receiver and vision receiver can be bolted together to form a complete unit. The interconnecting coaxial cable from L2 to L9 can be completed and the front panel holding the loudspeaker, and contrast and volume controls can be fitted, and those items wired up.

(To be continued.)

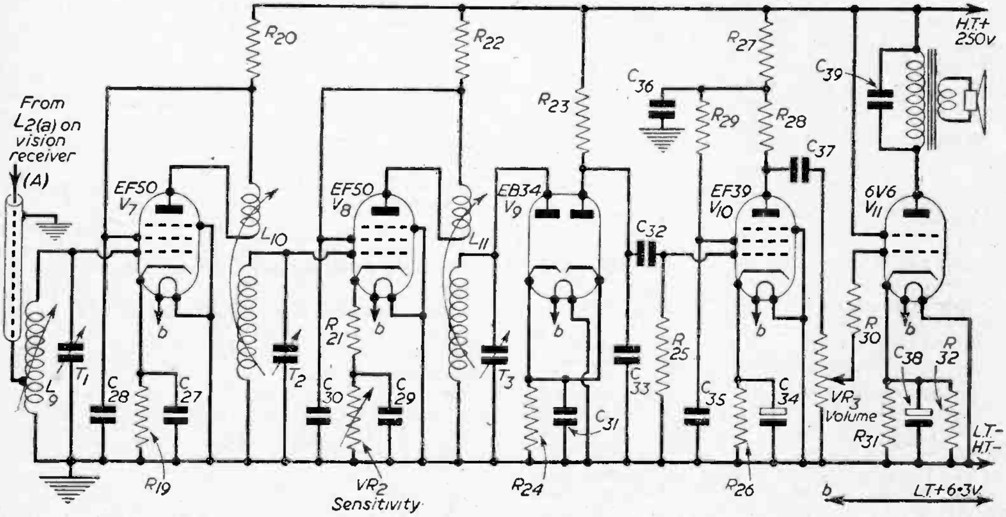


Fig. 4.—Circuit of the sound unit.

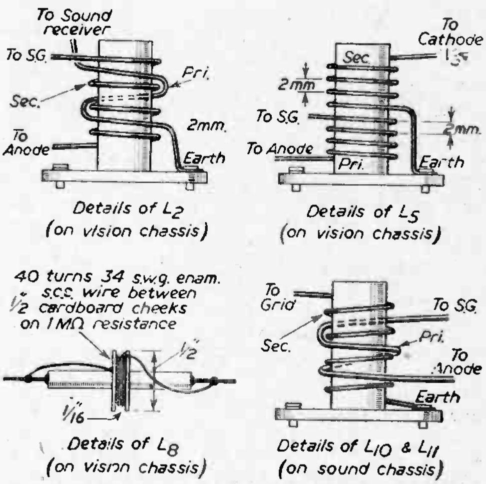


Fig. 5.—Coil winding data.

Modifying the AN/APR-4

FURTHER NOTES ON THE ADAPTATION OF THIS RADAR RECEIVER FOR TELEVISION

By John A. Bladon (G3FDU)

(*Concluded from page* 410 *February issue*)

THE audio gain control may be mounted on the front panel in place of the heterotone switch S-103, connections being made with screened wire. Power supplies are taken from the connections to the video receiver; there is little drop in H.T. voltage and no heating of components when this is done. If preferred, H.T. and L.T. supplies for the sound receiver may be taken from an outside source.

(c) The Video Peak Limiter

Noise interference in the sound channel is largely dealt with by the diode V6B. The effect of noise in the vision channel is to produce large white blots across the screen due to defocusing and, in extreme cases, tearing of the raster. Both these effects can be minimised by the addition of a simple limiter, the defocusing being eliminated entirely, the noise peaks appearing as white pinpoints which are not nearly so objectionable.

The limiter consists of an EA50 diode V9 connected across the output of the video amplifier V-101-6. An adjustable positive bias is applied to the cathode through R19, C18 decoupling the cathode to earth. The control R20 is adjusted so that the diode is just not conducting at peak-white level. A noise pulse greater than this will cause V9 to conduct and effectively short the noise pulse to earth. The effect is that the noise pulses are limited to a maximum amplitude little greater than peak-white level and cannot ever be great enough to cause defocusing of the spot.

It is important that the anode lead of V9 is short, as any additional capacity introduced at this point will reduce the bandwidth of the video amplifier. If the valve is mounted on the chassis side as shown, the anode of V9 is brought extremely close to pin 8 of V-101-6. C18 and R19 are mounted close to V9. R20 is mounted on the front panel in place of the dial light, R21 is accommodated in the power unit. The connection between R20 and H.T. positive is best made by taking a wire to the H.T. end of R128, which will be found on the resistor strip in the power unit.

The adjustment of the limiter is quite simple, the cut-off at peak-white level being quite obvious if the adjustment is made with a picture on the C.R.T. screen.

Phase Splitter and Sync Separator

These stages are included in the description as they may present a few new, though not necessarily original, ideas on the subject. V10, a 6SJ7, triode-connected, operates as a phase splitter; one difference from the usual circuit being that there is no coupling condenser between the grid and the cathode of V103. This is really a valve-saver, since the D.C. level is retained without the use of a clamping diode. R22 is included to tie the grid down to earth when the grid connecting plug is removed. Video output is taken from V10 cathode and positive-going sync pulses are taken from the anode through C19 to the grid of the sync separator; this consists of a 6AC7 (V11), operated as a transitron oscillator. The D.C. level is self restoring as the cathode is tied down to earth and, under normal operation, grid current flow during the sync pulses through R25 is sufficient to build up a cut-off bias on the grid. If this cut-off bias were absent, the valve would perform relaxation oscillations characterised by current pulses appearing alternately at screen and anode.

Time Constant

On the arrival of a 10 microsecond line sync pulse at the control grid, the cut-off bias is overcome and the valve goes into oscillation, producing a negative voltage pulse across the screen load R27, this pulse being fed via C22 to the line oscillator. The time constant C23-R29 is chosen so that more than 10 microseconds must elapse before a voltage pulse is produced at the anode. Hence, a line sync pulse at the control grid will result in a similar negative voltage pulse being applied to the line generator. When a 40 microsecond frame sync pulse is applied to the control grid the action is as before, except that there is now time for a pulse to be generated at the anode also, before the valve is once again cut off at the control grid. The voltage pulse developed across the anode load R26 is applied to the frame generator via C21.

The critical components in the circuit are R26, R27, R29 and C23, since it is these that determine the frequency of the relaxation oscillators.

Alignment of Receiver

The author has been unable to procure official alignment data for the APR-4 receiver, but the following method has produced satisfactory results. Some sort of signal generator is required, the output of which can be coupled to the input of the I.F. amplifier through a 10pF. condenser. Using as small an output from the signal generator as possible, the following circuits should be peaked for maximum diode meter readings at the frequencies indicated.

T-101-1	29.5 Mc/s.
T-101-2	30.5 Mc/s.
T-101-3	30.0 Mc/s.
T-101-4	29.0 Mc/s.
T-101-5	31.0 Mc/s.

If still in circuit L-104 should be peaked at 29.0 Mc/s. with the bandwidth switch at Narrow.

The vision signal may now be tuned in to give maximum meter reading with S-104 at Narrow, or to give the best resolution of the lines in the transmitted test pattern with S-104 at Wide. L1 and L2 in the tuning unit should now be adjusted to give the best possible definition. L1 and L2 in the sound unit should now be adjusted to give maximum sound output. R29 in the sync separator may now be adjusted to give interlace.

Conclusion

The output of the receiver as described is sufficient to modulate either an electrostatic or electro-magnetic television tube fully over the whole range of frequencies at present being transmitted by the BBC.

