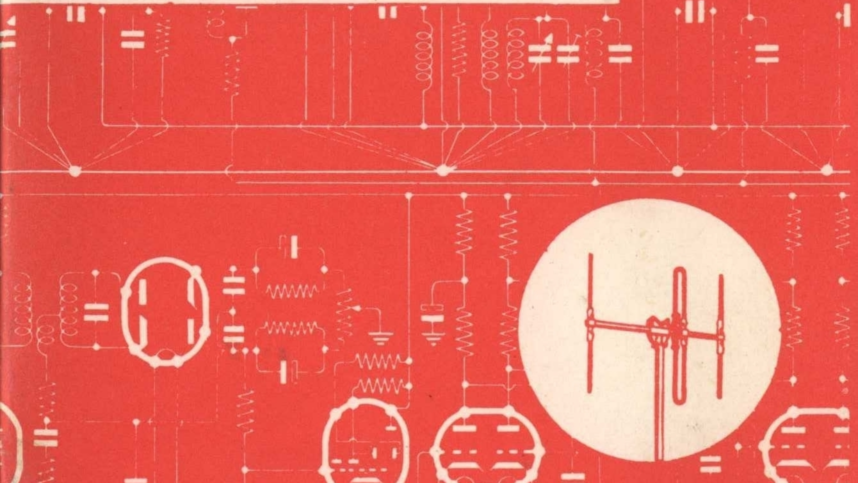
HOW TO RECEIVE FOREIGN TELEVISION PROGRAMMES ON YOUR TELEVISION SET BY SIMPLE MODIFICATIONS

by W. J. WEST

Many practical tested circuits and diagrams for converting your present set to receive extra programmes from FRANCE, BELGIUM, HOLLAND, GERMANY, SPAIN, ITALY, SCANDINAVIA, U.S.S.R. etc.



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by

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INTRODUCTION

Most TV viewers, including those enthusiasts who come under the heading of Radio Amateurs, have experienced the effect on their TV screens loosely referred to as "Continental Patterning".

Such interference with normal entertainment is generally received with annoyance, but there are an enlightened few who greet this phenomena with evident enthusiasm and frienzied activity.

The reason for this apparently unwarranted exuberance is that such "patterning" means for them perhaps one of the greatest thrills in amateur radio—that of receiving a perfect picture from a distant European or even Asian Transmitter.

There is surely a magic about television which transcends ordinary "steam" radio.

The thrill of the first Crystal Set—later to be surpassed by the "Super one-Valver"—even these epoch making occasions are, in their turn, culminated by the *SIGHT* of a foreign text-card materialising out of a snowy screen.

There are now over 500 Television Transmitters in Western Europe, but few people realise that there is no reason why, given the right propagation conditions and equipment—any of these should not be receivable in the British Isles.

All that is needed is a little "know-how", patience, perseverence and, above all— enthusiasm.

The author has carried out his own investigations, albeit on a somewhat modest scale, over the past six years, into the intriguing phenomena of Sporadic "E" reception and has come to some surprising conclusions.

Among them is the undoubted fact that signals can be received via Sporadic "E" in the 50-70 Mc/s band over very long distances most of the year round—only their strength and consistency varies—and even this is predictable to a great extent.

By this statement it is not implied that reliable transmissions of entertainment value are in any way possible, but that pictures of great interest to enthusiasts can be received at fairly regular intervals.

To me it was very soon evident that random viewing of a blank screen in the hope of eventually seeing something of interest was a soul destroying business even when conditions seemed favourable. Some form of unobtrusive early warning system was required in addition to one's accumulated knowledge of good reception conditions. A special monitor receiver developed specifically for this purpose was the answer and has since contributed more than any other single factor to obtaining successful pictures. The many refinements added over the years have also gradually improved the picture synchronisation and overall quality.

The interested reader will in all probability be asking some pertinent questions, among them perhaps being "How much does all this cost?" and "What sort of results would I get?" The answer to the first depends to a large extent on how much one can salvage from the "Junk Box", but—fortunately—"Band 1 only" TV Sets are obtainable very cheaply or are often given away. All the parts needed can be salvaged from scrap television receivers, excepting of course the camera for taking photos from the screen, but even this need not be expensive.

The attached selection of photographs were taken this year—over a period of about three weeks—mostly from the screen of a TV that has already given eleven years regular service and is now reserved for this purpose. This goes to show that satisfactory results are obtainable from a very modest outlay and it might also be interesting to note that older sets are often more suitable for conversion to the standards required. The reasons for this will be more clearly appreciated later but other redeeming factors are—that the performance of old sets can be boosted for the relatively short durations when pictures are taken, and, because sound monitoring is employed most of the time, the probably ancient cathode ray tube can rest for long periods and conserve its failing emission.

Taking photos from the screen makes the hobby more interesting, as well as proving to sceptics that long distance TV reception is possible. Even technically minded friends are inclined to look at one a little queerly at times when one mentions having watched a feature programme direct from Moscow.

Much of the success in obtaining good pictures from the screen lies in having some idea when to expect them. It's easy to be discouraged and give up too easily. In the next section we will consider exactly why Sporadic "E" reception is possible and the factors which influence the signal strength.

SECTION 1: WHY SPORADIC "E" RECEPTION IS POSSIBLE

Even those members of the lay public, whose only interest in radio is to listen to Radio Luxembourg, realise that wireless reception conditions are not constant and do in fact vary with the time of day and the season of the year. Those who stop to consider these effects a little deeper are also aware that—broadly speaking—the domestic receiver will pick up the more distant stations on the short wave band. Extending these thoughts even further, one could be excused for assuming that on the much lower wavelengths used for television the range would be more extended, but the unfortunate "fringe" viewer at any rate is also very much aware that the area over which television can be satisfactorily received is very limited. If the reader to whom all this meandering is very elementary will excuse us, a little revision on the characteristics and propagation phenomena on these relatively low frequency television bands may be helpful to those new to this field. It should be appreciated that much of what follows is not proven but merely data which has accumulated through my own and other enthusiasts' observations and studies.

As long ago as 1934 a theory was advanced that what were then considered very high frequency radio waves would bend in the lower atmosphere and should lead to the attainment of the distant VHF communications. Radio amateurs throughout the world were among the first to spend much of their time exploring and experimenting the erratic performance of propagation conditions in these higher radio bands. It is, in fact, in this field of propagation study that there is still room for the enthusiastic amateur to do much original research. Little is known about such propagation conditions as meteor and auroral reflections and transequatorial scatter.

Coming back to the subject of long distance TV reception, it is mainly the band of frequencies between 50 and 70 Mc/s which provide the most activity in Europe, and will therefore most interest amateurs in the British Isles.

We ordinarily think of TV reception as not being practical beyond the horizon from the transmitting point. This is because the electromagnetic waves at the higher TV frequencies tend to resist the bending effect of the ionosphere and are not "bounced back" to earth, as in the case with "normal" short-wave transmissions. But here is an important point—the highest radio frequency which can be "bounced back" to earth depends on the DEGREE of ionisation in the upper layers of the atmosphere and—although under normal conditions this maximum usable frequency for long distance communications rarely moves up as high as the TV bands—there are several phenomena which alter this otherwise normal state of affairs.

About every 11 years eruptions on the sun reach a peak (that is in quantity) when the ionised layers around our earth are disturbed and their increasing lensing action concentrates the amount of refracted energy enough to make long distance reception of much higher frequencies possible. The next peak in this solar cycle should occur between 1966 and 1969 when the MAXIMUM increase in VHF reflection occurs. This type of reflection is from an ionised layer about 200 miles up—known as the F2—and will permit communication over distances of 2,000 miles or more. Another important point is that this type of propagation is largely predictable and the probable maximum usable frequency is published in advance in technical journals. Whenever this maximum usable frequency approaches 40 Mc/s there is a likelihood of reliable DX. TV; but a great deal more patience is required at present to catch the more elusive stations.

The most common form of long distance TV reception at present is the extension of the normal service area associated with easily observed weather conditions. It is apparently the result of a change in the refractive index of the atmosphere at the boundary between air masses of different temperatures and humidities. These air masses are slow moving areas of high barometric pressure and occur in fair calm weather conditions often prior to a storm or other change in weather. Such favourable conditions occur most often in the summer months and the VHF enthusiast soon learns to recognise the various weather manifestations by watching the barometer, the changing cloud formations, wind direction, visibility and other easily observed—or felt—weather signs. The rapid cooling of the earth in early evening after a hot day in summer—with the higher air masses cooling more slowly—is one sign that those distant stations may be rolling in before sundown. This type of ionised air mass is usually not higher than one mile and will give rise to reception up to 500 miles.

There are, however, other patchy concentrations at a height of about five miles. These give the popularly known "Short-skip" condition on the 28 Mc/s band. Signals may then

be reflected over 2,000 miles and it is probably this layer which makes the more distant stations receivable in the early summer. Good reception conditions are most common in May, June and July during morning and early evening, but may occur at any time or season. Never be too discouraged though by purely local weather conditions. One of the most interesting and perfect transmissions received yet by the author occurred during very wet weather with the barometer abnormally low for the time of the year. The programme happened to be a Bull Fight from Madrid and the entire performance was received without loss of synchronisation with a far better signal to noise ratio than the local ITV station which supposedly covers our area A later check of the weather conditions prevailing *en route* revealed that they were indeed favourable.

Magnetic storms, which sometimes give the Aurora Borealis effect, make VHF signals receivable over distances not normally possible, and it has been suggested that aiming the TV Aerial at the centre of the Auroral curtain might produce some surprising signals. Aurora reflected signals usually come in with a heavy flutter rather like the effect of aircraft on local transmissions, so—although interesting—would probably not produce pictures worth photographing.

The responsiveness of radio waves to all these effects mentioned is directly related to frequency. The lower wave lengths are received more consistently. Unless the conditions are exceptionally good it is therefore best to stick to the lower channels. Another convenient way to check for possibly good TV DX. conditions is to listen on the higher frequency amateur bands. If these are lively the TV bands are often equally productive.

In the next section we will endeavour to become thoroughly familiar with all important aspects of the frequency band and signals we wish to explore.

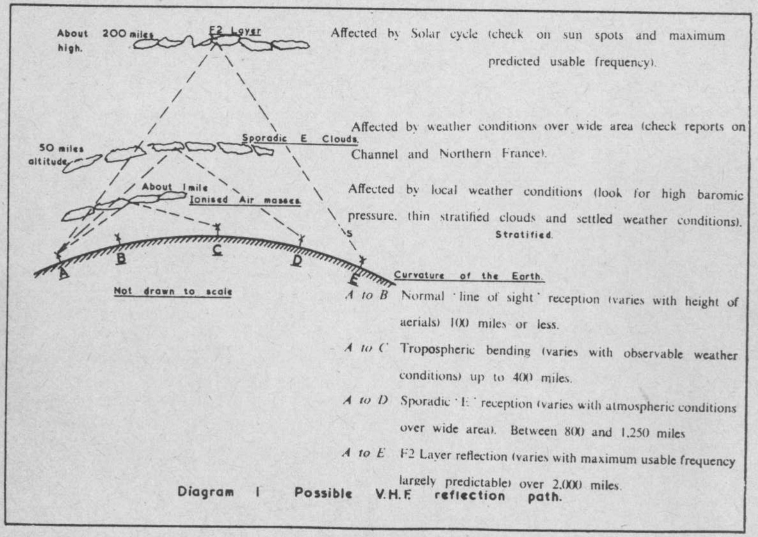


Diagram 1 Possible V.H.F reflection path.

Illustrating how the VHF waves are reflected by the various ionised layers.

SECTION 2. CHANNELS RECEIVABLE ON BAND 1

If we are to explore a band of radio frequencies in a methodical fashion rather than random searching, it is of some help to know something about the frequency allocations in that band if only to know " where to look "

Diagram 2 shows the frequency allocations which have been agreed upon by most of the countries in Europe and Western Asia. The author considers that this type of diagram illustrates much clearer than tables of figures the degree of overlap which exists between the different systems. It also clearly shows what chaos there would be if normal VHF propagation conditions gave way to continuously reflected waves.

It is clear that by far the most convenient method of channel selection is to replace the existing continuously or pre-tuned R.F. stages with one of the 13 channel turrets which are now available very cheaply on the surplus market—preferably one in which all the coils can be individually trimmed with brass slugs. Coils can then be fitted to cover all or any of the nine different channels as listed below :—

48.25 Mc/s ... EUROPEAN E2 (BBC Channel 2 sound provides a good marker).
49.75 M/cs ... EUROPEAN CHANNEL 01.
53.25 M/cs ... BBC Channel 3 (if sound signal receivable).
53.75 Mc/s ... Italian Channel A.
55.25 Mc/s ... European Channel E3.
58.25 Mc/s ... BBC Channel 4 (if sound signal receivable).
59.25 Mc/s ... European Channel 02.
62.25 Mc/s ... European Channel E4 and Italian B.
63.25 Mc/s ... BBC Channel 5 (sound if receivable).

Readers will be surprised to find how many of the BBC sound signals are just receivable at sufficient strength to act as markers even in poor reception areas. If these sound channels are not receivable there is, of course, no point in leaving the coils in place. It is easiest to set the channels roughly with a signal generator until they can be tuned up carefully on the appropriate signals. Once the channel has been received and confirmed it is best left alone, so try not to be tempted to retune later in the hope of improving reception. The fine tuner will normally give all the range necessary to allow for possible drift.