ALPHA RADIO SUPPLY COMPANY

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Large type, 600-120 M/A. 5/-

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1S5 ..	9/-	6X5GT	9/-	MS/PEN	7/9
1C5GT ..	8/6	6AM6 ..	11/6	MH41 ..	7/9
2A3 ..	7/9	6AL5 ..	9/-	PP225 ..	8/-
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42 ..	9/6	956 ..	2/9	TDD13C	10/-
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.02 mfd. 750 V. 7/-
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8 mfd. 450 V. D.C. 4/6

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Standard 3 way mounting suitable for 4 or 6 volts. 200-220-240 Primary. 350-0-350 V. 80 M/A. H.T. 0-4 V.-5 A.-6.3 V. 4 A.-0-4 V.-5 V.2 A. (Post 1/6) 16/-

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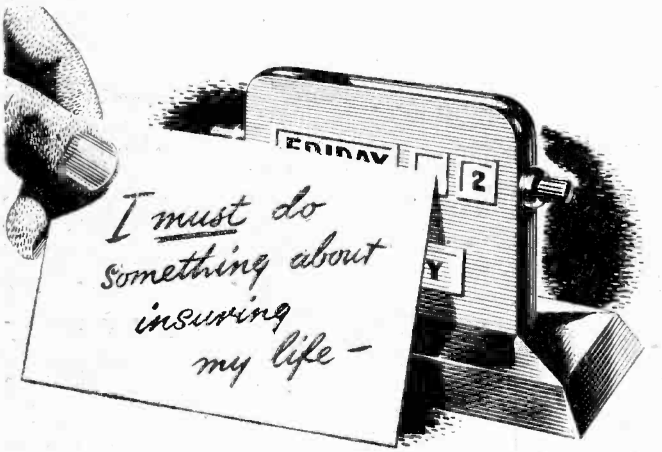

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Television in South Wales

AT the end of December of last year there were 1,915 television licence-holders in the Cardiff telephone manager's area, which covers Glamorgan and parts of Monmouthshire and Breconshire.

Newport, coming within the fringe area of the Sutton Coldfield transmitter, has 1,036 sets, Cardiff 336, Pontypridd and Porth 28, and Merthyr 2.

The number of interference complaints from all causes in the area during 1951 totalled 150.

"Other People's Jobs"

THE BBC presented another edition in the series "Other People's Jobs" on January 26th. The programme was entitled "The Silica Tube" and was transmitted by an outside broadcast unit from Chance Bros., Ltd., Glass Works, Smethwick.

Viewers saw how the bulb of the cathode-ray tube is made in separate parts all of which are afterwards joined together.

Ekco Electronics

MR. A. J. BRUNKER, B.Sc.(Eng.), A.M.I.E.E., general export manager of E. K. Cole, Ltd., who has just returned from a visit to South America on business, has now been given the additional responsibility of the commercial activities of the electronics division of the company.

The expanding Ekco business in this field covers electronic equipment for industry, V.H.F. communication equipment, and radar and nucleonic devices.

Lord Waleran, commercial manager of the electronics division, will support Mr. Brunker.

Croydon Power Station

COMPLAINTS have been received by the Post Office that the new giant power station at Croydon has been the cause of bad reception by viewers in the Croydon and Thornton Heath area.

G.P.O. engineers are investigating the complaints.

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

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

First Deposits

SINCE the Maltese Cross transmission signals first appeared on receivers in Scotland recently, television sales have been rising north of the Tweed, particularly in Glasgow.

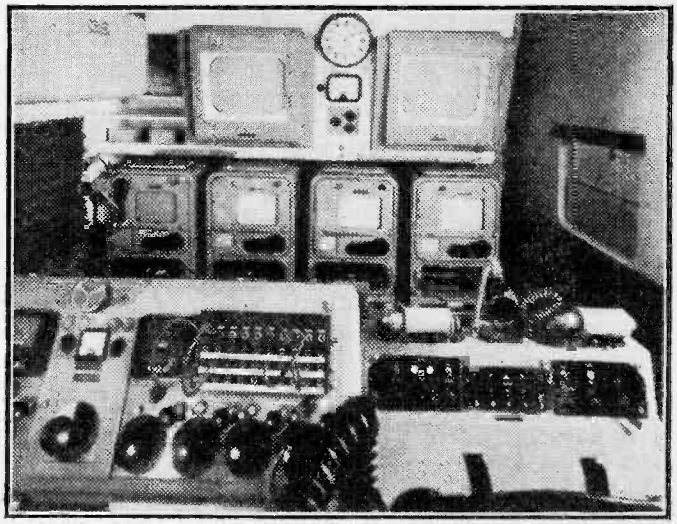
Although very few are buying sets outright, many have paid deposits and are leaving their selection of a set till stocks become larger.

Farther south, Newcastle to be exact, thousands of receivers have been bought in spite of the fact that work has been abandoned on the Pontop Pike transmitter and the nearest station is at Holme Moss, 115 miles away.

Hampden Park Relay?

IT is possible that the Scotland-England international soccer match to be held at Hampden Park, Glasgow, in April will be televised, providing the Kirk O'Shotts transmitter is in operation by then.

When Mr. Melville Dinwiddie, Scottish director of the BBC, visited the transmitter station recently with Mr. L. D. Gammans, Assistant Postmaster-General, he stated that should the Football Association prove to be willing, the B.B.C. would like to televise the match.



The interior of the new outside broadcast television vehicle equipped for the BBC by Marconi's Wireless Telegraph Co., Ltd. The picture shows: left, foreground, engineer's control desk; right, producer's desk. Background, camera control monitors, master monitor and (above) receivers.

Presidential Election

IN an end-of-the-year statement, Mr. David Sarnoff, chairman of the Radio Corporation of America, has said that for the first time in history television broadcasting will be a significant feature in the forthcoming presidential election.

It is estimated that by election day there will be almost 18 million receivers in the United States, commanding an audience of over 60 million.

Objection to Aerial

AN objection has been raised by members of the Isle of Wight Country Planning Committee to the proposal to erect a 750ft. television aerial on the island.

The protesters include Lord Mottistone, who lives at Mottistone on the island. He terms the plan as "disgraceful" and the prospective aerial as an "atrocity."

The site chosen for the aerial is at Rowbridge, where, BBC tests show, results would be better than at any other point on the island. The transmitter would remove the need for the erection of private aerials by thousands of island viewers.

Underwater Television

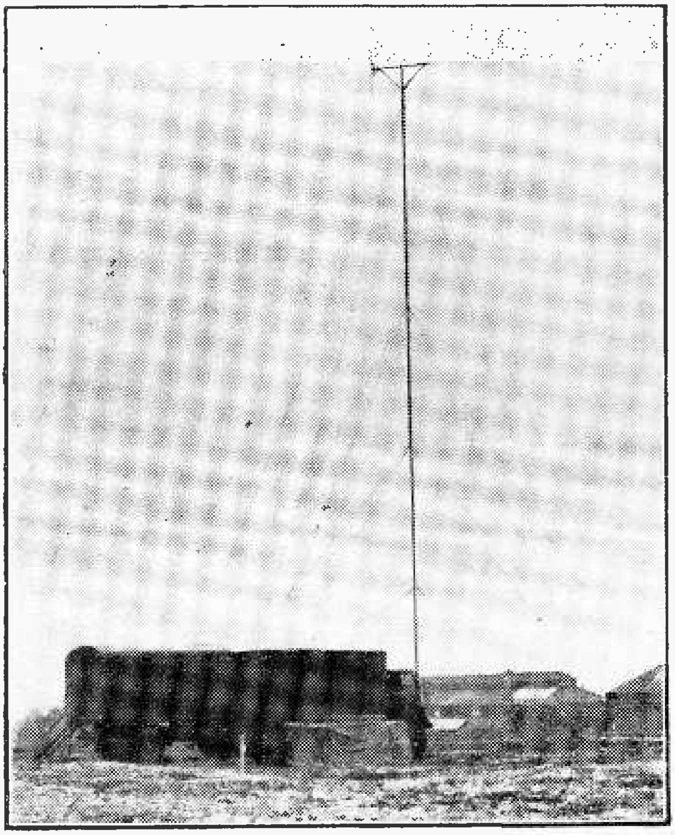
READERS will be interested to know that our last month's cover photograph was taken at the Tolworth Works and Laboratories of Siebe, Gorman and Co. Ltd.

They are the world's foremost designers and manufacturers of underwater and diving equipment, and the initial tests of the new Marconi underwater television camera took place in their test tank.

Progress at Wenvoe

AT the new BBC television station at Wenvoe, near Cardiff, last month, the first section of the 750ft. transmitter mast was moved into position.