For the European Channels obtain coils for the nearest British channel and then trim up the brass cores when the signal is steadiest. A few spare coil positions are left in case one is tempted to fiddle, and on occasions when inter-channel interference is being experienced, slight detuning from the correct setting does occasionally help to move or reduce the unwanted station. The correctly set up coils can then be left strictly alone for use when reception is at its best.

The following is a list of some of the higher powered Continental Stations to be found on the different channels. The vision frequency only is given in each case :—

	Approx. miles from Gt. Britain
E2 (C.C.I.R. System), 48.25 Mc/s.	
BELGIUM (Antwerp and Ruiselede)	400
WEST GERMANY (Bremen, Grunten, Saarbrucken, Biedenkopt)	450
SPAIN (Nava Cerrada)	800
SWITZERLAND (Bantiger)	600
AUSTRIA (St. Polten)	1,000
POLAND and CZECHOSLOVAKIA have also been received on this channel but not confirmed.	
01 (O.I.R. System), 49.75 Mc/s.	
HUNGARY (Budapest)	1,200
U.S.S.R. (Odessa, Moscow, Kharkov)	2,000
1A (Italian Exclusive Channel), 53.75 Mc/s.	
M. Caccia	1,400
M. Cammarata	1,400
M. Nerone	1,000
E3 (C.C.I.R. System), 55.25 Mc/s.	
BELGIUM (Liege)	500
DENMARK (Fyn)	800
EAST GERMANY (Helpterberg)	800
WEST GERMANY (Krevzberg, Rhon)	800
PORTUGAL (Louza)	1,000
SPAIN (Zaragoza)	800
SWITZERLAND (Vetliberg)	600
02 (O.I.R. System), 59.25 Mc/s.	
CZECHOSLOVAKIA (Ostrava)	900
POLAND (Warsaw)	1,200
RUMANIA (Bucharest)	1,000
U.S.S.R. (Katlinin, Kiew, Leningrad, Moscow, Riga, Tallinn	2,000
E4 (C.C.I.R. System), 62.25 Mc/s.	
AUSTRIA (Innsbruck)	1,000
CZECHOSLOVAKIA (Cottbus)	900
DENMARK (Copenhagen)	800
WEST GERMANY (Flensburg, Ochsenkopf, Reichberg)	800
NETHERLANDS (Lopik)	800
SPAIN (Barcelona)	800
SWITZERLAND (La dole)	
SWEDEN (Stockholm)	
IB (Italian Channel), 62.25 Mc/s.	
M. Finto and M. Penice	

It will be appreciated that all the stations listed on common channels are subject to mutual interference under Sporadic " E " reception conditions, and by studying *Diagram 2* it is possible to check on inter-channel interference.

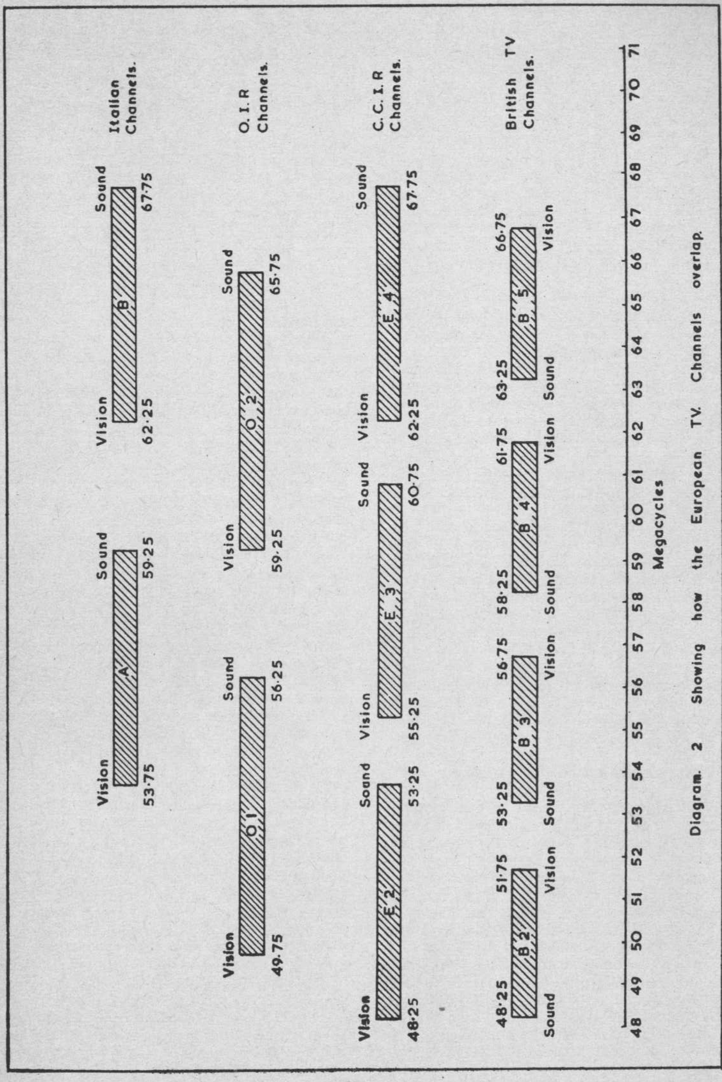


Diagram 2 Showing how the European TV. Channels overlap.

SECTION 3: MODIFYING AN OLD "BAND 1 ONLY" TELEVISION SET FOR EXPERIMENTS IN SPORADIC "E" RECEPTION

In order to carry out the modifications necessary to enable a Television Set designed specifically for our British Television system to function satisfactorily on another, it is first necessary to examine all the essential differences. Fortunately all present day television systems are similar in broad outline, and all make use of a fixed black or suppression level to separate the synch. pulses from the picture modulation. The Continental system in widest use is the BERGER 625-line often referred to as the C.C.I.R. Therefore this is the standard to which we will convert our 405-line TV receiver.

The main differences in the transmitted signal are the picture modulation sense and the line frequency; any other differences are superficial and do not affect reception.

We shall take the whole Television Receiver, section by section, and outline any changes that are necessary. It will be appreciated that some minor changes may be necessary to the circuits shown according to which make of set the reader has available. With this in mind the circuits have been made as basic and non-critical, as regards working conditions, as possible.

It is not proposed to recommend any particular make of set, but take heed of this warning: many of the "Band 1 only" sets can only be described as murderous as regards their local oscillator radiation. It may be that when all the sets in a given area were certain to be on the same channel this was not thought important, but the DX. fan will want to range up and down the whole of Band 1 so please check first that you will not be spoiling your neighbour's reception. The use of additional screening and filtering may cut this radiation down, but it is sometimes simpler to fit a new tuner unit.

The Receiver Section, Radio Frequency and Oscillator Circuits

The first basic requirement of the Receiver Section is that it should cover all the European and Asian Channels likely to be affected by Sporadic "E". Although the author has heard of reception in the Band 111 Channels, activity is definitely most consistent in Band 1. The requirement of the R.F. Unit is therefore only that it should be capable of tuning over the whole of our Band 1.

The R.F. band-width of our own receivers, although not required to be as wide as the Continentals, will normally be adequate for good picture quality, and in any case will be at least as broad as we can reasonably make the IF's. No modification is therefore necessary for the R.F. section other than possible replacement of the existing stages with the more convenient turret tuner.

Vision Intermediate Frequency Amplifiers

The idealised receiver response for our own and the GERBER system of transmissions are compared in Fig. 1, A and B. The sound carrier is 5.5 Mc/s above the vision carrier instead of 3.5 Mc/s below, and the vision pass-band extended accordingly. Sound is not essential unless one is an accomplished linguist, and a vision pass-band of just over 3 Mc/s was found both practical to achieve and adequate for good picture quality and adjacent channel rejection. The pass-band was extended as shown in Fig 2, A. and B, by the simple expedient of "staggering out" the sound and adjacent channel traps; this avoids the steep slopes associated with these rejectors and puts the new vision carrier approximately where the sound channel used to be; this fulfils another requirement to be explained later. The vision I.F. in actual use is immaterial as the frequency relationship will be as shown. Providing the actual vision I.F. transformers have not been previously trampered with their response should open out nicely, as shown, without attention, but if one is lucky enough to have the use of Wobbulator equipment the pass-band can be re-set visually for optimum response. Owing to the restricted bandwidth, no trouble should be experienced with rejecting the new sound I.F. which—in the GERBER SYSTEM—is normally Fm and is extracted from the video circuits at the inter-carrier frequency of 5.5 Mc/s. If serious breakthrough is experienced from the local B.B.C. channel it is sometimes possible to utilise one or more of the old rejectors without seriously impairing picture quality. The aerial system can also be designed to help in this respect.

On an old set it is unlikely that any form of automatic picture control is employed, so it is important to fit a simple system to handle the heavy signal fluctuations met with under Sporadic "E" conditions. The usual form of manual contrast control is shown in Fig. 3, together with the modified automatic control circuit. This is a standard mean level type and no explanation of its operation should be necessary. As one's main interest in DX. TV is likely to be a collection of good photographs of the more interesting stations received rather than trying to attain the ability to lock the weakest possible carrier, no great attention has been paid to this aspect of design. If one employs one of the new frame grid RF valves

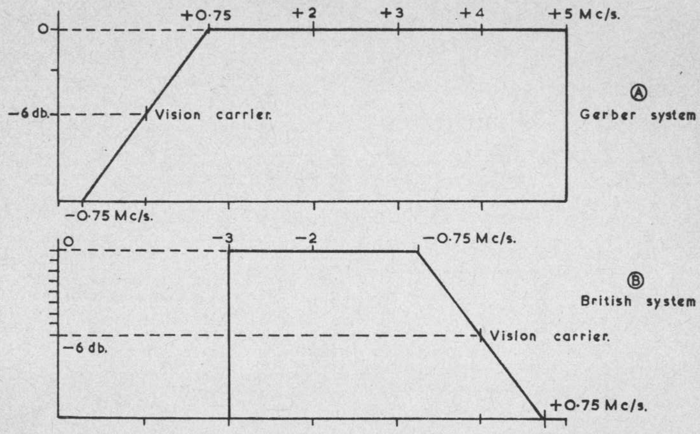


Fig. 1 Vestigal sideband idealised Receiver response.

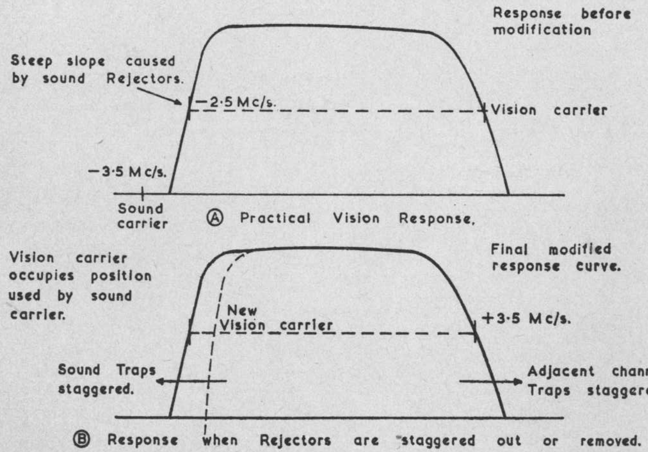


Fig. 2 Showing how the vision response is modified.

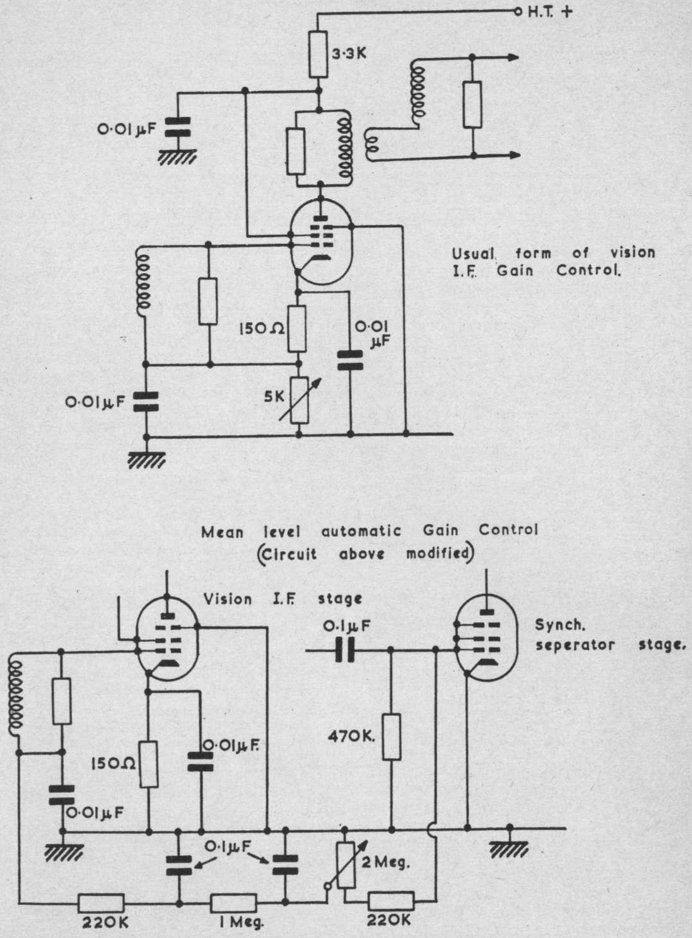


Fig. 3

NOTES

Photographs 1–6 were taken from a 15" screen using 35 mm. camera with a 1 diapta close-up lens. 1/30th second at f3.5.