The whole construction of 100 tons will pivot on a steel ball only 2in. in diameter on which the base of the mast was placed.



The 100ft. mast erected for the first tests at the Crystal Palace, Sydenham, to find the best site for the new TV station.

Orkney Aerials

KIRKWALL TOWN COUNCIL have been considering the rules and regulations concerning the erection of television aerials to council house chimneys.

Kirkwall is in the Orkney islands.

Coventry Survey

IN a recent survey 500 Coventry teen-agers were asked how much their lives were being affected by viewing television.

The survey was conducted by eight students of psychology of Birmingham University and took the form of a questionnaire. Questions put to the schoolboys, schoolgirls and factory hands included: How many evenings a week do you view? Does viewing interfere with your studies? Has it caused you to give up any of your hobbies? Has it increased your interest and attendance of outdoor sport?

New Station Tests

AS the lease of Alexandra Palace expires in four years, tests have begun to find a new site for London's transmitting station which has been at Alexandra Palace, Wood Green, ever since the television service began in 1936.

It is expected that the new station will be built in the South London area and possible sites include the Crystal Palace park at Sydenham, S.E., where a 100ft. mast has been constructed, and Wrotham, Kent, where there is already a BBC short-wave experimental station.

Possible Scottish Newsreel

SPEAKING at his Alexandra Palace headquarters recently, Mr. Harold Cox, television newsreel manager, said that as soon as the Kirk O'Shotts transmitter opens there is bound to be a demand for more newsreel reports on Scottish events, and that as this was bound to increase the need for a more varied range of newsreel he hoped that one day there might be a new edition each evening and possibly a separate Scottish issue.

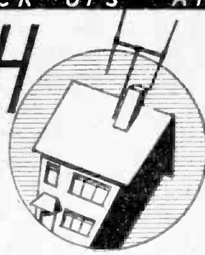
Northern Tastes

NOW that the north has had its own share of television since October, the BBC is anxious to discover whether the present programmes appeal to the Yorkshireman's tastes.

A questionnaire has been prepared.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

BBC CHARTER

TIME marches on ! The six months' extension of the BBC Charter has nearly come to an end. And the time is fast approaching when decisions will have to be made upon possible revisions to the proposed new BBC Charter—with attention focused upon provisions which may give BBC Television a greater measure of independence from the sound side, together with the possibility of a cautious and limited amount of sponsored programmes. It is a great pity that during this six months' period of "reprieve," viewers were not permitted to have a few samples of sponsored programmes, just to see whether they really liked them or not. How can the British public (or the politicians who represent them) decide whether they want competitive sponsored programmes, without having an opportunity of judging their merits ?

SNOB AND SOB APPEALS

THE stories one hears of American television, with hundreds of stations and dozens of networks, competing for the eyes and ears of the viewers, are sometimes terrifying. Nevertheless, the impact of the medium is so terrific that sponsors are willing to invest millions of dollars on expensive artistes and specially made TV films, merely for the privilege of a short reference to the particular product they wish to advertise. The most successful sponsors are not those who thrust their advertising blurbs at resentful viewers. Entertainment has to be of wide appeal, but is nevertheless usually graded in subject matter in a manner related to the product advertised. This follows the same rule which seems to apply to dignified advertisements in, say, *The Times* or *Daily Telegraph*, as compared with the more blatant blurbs in some papers. As with newspaper or glossy magazine advertising, TV advertising has its varying grades of appeal, from the specialised "bookish" appeal to the "snob" and the "sob" appeals, to the "moron" one-syllable appeal and to the mass "general purpose" appeal.

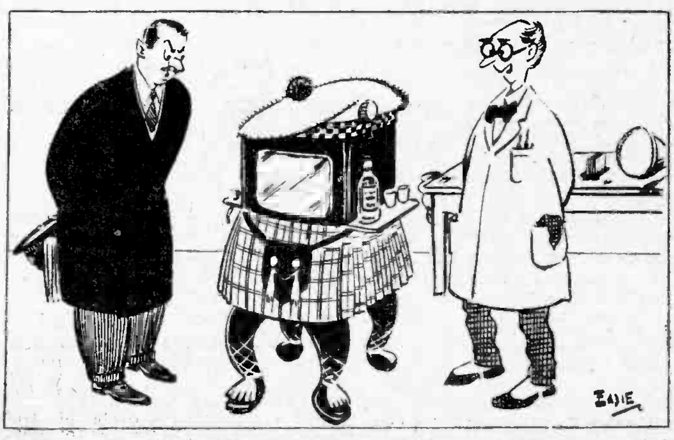
PROBLEMS OF A SPONSOR

AFTER all, sponsors are only human. Their aims may be to please a special section of the public rather than the vast mass. They may regard their TV programmes, like the product they wish to sell, as a commodity. And yet, it appears, the moment they treat their programmes as a *mere* commodity, a routine matter, they lose their public. Ella Wheeler Wilcox might have described a successful American television sponsor as being a business man, but not a *mere* business man. He is a professional man also. Don't underestimate the intelligence of producers of television plays and "features," sponsored or otherwise. Superior persons may say that script writing for sponsored television programmes is an industrial process. But it seems that the most successful writers turn out to be those who concern themselves very little with literary values, well-tried situations or logic. The writers who deliberately set out to write programme material of great "popularity" almost always miss it. Let those readers who dislike the very idea of any kind of sponsored programmes ponder over these Ella Wheeler Wilcoxisms, and take comfort in the fact that poor sponsored programmes cannot survive for long. And, the advertising tags permitted in England would be of the briefest kind.

Therefore, let us hope that, without at present incurring the capital expense of a competitive television network in this country, we may at least have an opportunity of seeing and hearing sponsored programmes one night a week on the British television service. That would save the BBC a lot of money and even provide a little revenue as compensation for retention by the Government of some £2,000,000 of the licence revenue.

THE SOUL OF TELEVISION

MAURICE WIGGIN has pointed out that British sound radio, with its three alternative programmes, can now afford to pump out quantities of rubbish as well as a great deal of fine material. But he is alarmed at the prospect of the one television programme having to cater for the lowest common denominator of entertainment, rather than carry on the tradition of Lord Reith and aim a few points higher than public taste. On the other hand, Sir Ernest Benn and John Rodgers, M.P., are deeply concerned at the possibility of the perpetuation of listeners and viewers having no



"I'm certain this should sell well in a certain part of the country !"

choice but that which is thought to be good for them by the BBC "junta." So the battle in the Press continues, a prelude to a battle in the House of Commons. This is not a party issue. Viewers, at any rate, should be given an opportunity of judging for themselves before a final decision is made.

BALLETOMANIA

I EXPECT that most of my readers have long ago formed the opinion that "Iconos" is a bit of a Philistine, with an aversion to anything which might be termed *avant garde*. Nevertheless, I must confess that I have a weakness for ballet, both traditional and modern. Christian Simpson's production of *The Sleeping Beauty* was a very smooth presentation of the Pepita ballet, in which mobile cameras, crane shots, dissolves, double exposures and a narrator were used to clarify the story of Perrault's fairy tale. The virtuosity of the principals was discreetly emphasised by the most expert choice of camera shots. It was a long performance—an hour and a half—and inevitably there were a few shots with faulty lighting or other imperfections; but the most surprising thing is that technical flaws were so few. Many of the shots revealed a beauty of composition and lighting seldom seen on TV. It would seem ungrateful to indicate that, perhaps, for some viewers (not me, this time !) the presentation was too long. The new Vinten power-driven camera crane was used most effectively, attaining a precision worthy of the film *Tales of Hoffmann*. As a matter of fact, thinking of that great opera and ballet film, it made me regret the absence of colour. After all, the *fouettés* and *entrechâts* are one part only of a composite art form in which are integrated colour of dress and *décor*, music, mime and acting.