Special Note: Photograph 6. By turning the dipole 90° it is possible to receive a West German station on the same channel as the Spanish station shown in Photograph 5, although the Spanish station was too strong to be rejected completely.

Photographs 7–15 were taken with a close-up lens. 35 mm. enlarged. 1/30th sec. at f5.6.

Special Note: Photograph 10 was taken from a current production model 405/625 line televisioı. with the vision I.F. response not modified. The response shown on the test card would correspond to about 2 Mc/s on our system.

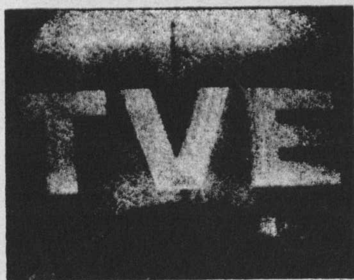
Photographs 20–23 were taken under rather less favourable conditions of reception.

Photographs 24–28 have been taken from original television transmission direct from Russia and are of particular interest as they all relate to the Gagarin-Titoff satellite flights.

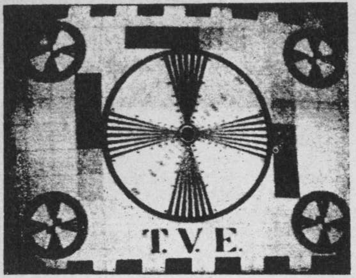
1. *Spanish Television Announcer.*

2. *Fashion Show from Madrid. Photographed July 2nd, 1962.*

3. *Fashion Show from Madrid. The focus is good enough to show the 625-line structure.*



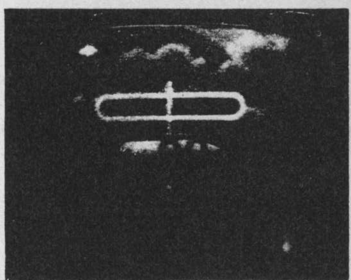
4. *TV Espanola. The slight pattern in the background is caused by the station shown in photograph No. 6. Received on 48.25 Mc/s.*



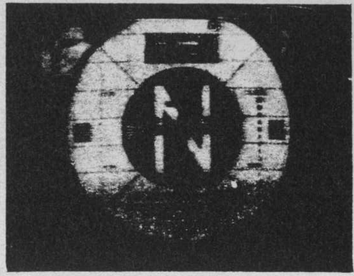
5. *Spanish Test Card. This clearly illustrates the good quality which can be obtained even with restricted bandwidth*

6. *West Germany. Programme Schedule. Co-channel intereference from station in photograph No. 5.*

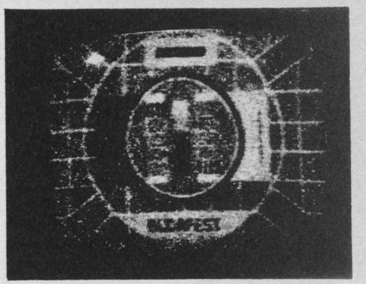
7. *Italian Television Transmission for Schools. Received on 19" current production 405/625 lines switchable TV set (detector modified for negative modulation).*



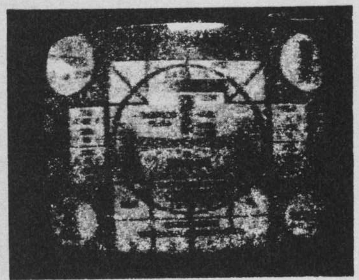
8. *Italian Television Schools Transmission as in photograph No. 7.*



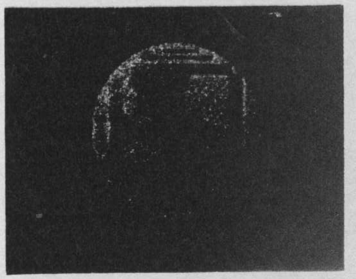
9. *Testcard Italy. On Italian Television Channel A.*



10. *Hungarian Testcard from Budapest, Hungary.*



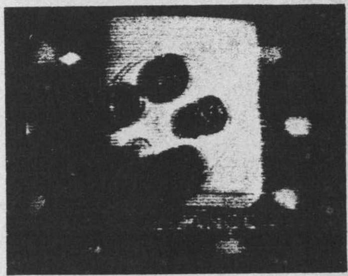
11. *Russian Testcard probably from Riga.*



12. *West German Testcard.*

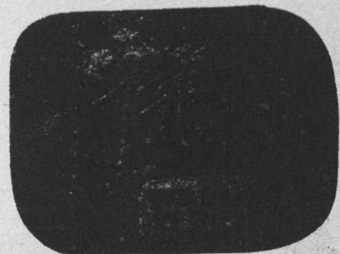
13. *Spanish "break-in-transmission" apology.*

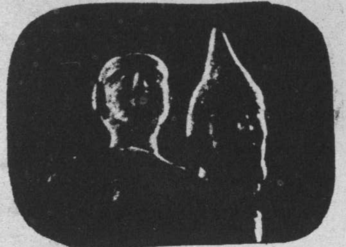
14. *Spain (with slight ghosting and shared channel interference).*



15. *Announcer, probably West Germany.*

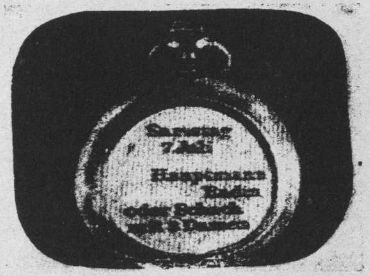
16. *Introduction picture from Madrid Television.*

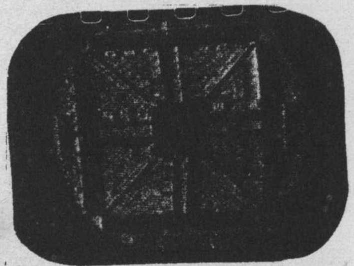




17. *Spanish Television. Visit to a museum.*

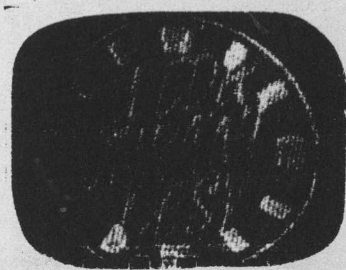
18. *German programme schedule from East or West Germany.*

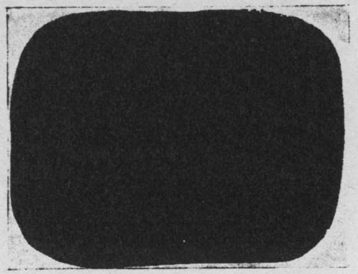




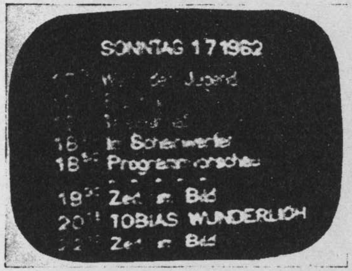
19. *Testcard. Probably Warsaw, Poland.*

20. *Programme announcement. Origin uncertain, believed Hungarian.*



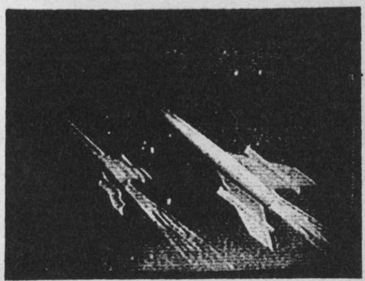


21. *Origin uncertain, probably Polish.*



22. *Programme schedule. West German Television.*

23. *Warsaw Television announcement card, Poland.*



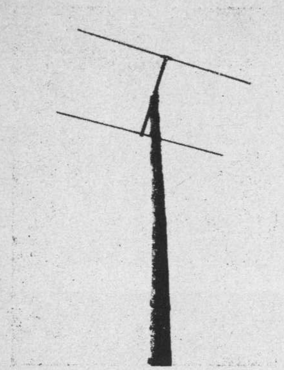
24. *Received on Channel 01 either from Riga, U.S.S.R., or Czechoslovakian transmitter.*

25. *Picture of the two Russian Cosmonauts.*

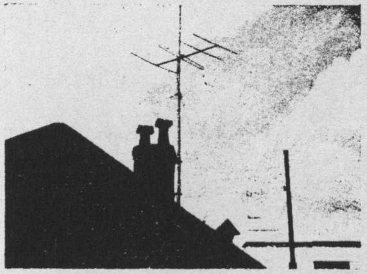
26. *Direct transmission via Russian Television of Cosmonaut in flight.*

27. *Direct transmission of Russian Cosmonaut under acceleration stress.*

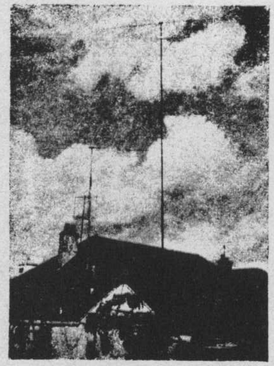
28. *Russian Cosmonaut and wife being interviewed on Russian Television. Direct transmission.*



29. *Horizontal " H " aerial for sporadic " E " on 30-ft. wooden mast dipole. It is cut for Channel E-4, 62.25 Mc/s.*



30. *Horizontal wide spaced four-element TV aerial cut for Channel E-4, 62.25 Mc/s. Improvement over simple dipole shown in photograph No. 29 was, unfortunately, not worthwhile.*



31. *Two of the horizontal dipoles shown most effective for sporadic " E " reception. Cut for Channel E-2, 48.25 Mc/s.*

in the first amplifier stage, no other complications are likely to make much improvement in signal to noise ratio in the standard of picture we are interested in.

The Vision Detector

The GERBER system uses negative modulation of the vision carrier in which the substantially zero RF signal corresponds to peak white and 100% modulation to the synchronising pulses. Black level is at 75% of the maximum carrier amplitude.

This is directly opposite to the British system which uses Positive modulation, that is 100% modulation is peak white level, with 35% black level, and from 35% down to zero utilised for the synchronising pulses.

The main modification needed here is to reverse the detector diode, making the waveform at the video amplifier grid appear almost identical with that in the British system. The important different being that the D.C. component applied as bias to the video amplifier grid will now be negative instead of positive. It is therefore necessary either to step-down the D.C. component or to modify the standing bias applied to the video amplifier. It has been standard practice in video amplifier design for some time now to use a fairly high cathode bias resistor and obtain some HF correction to the video response by using a fairly low value of by-pass condenser—thus obtaining the correction by selective negative feed-back. One way of obtaining approximately the same correction factor while suitably changing the bias is to halve the value of bias resistor and double the by-pass condenser. The D.C. step-down circuit as shown in Fig. 4A should also be fitted. A further useful refinement which can be added to the vision detector circuit is shown in Fig. 4B. This completes the modifications to the detector circuit.

The Video Amplifier

Some modifications to the video amplifier have already been described; the only other refinements which could be carried out are to ensure that the response is maintained as high as possible. To aid in this connection it helps to make sure the anode load is at least no higher than 6.8 kilohms, and providing sufficient drive can be obtained 4.7KΩ would be even better. Any 3.5 Mc/s filters should next be removed or tuned higher. These are usually feeding the video amplifier grid—in the video amplifier cathode circuit—or occasionally in the lead feeding the cathode ray tube. These last alterations are not by any means essential but every little may help. An anti-flutter circuit feeding the CRT in addition to the similar circuit in the detector will aid in stabilising the picture and also help with EHT regulation (see Fig. 5).

The Synch. Separator

Fortunately the synchronising pulses from the video amplifier with the GERBER SYSTEM are still positive going and the standard pentode synch. separator will therefore be working efficiently. The only differences in waveform that do occur between the two systems lie in the varying durations and reoccurrence frequencies of the pulses, also the different relative amplitudes of the synch. pulses and picture signals. None of these changes affect the principles of synch. separation, however, and the more common component values have little effect on the efficiency of operation. Unfortunately, however, the effect of impulse interference on the synchronising circuits is very much more severe with negative modulation than with the British System. Interference pulses are no longer limited in amplitude to at their worst the same level as the synch. pulses, but can now often far exceed them. This makes the use of a " flywheel " line synchronising system essential, instead of merely an advantage in fringe areas. Something can be done to improve the slicing action of the simpler synch. separator and by this means it is possible that in a very " quiet " locality one may be able to dispense with a " flywheel " circuit. Such a circuit is shown in Fig. 6. This circuit not only rejects picture modulation very efficiently but also produces much " cleaner " pulses than most, clipping as it does both ends and passing only a section of the pulse free from noise.

In areas where much impulse interference is experienced the only satisfactory solution is to " build in " a " flywheel " circuit. This is not nearly so difficult as it might sound and the circuit to be described has been chosen because it is simple—requires no special components whatever—and is very tolerant as regards operating conditions. The author has built this circuit with very minor modifications into many different sets and has found it surprisingly good tempered as regards both synch. and reference pulse levels, and no special equipment has ever been needed to persuade it to work effectively. Another tremendous advantage, when modifying as distinct from new construction, is that no new valve bases have to be fitted. The existing line time-base, which has to be altered in any case, is rebuilt to a multi-vibrator for the new standard and the additional components occupy only a little more space around it (see Fig. 7A).