THEATRE RELAYS

TECHNICAL problems of televising spectacular musical shows from a theatre are great. But some of the difficulties experienced in the transmission of a provincial pantomime at Christmas-time seemed to be largely mastered in the relay from the Princes Theatre of Bertram Montague's production of *Cinderella*. The excellence of the close-ups of artistes, obtained with very long focus lenses, revealed the great progress that had been made. The producer made the most of a wide range of camera angles available to him from four TV cameras, each carrying a lens turret with a selection of several lenses. At one moment, a wide-angle lens revealed the whole proscenium and orchestra, to be changed in a few seconds to mid-shots or head close-ups of individual artistes. Possibly the greatest technical difficulty in dealing with this kind of show is to obtain a reasonable pick-up of sound from the various hidden microphone positions. There were times when artistes spoke lines of dialogue in dead spots on the stage, positions in the no-man's land between widely separated hidden microphones. Nevertheless, the clear diction of the artistes assisted considerably. Too often on the stage, in films and in television plays, dramatic situations (and comic ones for that matter) are ruined by the slovenly diction which some misguided producers regard as "naturalistic." The running together of sentences, swallowing of words, slurring of consonants and throwing away of important lines seems to be considered the smart modern method of speaking dialogue. Some actors talk with mouths practically shut, like ventriloquists, and others walk upstage and turn their back on the audience, carried away by their own virtuosity. The art of voice production is mocked as being "stagey." And yet, there are still a few actors, like Sir Godfrey Tearle, who can put over what appears to be the softest whisper, which can be heard right at the back of the gallery. Let the BBC Television set the standard in clear diction in television plays, as they have in radio plays, and not copy the latest fatuous fad of the stage and the screen.

BIG SCREEN PROGRESS

BIG screen television in the cinemas now becomes more than a possibility. The big circuits are making preparations for the installation of equipment and the training of personnel. About two hundred chief projectionists are taking a special educational course on television in the cinema, organised by the British Kinematograph Society. One of the most pleasing examples of co-operation in this course by the BBC is that the first lecture was given by Mr. Douglas Birkinshaw, M.B.E., M.A., M.I.E.E., Superintendent Engineer of the BBC Television Service. By a coincidence, the lectures are held at the Elma Lighting Bureau, 2, Savoy Hill, in a room which, twenty-seven years ago, was the main control room of the British Broadcasting Company, Ltd. From 2LO to TV !

As regards the installation of big screen equipment in the cinemas, I think that the final decision to go ahead will depend upon whether the Government will allow the allocation of a special trasmission frequency, with the higher standard of definition than 405 lines. This would be for the exclusive use of cinemas with big screen TV.

Blind Service Engineer

DURING January a television programme about the life and work of Louis Braille was broadcast during the evening session.

One young man taking part in this programme was Michael Griffin who, in spite of having been almost completely blind from birth, has become proficient as a radio service engineer.

He was one of two trainees of the National Institute for the Blind who attended and successfully completed a year's course on the Principles and Practice of Radio at E.M.I. Institutes.

Special test apparatus was devised by E.M.I. Institutes in co-operation with various manufacturers to enable these blind trainees to undergo training exactly similar to that which is given to normal sighted students.

Versatility

Although not typical of the normal training undertaken by E.M.I. Institutes, Ltd., the remarkable results achieved with these blind trainees is an indication of the versatility of the organisation, which is playing a major part in helping to meet the well recognised acute shortage of electronic technologists.

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Goodman's Axiom 150 Speakers	10	5 6
Partridge Output Transformers for Williamson Amplifiers	6	12 0
Cossor Double Beam Oscilloscope 1035	85	0 0
Cossor Double Beam Oscilloscope 1049	120	0 0

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MODEL 65A with 5 yards of Twin feeder. **PRICE 32/-**

Also **MODEL 66**, which has two flexible arms. Complete. **PRICE 25/9**

MODEL 66A, with 5 yards twin feeder. **PRICE 25/9**

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MODEL 74. Has three fully flexible elements. High pickup properties. Trouble-free performance. Centre element has a spring tensioning device and neat connector box. All Channels. **PRICE 13/6**

MODEL 53 (similar to 74). Three rigid metal elements. Installed in variety of positions. All Channels. (Coaxial lead-in extra.) **PRICE 32/6**

25 TO 40 MILES

MODEL 57. Single dipole for chimney stack mounting. Complete with chimney bracket, mast, lashings, etc., ready for installation. Excellent performance. **PRICE 62/6**

MODEL 58. A dipole designed for wall mounting. Cranked stand-off mast similar to Model 57. **PRICE 52/6.** (58A with straight stand-off arm, 47/-.) All Channels.

40 TO 60 MLS.

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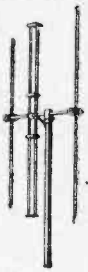

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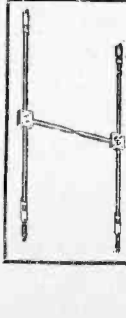

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Pioneers of Television

1.—PAUL NIPKOW AND HIS PIONEER IMAGE-SCANNING EXPERIMENTS

ON the morning of August 24th, 1940, an elderly patient died rather unexpectedly in a noted Berlin hospital. Two days previously he had attained his eightieth birthday and on that occasion he had slipped and apparently fractured his leg seriously as a result of the accident. But before the full extent of his injuries could be determined in hospital a heart-attack developed and carried him away.

At this time Germany had geared herself up energetically for her hopeless fight against the Western nations which, for the most part, constituted World War II. It was, therefore, only to be expected that little news about this patient's death filtered through to Britain and to America. Moreover, although the dead man had managed to keep on good terms with the Nazis, he was not, by birth, a true German. On August 22nd, 1860, he had first seen the light in Poland, but, going to Germany very early in his life, he had remained there more or less ever since.

His name was never a widely-known one except to those intrepid and persevering television experimenters who for years so persistently pursued the practical solutions of their many problems, but, to them, it had always remained an honoured one, well worthy of scientific recognition and respect. Dr. Paul Gottlieb Nipkow had died. He had been the original inventor of the first practical image-scanning disc which was to constitute the device of which so many other television inventors had made good practical use until, half-a-century later, they had ultimately to cast it aside for better means of image scanning.

Television, at least on its theoretical side, goes back much further than many of us realise. Its basic conception may be traced back a hundred years or more. When the light-sensitivity of selenium was first discovered in the early '70s of the last century some sections of the pseudo-scientific world went half-crazy with the idea of being able to transmit images over a distance through the agency of the then unique properties of this curious element. It was then that television came up (on paper) for the first time. Numerous were the plans for "electrical seeing" which were proposed by various people in Britain and on the Continent. But they all came to nothing because it was, at that time, hardly recognised that if you wished to design an instrument for transmitting a view, a scene, or an image, you would first have to arrange for some practical means of breaking-up or dissecting that image into minute pieces, sections or "elements" and of presenting these image-fragments in due and regular order to the transmitting apparatus for assimilation therein. At the receiving end of the system, the transmitted succession of image-elements would have to be accurately reassembled in order to reconstitute the whole of the transmitted picture.

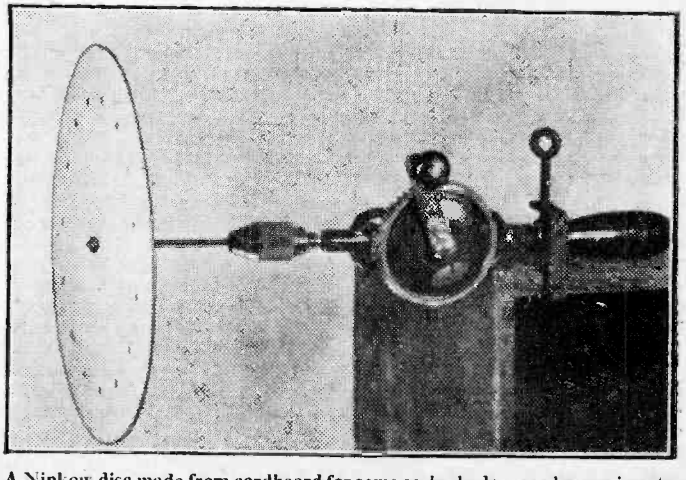
Image Elements

It was at that juncture hoped that the element selenium, the so-called "moon metal," would do the required trick adequately in the way of responding rapidly and accurately to the various gradations of light-intensity, but the prior problem at that time was to devise a way of presenting to it in due succession all the innumerable picture fragments or "elements" which went to make-up the image or picture in question.