The flywheel action is provided by the long time constant of the network feeding the line time-base producing electrical inertia, while RH prevents " hunting ". If the original time-base was of the two valve type employing a "blocking" pulse supplied by a special winding

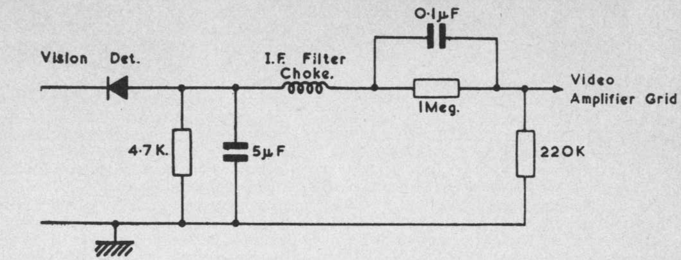
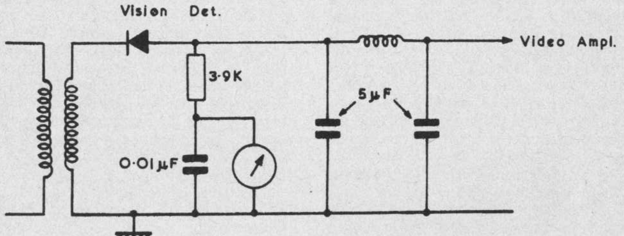


Fig. 4A D.C. "Step-down" circuit for vision detector.



The meter 0–500 microAmps is connected in the chassis return of the diode lead as shown.

When readings are taken the A.G.C. must be inoperative; in circuit (fig. 3) merely turn the contrast control 'full on'. A really strong signal will give a full scale reading, further calibration could then be carried out on the contrast control or by suitable meter shunts. The Author merely refers to this as S9+.

Fig. 4B

Simple signal strength meter for comparative measurements

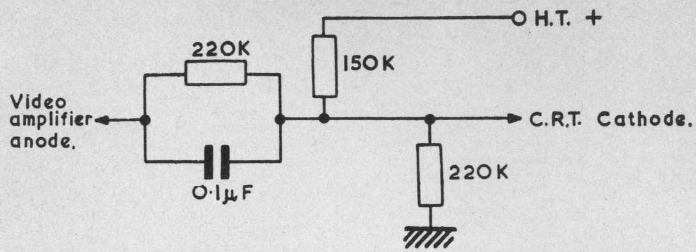


Fig. 5 Anti—Flutter network.

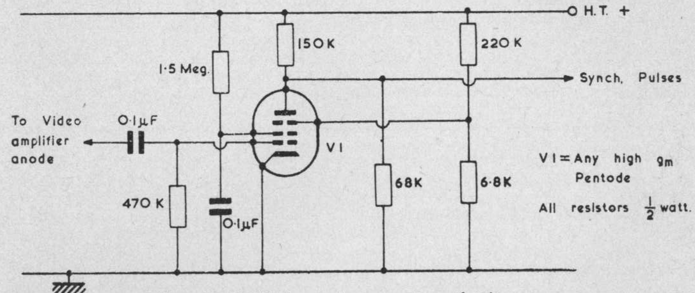


Fig. 6 Modified synch. separator circuit.

on the line output transformer, this can best be utilised to provide the reference voltage, otherwise use three resistors in series in an insulated sleeve and obtain the positive going pulse from a suitable tapping on the L.O.P.T.

A little experiment may be needed with the total value of these resistors to obtain the best performance, but the values shown will perform satisfactorily. The tapping on the line output transformer, nearest the line output valve anode and feeding the scan coils, is usually the best. As this point is fairly "*lively*" the sleeving over the resistors is essential.

The Line Time-base

The corresponding frequency for the line time-base with the BERGER System is 15.125 c/s as compared with our 10.125 c/s. There is no difficulty in modifying the line oscillator. It is only necessary to change the values in the time constant that controls the frequency. In the cathode coupled multi-vibrator type of oscillator shown in Fig. 7B, these components are V2 grid coupling condenser and resistor. It is, in fact, the aiming potential of V2 Grid that is changed to alter the frequency. If these values are employed in similar circuits the required frequency should be covered.

The Line Output Stage

The major problem in this stage arises in the cathode circuit of the line output valve. When the scanning frequency is increased from 405 to 625 lines the peak to peak current required in the scanning coils remains the same, but the rate of charge of current has gone up approximately in proportion to the frequency ratio. The voltage drop during the scanning

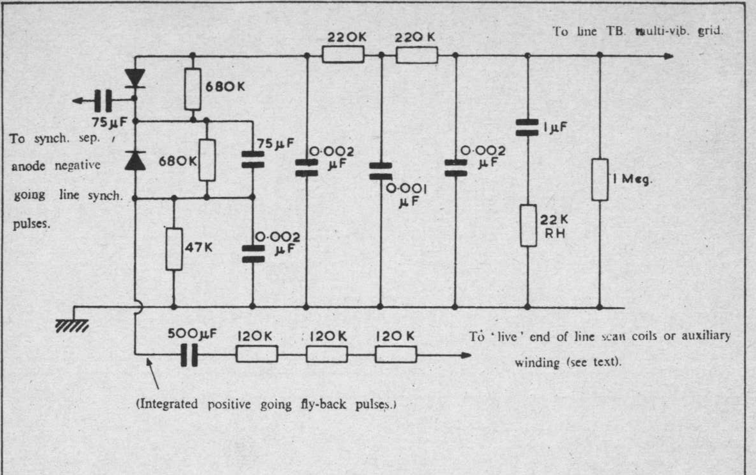
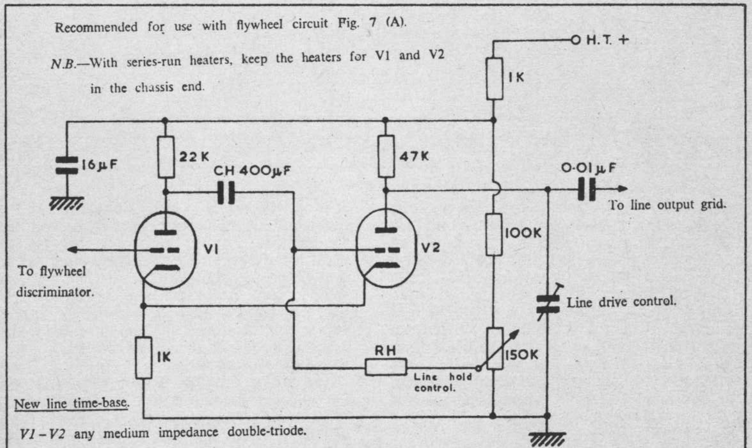


Fig. 7A



Cathode—coupled multi—Vibrator.
Fig. 7B

also goes up and in order to maintain the same voltages on the transformer primary it is best, if possible, to tap the scanning coils further up the transformer from the boost rail end.

This often only means altering what is already a pre-set amplitude control, but it is sometimes necessary to remove the series inductance type of control completely. Some idea as to whether the EHT is still correct can be obtained by checking that a reasonable focus can be obtained within the normal range of the control. If this is not the case try adjusting the line drive control, if fitted. If not, fit one by replacing the existing fixed condenser across the line output grid circuit by a variable trimmer of the same maximum value as the fixed component. Try to maintain the time-base frequency constant by resetting the line hold control while at the same time setting the line drive condenser for better focus.