Paul Nipkow was the first man to hit upon a solution of this difficult problem. He solved the riddle by the very simplest of mechanical means, namely, through the agency of a rapidly rotating vertical disc of metal in which a series of small holes were staggered in shallow spiral formation. This device he called an "electrical telescope," and he took out a German patent (No. 30105) for it in 1884. Nipkow, however, was a poor man. He was unable to find anyone who showed an interest in his device and when the time came for the patent fees to be renewed he had no money to expend on such a luxury. Thus, Nipkow's "electrical telescope" patent lapsed, and its originator, feeling, no doubt, somewhat frustrated by the seemingly apparent practical uselessness of his invention, immediately gave up his endeavours for the furtherance of his television schemes and spent the rest of his working lifetime of nearly thirty-five years in the capacity of engineer in a railway signal company on one of the main German lines.

The "Electrical Telescope"

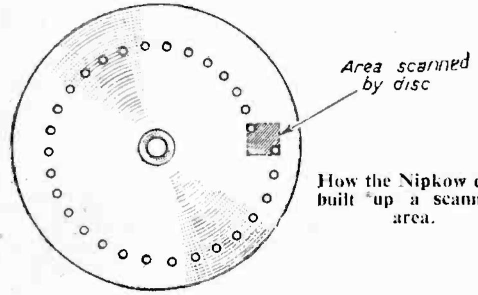
In the interim, the idea of the image-scanning disc, or the "electrical telescope," as Nipkow himself originally called it, did not altogether become buried under the vast amount of debris which accumulated yearly in the German Patent Office. The idea persisted in the minds of many other experimenters throughout the years. The notion was developed, modified, and ultimately improved. In particular, the Baird Television interests



A Nipkow disc made from cardboard for some early shadowgraph experiments.

in Britain took it up years afterwards and made considerable success of the revolving disc device before the coming of the modern non-mechanical cathode-ray system of television. But although, in technical literature, courtesy was paid to Paul Nipkow in attributing the scanning-disc idea to him, when it was playing an important and even an indispensable part in television technique, its inventor had nothing to do with such later activities.

Indeed, it was not until the 1930s that Dr. Nipkow received any public acknowledgment of the pioneer part which, so long ago, he had played in the progress of television development from its crudest beginnings. Belated recognition came to him at last when he was elected first honorary president of the newly-founded German Television Society. Such an honour, little, perhaps as it was, materialised for him only after an entire half-century from the date of his ill-fated and



How the Nipkow disc built up a scanning area.

initially little recognised "electrical telescope" patent of 1884, a device which may well be styled the first worthwhile patent of television.

In his early days, Nipkow had been brought up in the technical and, particularly, in the then rapidly advancing electrical sciences. He had received the usual advanced German doctorate degree for evidence of outstanding ability, and he had been a technical teacher for some years. As a result, his first scanning-disc had made its original unrecognised and almost unknown appearance in the physics laboratory of a small technical school.

Theory of Scanning

The earliest television experimenters had tried to transmit images electrically over wires by means of various highly complicated systems which involved the use of countless miniature selenium cells, multitudinous connecting cables and a like number of corresponding electric lamps. It was Nipkow, however, who first recognised the complete and utter uselessness of all such systems. It was he who first put forward what may now be called a practical theory of scanning, the validity of which he essayed to demonstrate by means of his disc invention which he used to "scan" the image or picture to be wire-transmitted and to separate it into tiny individual sections or fragments.

Nipkow seems to have begun his experiments by drilling small holes in circular formation around the edge of a plain metal disc and to have rotated the disc rapidly by means of a clockwork motor. A light-source was placed on one side of the wheel and a selenium cell on the other side. Since the cell's resistance is varied by changes of light intensity, the rapid succession of illumination cut-offs caused the cell to set up a pulsating current.

This, obviously, was no real invention. It was a plan which might have been devised by anybody. Nevertheless, it apparently gave Nipkow the first notion of his disc-scanning device and his patent of 1884. The spiral pattern of the holes in the scanning disc causes a small spot of light (perhaps merely one-tenth of an inch in diameter) to sweep across the picture-image to be transmitted in a series of horizontal lines. If the disc revolves with sufficient rapidity the first spot switches back to its original position (or near to it) almost instantaneously so that by means of this shallow spiral of small holes revolving vertically a picture or image on which the light spot can be thrown is able to be dissected sequentially into small areas or "elements" which are, in equally rapid sequence, presented to the selenium or other light sensitive cell for electrical transmission as mere variations in the strength or intensity of a pulsating direct current.

That was the gist of the Nipkow disc. Its basic principle attracted most of the pioneer television inventors of the present century, and although this scanning device was slowly modified and improved by various means, its inherent limitations ultimately became so apparent that the entire principle of disc scanning for modern high-definition television purposes had, ultimately, to be completely abandoned in favour of cathode-ray scanning, which now constitutes the whole basis of present day television technique.

Selenium Fails

Paul Nipkow fought doggedly against colossal television difficulties in his early inventive days. Selenium cells were altogether far too sluggish for use. Photocells, with their much greater rapidity of action, were then quite unknown. Neither were there any amplifying valves to increase and augment the power of the microscopic current-variations created by the sluggish selenium. Furthermore, the scanning disc could never be revolved fast enough to give really effective high-definition scanning. Television demanded an even quicker scanning speed than any mechanically rotated wheel, disc or any other device could possibly supply. Only electrons were able to cope with the required speeds for the job. Thus, the use of cathode-rays (which are merely controlled streams of electrons shot out from a cathode or negatively-charged electrode) became a necessity. All mechanical systems of television involving the use of scanning wheels, discs, drums, mirrors and other devices, ingenious as many of them undoubtedly were, proved themselves to be constitutionally and theoretically incapable of giving satisfactory results.

The Nipkow disc was an important invention in the history of television technique. Yet, as we have seen, it was, from its very beginnings, a strangely ill-fated one. In its worst form it was able to produce satisfactory shadowgraphs or silhouette images. At its best, ill-defined, poorly-lighted images were its results. To-day, it is a well-nigh forgotten technical relic. What its inventor really thought of the device, what attributes he saw in it, what hopes he originally invested in it, we shall never know. Paul Gottlieb Nipkow seems to have been more or less contented in helping merely to blaze the initial television trail, thereby leaving others to develop the progress of scanning and thus to achieve practical and commercial successes by means of a system which must originally have been entirely unknown to him.

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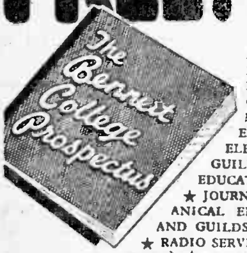

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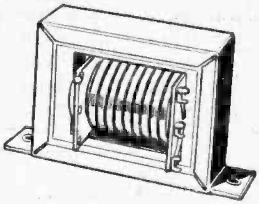

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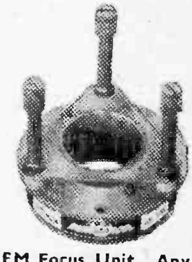

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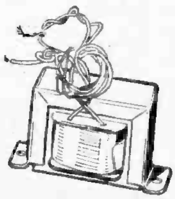

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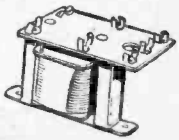

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The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

AERIAL SCREENING

SIR,—Mr. George H. Gill, in his letter in the February issue, seems to doubt the fact that a building has a screening effect on TV signals. If it were not a fact that V.H.F. signals were deflected by material objects then radar would not be workable, and we in the fringe areas would not suffer the effects of reflection from aircraft flying overhead. V.H.F. *is* affected by material objects and that is why there are "blank" spots, so far as reception is concerned, at places quite near to the transmitter which lie in the shadow of a hill. Streets, and streets of houses, have the same effect, and that is one reason why an external aerial is advisable in situations where the signal is weak. The general recommendation is to erect an external aerial at points beyond the 25 miles radius from the transmitter.

I would not like to give a verdict on Mr. Gill's experiments without being in possession of the precise details, but I should like to mention that he should be very careful against drawing incorrect conclusions from the results he obtained. So far as V.H.F. is concerned, earthing the plate would have little effect; further, the dimensions of the plate may have been such that it was acting in some degree as a parasitic element.

He states that he thinks there is a good deal of imagination at work about aerials, but there are certain effects which are obvious, and the practical results of various experiments have been published from time to time in this journal; here is the result of one of the many I have tried myself: two aerials were erected at the same height but at a distance from each other so that there would be no mutual interference. "A" was an H aerial and "B" was fitted with a director and a folded dipole. Both aerials were made by the same manufacturer and had transmission lines of equivalent length. "A" was connected to the televisor, and the contrast and brilliance controls adjusted to give a normal picture. The contrast control was then reduced until the picture just disappeared. "A" was disconnected and immediately replaced by "B." The screen gave a brilliant picture which necessitated further reduction of the contrast control.

If Mr. Gill is seriously troubled with interference, then I would suggest that he equips himself with an H aerial externally erected with a coaxial lead to the receiver and attenuators fitted at the receiver. He should be able to orient the aerial into a position of minimum interference.—"ERG" (Bristol).

VALUABLE TUBES

SIR,—Your excellent magazine has on numerous occasions in the past printed technical articles on cathode-ray tubes, both in the field of their physical construction and the theory of how they work. Most of this ground has been so well covered that many amateurs owe what they know about C.R.T.s to these excellent articles.

The cost of large-picture tubes is such that a mistake by a constructor in the setting-up of a large tube can be a major disaster. Many a constructor has approached the switching-on of his new C.R.T. in the manner he took over his first high dive into deep water.

There is a field of information regarding the working conditions of C.R.T.s that I feel has not been well covered in your magazine, and that is the damage that may be done to a C.R.T. by the omission of voltage on any electrode or the presence of too large a voltage.

I personally have been mystified by a statement in September, 1951, page 192, that there is a risk in running a C.R.T. with the heater voltage alone (no E.H.T. or signal voltage). I should like to see an article on such pitfalls, and hope it deals more with the costly magnetic tube than the VCR97.—JAMES DRAPER (Accrington).

A.C./D.C. RECEIVERS

SIR,—Owing to the large number of A.C./D.C. radio and television receivers being sold at the present time I think something should be done to make this type of set much more safe to use than it is.

As one knows, one side of the mains supply usually goes straight down to the chassis of the receiver, thus making all the metal parts, including the grub screws of the control knobs, etc., "alive" if the plug to the main switch or two-way adapter happens to be put in the wrong way round.

One can naturally see that this arrangement can be very dangerous as all small children, indeed, even grown-ups, are very prone to prodding about with steel knitting needles and screwdrivers.

A very simple idea to minimise this source of danger is to use a small neon lamp, such as a peanut type or one taken from a sparking plug tester, and wire it in series with a 2 megohm resistance, one side of the neon going direct to the metal chassis of the receiver and the other end of the resistance going to a small bolt on the cabinet in a suitable position.

The receiver is now plugged into the mains and switched on. On placing a finger on the small bolt head no glow should be observed in the neon lamp, thus proving that the chassis is at earth potential and the receiver is safe to use. If a glow is seen one should reverse the plug in the socket, when the neon will cease to glow.

In fairness to manufacturers of these types of receivers I must add that they are usually careful about covering the outside screws, etc., with wax and plastic covers, but I am sorry to say that after returning from being repaired by certain dealers these items are not always found to have been replaced.

Personally, I would like to see some such device as the above fitted to all these universal supply receivers.—L. D. TONG (Rochester).

PROVINCIAL RELAYS

SIR,—I was very interested in the notes on "Provincial Relays" in your January issue, page 376, which I think everyone will endorse: but surely the writer is aware that the Blackpool Tower was, in fact, used for the very fine television broadcasts of the Blackpool Illuminations, the "Have a Go" from the Miners' Home, and the Circus, all of which were televised in connection with the opening of the Holme Moss transmitter in October, 1951. This was given full publicity in the northern Press, and it is very clear that municipal and private bodies in Blackpool co-operated fully with the BBC.

There can be no doubt in view of the increasing number of outside television broadcasts that the BBC engineers have accumulated a great deal of useful data about vantage points on high ground or tall buildings for their mobile transmitters, and more especially for their micro-wave radio-link equipment. I think one can be certain that the Blackpool Tower will not be overlooked when further transmissions from the north are planned.—W. P. R. (S.E.24).

TUNING SLUGS

SIR,—Your writer, F. R. Pettit, in his article, "The Uses of Tuning Slugs," should have given a warning that dust-iron slugs must be treated with great care.

They very easily "seize" up, and any effort to remove them, especially if one is foolish enough to use a metal screwdriver, results in the adjusting slot breaking away.

To avoid this it is a good plan to smear zinc ointment, which is a very suitable lubricant, round the threads of the slugs. A suitable tuning tool can be made by filing screwdriver flats on the end of a plastic knitting needle.

If a metal tool is used this will interfere with the tuning.—J. ANDREW (Manchester).

PROGRAMME PLANNING

SIR,—Every Monday evening, on returning home from work, I receive a vivid account from my wife of the film, usually an adventure story, which was televised during the same afternoon.

Yet each Sunday, the only complete day I spend at home, I find there is no transmission until the children's programme at 5.30. Surely, as there must be a larger viewing public on Sunday than on Monday, the programmes should be planned differently.—H. TURNER (Hayes, Kent).

LINE TRANSFORMER

SIR,—I have tackled the problem of high voltages existing in line output transformers in a way different from that of Mr. Jenkins. I divided the bobbin into three compartments side by side, using 1/16in. presspan separators, then winding the primary in the two outside compartments and the secondary in the middle. The primary being thus divided between two sections, the voltage per layer becomes about one-third of that existing when the winding is the full width of the bobbin. (The secondary occupies about one-third of the width.) Using wire covered with enamel and single silk, it is possible to "random" wind the coils, and there is a margin for a slight sinking of occasional turns below previous ones. Paraffin wax is used to soak the bobbin first, and later the windings.

I overwind the primary and get E.H.T. by using a voltage doubler with metal rectifiers. The outside layers of the primary winding should be something like 3/16in. from the stampings.—A. O. GRIFFITHS (Wrexham).

LICENCE DODGERS

SIR,—It is with regret that I read of the old-fashioned method being adopted in an attempt to trawl the licence dodger. My connection with radio goes back to crystal days, and the same scare has been put into operation many times since.

Drastic methods have to be taken when anything is licenced. During the war every person had to sign a register when sleeping in a boarding-house or hotel.

I suggest a similar method with regard to television and radio receiving sets. For sales *and* servicing a register should be kept by every agent, containing names and addresses of every transaction, for inspection.

Actually, the net could be closed by requesting service men to ask to see the current licence before any work is done on a receiving set.

Those that service their own sets? Well, from my own experience, 99 out of every 100 of those have licences.—CHARLES HASSELL (N.11).

CIRCUIT DESIGN

SIR,—I have recently been given a batch of American magazines, as I have taken up the television hobby. I have had a fairly good technical grounding in radio and it has not been difficult to get up to date. I have been mystified, however, by the fact that I have found dozens of American circuit features which do not appear to be in use in the television receivers made in this country. Such items as flywheel circuits for maintaining time-base control; A.G.C. arrangements to prevent fading; black-level clamp; and the apparent general use of D.C. restorers in preference to direct-coupled circuits are only a few of the features I find in American commercial specifications. Up to date there are, of course, electrostatic focusing and shift controls on the tube, but these are probably forced on the industry as a result of metal shortages due to rearmament schemes. Can any manufacturer say, however, why the aforementioned circuits are not incorporated in the better quality receivers in this country?—H. K. EASTMAN (Edgware).

BLACK SPOTTER

SIR,—I was interested in Mr. Wylie's circuit in the January issue and the previous articles on this subject. It has occurred to me, however, that this is a rather uneconomical idea and a case of "locking the stable door. . . ." Surely, if grid-modulation of the cathode-ray tube is employed, and the video stage is not biased, high picture quality should be obtainable with interference peaks running over the bend of the video characteristic and thus remove the necessity for "black spotters" or similar devices. Is it not a case of polarity, which one should consider in this stage?—J. FARROW (Harrow).

SPONSORED TELEVISION

SIR,—I agree with Mr. Waterfield's remarks in the January issue and think the BBC are very two-faced in their outlook. "Picture Page," for instance, introduces people who have just published a book, or are opening an exhibition of their works, whilst when an O.B. is taken great care seems to be exercised to prevent an advertising sign or hoarding being brought into the picture. I have been told that some outside sporting events have been banned by the BBC because of the inability of the cameras to do their work without including an advertisement in the picture. I think we should have sponsored television running parallel with the BBC, say, sponsored every other night, and certainly for variety shows where the stage people have a wider experience of production, etc.—H. THOMPSON (N.W.3).

Club Report

BRITISH TELEVIEWERS' SOCIETY

THE monthly meeting of the British Television Viewers' Society held at Kennard's Restaurant, Croydon, on Monday, January 7th, took the form of a lecture delivered, at very short notice, by Mr. L. G. Pace, one of the society's technical advisers. Mr. Pace spoke about the pre-war days of the BBC television service and compared the cameras and studio equipment in use then with that prevailing to-day at the Lime Grove studios.

He also described in non-technical parlance the setting-up of the Sutton Coldfield and Holme Moss transmitters and their connecting links with London.

The progress made in television set construction since 1936 was demonstrated by means of components and receivers on show during the evening.

At the close of the meeting many members took the opportunity of consulting the technical advisers present on matters appertaining to their sets.

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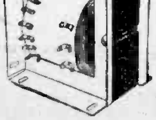

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TRADE TOPICS

Ekco 15in. Table Model

EKCO announce a new table receiver incorporating a 15in. aluminised tube, and "spot wobble." Main features of the receiver are:

Brilliant 13½ Kv. pictures on big 15in. aluminised tube all within compact cabinet dimensions.

Superhet circuit readily adjustable to any of the five BBC television channels.

Completely separate sound and vision I.F. channels provide high definition in the picture.

Sensitivity approaches the maximum practicable ensuring good entertainment; a pre-amplifier can be added easily if required.

Efficient "fixed" focus of proved reliability and freedom from drift ensures clear and consistent pictures. Simple lever control enables viewer to counter serious mains voltage fluctuations.

Automatic sound and vision interference-limiter circuits of proved effectiveness are incorporated. The vision interference limiter which has two ranges automatically provides the selected degree of spot-limiting for any setting of the contrast control.

The cathode-ray tube is independently mounted in the cabinet and need not be disturbed to remove the chassis for servicing.

A rubber seal between the cathode-ray tube and the grey-filter screen excludes dust.

The price is 89 gns., including Purchase Tax.—**E. K. Cole, Ltd., Ekco Works, Southend-on-Sea.**

17in. Low-voltage Focus All-glass C.R. Tube

THE latest R.C.A. 17HP4 is a 17in., all-glass rectangular picture tube utilising low-voltage electrostatic focus—a design feature which makes it possible to obtain the voltage for the focusing electrode from the low-voltage D.C. supply of the receiver. The required focusing electrode voltage is only 0 to 2.5 per cent. of the ultor voltage.

The focusing electrode in the 17HP4 has its own base-pin terminal so that designers can have a choice of focusing voltage for best results. This advantage is significant in view of the fact that the focusing voltage range within which a cathode-ray tube gives optimum focus will change with different combinations of ultor and grid No. 2 voltages. Adjustment for this change is made possible by the separate focusing electrode terminal.

Using a design in which the cathode is not connected to any other electrode, the 17HP4 retains the advantage of low input capacitance when employed in a cathode drive circuit. Also, since the focusing electrode is not connected internally to grid No. 2, the 17HP4 has the advantage of permitting reduction in focusing voltage as grid No. 2 voltage is raised—a necessary relationship for optimum focus.

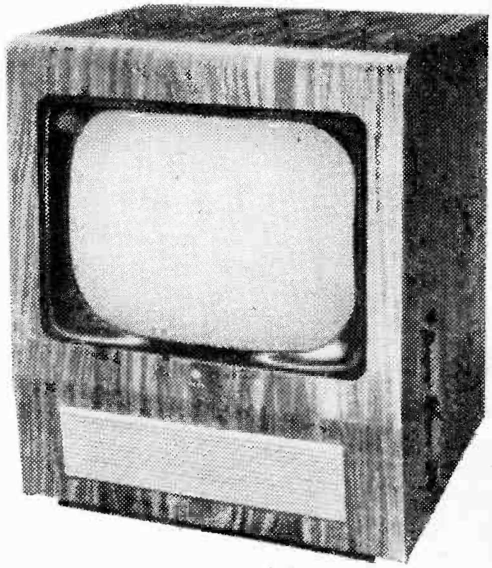
The 17HP4 has a filterglass faceplate; an external conductive bulb coating; an ion-trap gun requiring an external, single field magnet, a design centre maximum ultor voltage rating of 16,000 volts; and a picture size of 14⅜in. x 11 $\frac{1}{16}$in.—**RCA Photophone, Ltd., 36, Woodstock Grove, W.12.**

"Elpico" Colour Filter

THE "Elpico" colour filter applied to the screen of any black-and-white television receiver gives the picture a most pleasing appearance in three colours and at the same time eliminates much of the normal glare and the eye-strain resulting from it.

This interesting improvement in televiewing is attached to the screen in a very simple manner with the self-adhesive tape supplied with each filter. The "Elpico" filter is non-inflammable and is made in three sizes which will fit all standard screens from 9in. to 16in., including projection receivers.

The considerable success which has attended the introduction of these filters has enabled manufacture to be planned on a mass production scale and, in consequence, it is possible to offer them at the following retail prices:



The new Ekco table model with 15in. tube.

For 9in. and 10in screens (filter size, 10¾in. x 9in.), retail price. 10s. 9d. each. For 12in. screens (filter size. 13in. x 10½in.). retail price 12s. 6d. each. For 15in. and 16in. screens (filter size, 16½in. x 13½in.), retail price, 19s. 6d. each.—**Lee Products (Gt. Britain), Ltd., 90, Gt. Eastern Street, London, E.C.2.**

Neon Voltage Indicators

PHILIPS ELECTRICAL, LTD., have reintroduced two neon voltage indicators, for use in testing low and medium mains installations.

The popular pencil type, Cat. No. Q.5000, is priced at 5s. each, list, and can be used on A.C. or D.C. mains voltages between 110 and 500. It is housed in a black insulating pencil-shaped case, with a pocket clip.

The voltage and polarity indicator, Cat. No. Q.5005, is a much larger type suitable for 80/750 volts A.C. and 100/750 volts D.C., and for indicating polarity on D.C. It has two black "Philite" moulded insulated test prods, fitted with collars to prevent accidental hand contact with the metal probes, joined by a 39in. length of tough rubber-covered cable. One prod houses a Type 4017 indicator lamp, which can be replaced. List price is 30s. and supplies of both types are available immediately.—**Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.**

YOUR Problems SOLVED

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

DIPOLE AERIAL DIMENSIONS

"I am anxious to build an aerial for the Holme Moss transmitter and should be glad of advice as to the best aerial and the dimensions. What are the advantages of the 'H' over the simple dipole?"—G. H. T. (Halifax).

The "best" aerial is dependent upon local conditions. It is quite possible for a viewer in one street to find that a simple dipole gives good results and for a viewer in a street a few yards away to find it necessary to use an "H" aerial. Generally speaking, the "H" and other directional aerials produce a stronger signal and enable interference from the rear to be reduced, but in some cases the stronger signal may result in the need for the fitting of an attenuator. Therefore, each situation must be considered separately, and a local trader will no doubt know the best arrangement to use. Dipole measurements for the five channels are:

Channel 1—10ft. 5in.
Channel 2—9ft. 4¼in.
Channel 3—8ft. 6in.
Channel 4—7ft. 9½in.
Channel 5—7ft. 2½in.

These dimensions are for "centre tune"—that is to give adequate reception of sound as well as vision and consequently are not in the centre of the vision spectrum.

COIL WINDING DATA

"Can you give me some aid in the winding of coils for an experimental receiver? I have looked through various back numbers and find that some designers use bare wire; some covered wire; some space the turns, and some wind them close. In addition, I find that it is possible to use brass tuning cores or powdered iron. As a beginner I am a little lost by all this and should like to know whether there is some rule which I could follow."—F. B. N. (Stratford).

There is no rule, but the following points should be borne in mind: In most circuits, damping is introduced by shunting the coil with a resistance to provide a wide tuning band. Consequently it is not necessary to try to make a very efficient coil from the low-loss point of view. If the coil is to be "doped" to retain the windings *in situ*, a cotton or silk-covered wire will be found better than enamel as the dope will adhere better. A close-wound coil will be found to tune "sharper" than a spaced winding. That is to say, if the turns are spaced slightly the movement of the core will not make such a big difference as it will embrace a smaller amount of wire and thus more accurate tuning is available if it is required.

FEEDER CABLE

"Is there any objection to using screened cable (ex-Service), which I am told is 75 ohms? The only thing about it is that the outer P.V.C. covering is broken away in places, but as the screening appears intact and there is no short-circuit I cannot see that it would matter. I should like your advice on this, however, before fitting it to my home-made aerial."—K. S. (Hampstead).

The lead may be quite satisfactory from a theoretical point of view, but there is one practical point which should be borne in mind. In the case of the aerial being used with an A.C./D.C. receiver, the screening of the feeder cable will be joined to the chassis, which is probably "live" to one side of the mains. Consequently, if the bared screening braid comes into contact with some earthed object (such as a rainfall or stack-pipe) it may result in the mains fuse blowing. Alternatively, if the bared portion comes within the house there may be a risk of someone getting a severe shock on touching it. Furthermore, as the feeder has obviously been damaged in some way there is the possibility that there may be a bad R.F. leakage in it and we would think it desirable to obtain a length of new lead in this case.

OSCILLATOR SETTINGS

"I have just been servicing a commercial receiver and am rather puzzled by the performance of the frequency changer. It seems that this affects quality on sound more than on vision, but although I can get a good bright picture on one setting, the sound is poor; whilst for good sound the picture is poor. Would you suspect any of the sound unit components, or is it a bad oscillator?"—N. F. T. (Croydon).

Without a circuit it is not possible to say definitely, but there are one or two points which might be indicated. First, most oscillators have two settings—one on either side of the signal frequency. It is important that the correct setting be obtained. If your receiver has a frequency-changer which automatically produces two I.F.s (one for vision and one for sound), the wrong setting would give you the trouble mentioned. On the other hand, if the *vision* circuit is not operating properly you might find that the correct setting—that is the one where sound is O.K.—will result in a poor picture. If you can get good sound we would suspect the vision section rather than the oscillator. If the vision receiver incorporates a crystal diode as demodulator we advise a replacement before making any further tests.

LINE FOLD-OVER

"My picture is quite good, but there is a bright line about ½in. from the left-hand side of the frame. I have noticed that when adjusting the width control this moves in slightly but keeps the same width, but whilst adjusting the linearity control I can make the line wider and it becomes jagged right down the right-hand edge. It will open to about ¾in. and at its best it is a very thin line, but then is very bright. Can I get rid of this?"—H. B. (Aylesbury).

The line is due to what is known as a fold-over in the line scan. Due, generally, to oscillation, the line doubles back upon itself and thus produces increased brilliancy, as the tube is being scanned twice in the same spot. As width adjustment merely shifts the position of the fold-over and linearity varies its width, it would appear that the fault is actually in the line damping circuit, of which the linearity control is, no doubt, one of the components. The usual arrangement is for a condenser to be joined in series with a variable resistance, these being shunted across the scanning coils. Leakage in the condenser or an unsuitable value of resistance will produce the fold-over and therefore you should have the condenser tested or replaced, and you might try the effect of adding further low value resistances in series with the variable.

INTERFERENCE LIMITER

" I have a commercial receiver with a plug-and-socket at the back for interference limiting. There are three positions, and I find that, living on a main road, best results are at the ' M ' position but there is a lack of brightness in the picture when set here. In the other two sockets the picture is much brighter but the interference is very bad. Do you think the suppressor is faulty, or is the result to be expected ? "—J. K. (Slough).

An interference limiter will reduce the strength of peak white, and the better the suppressor the more will the brightness of the picture suffer. It would appear in your case that some steps should be taken to remove the interference at the aerial rather than rely upon the suppressor in the receiver, thereby enabling this to be set to a lower setting. If the main road traffic is " behind " the aerial so far as the transmitter is concerned, an " H " or multi-element aerial should be used. If, however, the traffic is between your aerial and the transmitter, the only way to reduce the interference is to try to put the aerial up higher and as far away from the road as possible, even if this means a very long feeder. The latter must, of course, be of the screened (coaxial) type to avoid the interference being picked up on this.

LOSS OF WIDTH

" I recently found that my picture did not quite fill the screen and after one or two nights it has decreased in width still more. This has gone on now for over a month and the picture is getting slowly narrower. I have kept the proportions right by reducing height, but I notice that when I have to do this the picture opens out very slightly which seems to indicate to my limited knowledge that the H.T. may be low. Do you agree, and how should I check this without damage to either the set or myself. I am now too keen on delving into the set when it is on."—S. W. (Wandsworth).

Although failing H.T. (due to a leaky smoothing condenser) could cause a reduction in width, it would also tend to introduce other faults. A rise in E.H.T. could cause a reduction in line width, but again, this is a fault which is not likely to arise under normal conditions without giving some other evidence of its presence. We think the most likely cause of the trouble is in the line oscillator stage, the anode resistor probably having " gone high ". If you can ascertain what value this should be you can measure it with a good ohmmeter when the set is switched off and we think you will find that it needs replacing.

ELECTROLYTIC CONDENSER REPLACEMENT

" My receiver broke down recently, and a quick inspection showed that the electrolytic smoothing condenser had broken down in the mains pack. The value was 16 μF, and I bought a new one which I put in the pack. When I switched on there was a terrific hum and the picture was marred by a heavy black line running slowly across it. Sound was very bad and I looked to see if the receiver was glowing blue, but it seemed to be all right. Is there likely to be any other fault in the set, or is the new condenser likely to be faulty also ? "—H. G. T. (Wolverhampton).

If the condenser had been in stock some time, or was an ex-Service component it would no doubt need reforming. An electrolytic condenser which has been in store for a considerable time is no longer a condenser and before use should be put on a D.C. circuit with a lower value and the voltage slowly raised to that for which the condenser is intended. Ex-Service electrolytics may be found so bad (due to the conditions under which they have been stored) that they cannot be reformed, and they are therefore useless. The application of a high value of H.T. (especially as in your case, where the surge voltage would be much higher than the rating of the transformer, for instance) would probably destroy the component ; but you can try the effect of connecting it to a low voltage source and slowly increasing the applied voltage up to the rating of the condenser and then try it in the power pack.

16in. TUBE AND " VIEWMASTER "

" I have noticed an advert. for the 16in. C.R.T. by English Electric, and as I am contemplating the building of a ' Viewmaster ' I am taking this opportunity of asking your opinion as regards using this larger tube in place of the usual 9in. or 12in."—R. O. M. (Dunstable).

Work is being carried out on modifying the " Viewmaster " for use with the 16in. tube. Very considerable changes will be required and full information will not be available for some while. When this is ready, details will be published.

INEFFECTIVE SHIELD

" I am experiencing a curious trouble with my VCR.97. The tube is fitted with the usual shield and is mounted a few inches above the T.B. chassis in a console cabinet, with the power pack on the lower shelf. I find that after a week or so of good pictures of normal size, the top of the picture merges into a thick line, resulting in a loss of height and details. This can be overcome by either turning up brilliance until all contrast is lost, or by removing the shield, banging it, and replacing it. It may also be partly overcome by rotating the shield on the tube neck." —E. G. P. (Birmingham, 12).

It appears that a magnetic field is affecting the mu-metal tube shield in some way so that after a period of time the shield becomes magnetised and distorts the raster. There are a number of ways in which this can happen, especially with high permeability material, and the field of the mains transformer or smoothing choke may be the cause in your case. Mu-metal shields are specially treated during manufacture to make their shielding properties effective, and any rough usage can destroy these properties to a large extent. It is not an easy matter to treat shields in this way at home and your best plan is probably to obtain a new shield.

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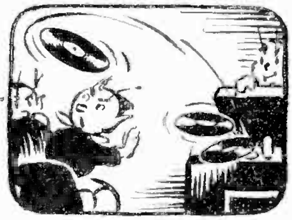

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