If this capacity is too high *cramping* will occur in the centre of the raster ; the optimum setting is just before this " cramping " occurs. Another more serious complication not met with in the older sets is that some line output transformers are what is known as " third harmonic tuned ". This means that their efficiency is improved by arranging that the natural ringing frequency of the EHT over-winding is such that the number of odd half-cycles is three, and the ringing voltage subtracts from the anode of the line output valve and adds to the total EHT available. What this means to the reader in practice is that sets using this design method will almost certainly suffer from low EHT when the line frequency is raised. Short of replacing the line output transformer, the author has yet to find an answer to this problem. It is anticipated that most of the sets converted for our purpose will be " old stagers " and therefore no great difficulty is likely to be experienced.

The Frame Time Base

The foreign frame pulses do not differ materially from our own, except that they are possibly better because of the inclusion of extra equalising pulses which make reliable interlace easier. It may, however, be necessary to add extra smoothing, for although the number of frames per second is related to the supply mains in each case, the supply frequencies are not necessarily in step. Fig. 8 shows all the extra smoothing that should be necessary. With some sets employing another stage of clipping for the frame pulse in addition to the synch. separator, the author has sometimes found it necessary to attenuate the frame pulse at the input to this stage in order to give better locking.

The Cathode Ray Tube

As most sets converted are likely to be old the CRT will probably be low in emission. Fortunately there are several factors in our favour when considering the purpose for which the sets are intended. Firstly, the older two-valve heaters took very kindly to being " boosted "—that is with up to 50% increase in heater voltage the emission could often be restored to normal. Although this " restoration " normally worked only for a limited period, usually not longer than six months, we will only require to view the tube for short periods as most of our monitoring will be done by ear and the increased life will be correspondingly longer. The " boosting " is best done by using one of the " low capacity " isolating transformers designed also to overcome the effects of heater to cathode short circuits. A good scheme is to apply the maximum boost only when taking photographs from the screen ; in this way the life of the tube will be even more extended. Extra *boost* can also be applied to the whole set by tapping down the mains adjuster for short periods, but please note that this is *NOT* recommended for normal domestic equipment where any variation from the correct supply is detrimental to valve and cathode ray tube life. It is only suggested for this *particular* application, where the equipment has probably already exceeded its normal life expectation. Any further use is purely gratuitous, and we are in fact only interested in a short term high performance rather on the lines of photo flood-lamps. The application of this otherwise bad practice is therefore considered legitimate.

Converting the Sound Channel into an Audible Vision Carrier Monitor

As mentioned previously, the existing sound channel frequency is now very near the peak of our new vision carrier. It therefore forms a good ready-made monitor receiver, but to make it ideal we need some form of quieting when no carrier is being received.

The changes necessary to do this are shown in Fig. 9. It consists in applying a small bias to the detector, so that it doesn't conduct until signals reach a predetermined level. In operation this system is highly satisfactory and any other form of long-term monitoring is not recommended. With practice the " goodness " of the vision carrier being received can be detected by ear, for it should be appreciated that sometimes as many as three or four stations are received on the same channel and whatever their strength useful pictures are unattainable. Another useful refinement is to have means of extending the loudspeaker. This is not as straightforward as it might appear, for this is one case where a little knowledge is definitely dangerous. The chassis of most television receivers is at mains potential and therefore can be lethal.

The sound output transformer on most sets is not designed with a sufficient safety margin to allow for adequate insulation, the risk may be small but it is there, so always fit one of the small insulating transformers designed for this purpose. This applies when extending any loudspeakers from any AC/DC equipment unless the correct safety measures have already been taken by the manufacturers. One big advantage of the extension speaker is that normal household life can go on undisturbed and monitoring can therefore be carried out *ad lib.* Younger members of a household might often be coerced or bribed to "lend an ear" whilst carrying on with their normal activities, although unless some sort of prize is offered for successful "alerts" interest may soon flag. Some pattern of the usual reception conditions to be expected in early summer may be helpful and a few extracts from the author's log book are shown below. It should be stressed for those who feel that results are too spasmodic to hold interest that not once during the months of MAY, JUNE or JULY of this year was there an evening when long distance reception of some sort did not occur. However, unless the video signal is heard "loud and strong" for a duration of three minutes or more—in every ten—it is doubtful whether the pictures will be worth photographing. It is therefore best to resist the temptation to even "look" until the mute is being lifted fairly regularly and the signal sounds "clean" and free from heterodynes.

Date	*Time B.S.T.*	*Barometric pressure inches*	*Temp. °C.*	*Local weather conditions*	*Stations received*	*Comments, notes, etc.*	*S Meter*
1/7/62	1.25	30.25	11.6	Cloudy	Czechoslovakia Budapest	Fairly steady for one hour	3 3
2/7/62	7.15	30.3	11.1	Cloudy	Spain West Germany	Spain steady until 8.15 p.m.	4
3/7/62	7.20	30.3	10	Very overcast	Spain One other unidentified	Complete fade-out after 9.15 p.m.	R3
4/7/62	6.50	30.45	13.3	Steady rain, close	Spain West Germany	Spain very good West Germany fading	R9+ R3
5/7/62	7.10	30.6	14	Dull, cloudy	Spain	Heavy fading, no signals after 8 p.m.	R4
6/7/62	1.25	30.5	13.9	Cloudy	Budapest Warsaw	Spasmodic reception all day until 10.45 p.m.	R3–4
7/7/62	5.30 to 10.30	30.5	17.7	Fair, warm	Four superimposed	Strong unusable signals	R9+
8/7/62	5.30 to 10.30	30.4	18	Fair, warm	Three superimposed	Strong unusable signals	R9+
9/7/62	7.30 to 10.30	30.2	15	Fair, warm	Not identified	Signals until 8.30 p.m.	R3
10/7/62	8.00	30.3	13	Rain	Spain Russian Italian	Signals until 10.15 p.m.	R3
11/7/62	7.45	30.2	10	Rain	Spain West Germany	Signals until 9.30 p.m.	4
12/7/62	7.30	29.9	13	Cloudy	Czechoslovakia Spain Italy	Signals until 9.15 p.m.	3
13/7/62	6.45	29.7	13	Cloudy	—	No usable signals	—
14/7/62	7.00	29.7	18	Cloudy	—	No usable signals	—
15/7/62	7.10	29.8	16	Cloudy	—	No usable signals	—
16/7/62	6.45	30.0	13	Cloudy, fine	Spain West Germany	Signals until 8.15 p.m.	R4
17/7/62	8.00	30.0	13	Cloudy, fine	Spain Poland	Signals until 8.45 p.m.	4
18/7/62	7.10	29.6	12	Cloudy	Spain Germany	Very spasmodic signals	3

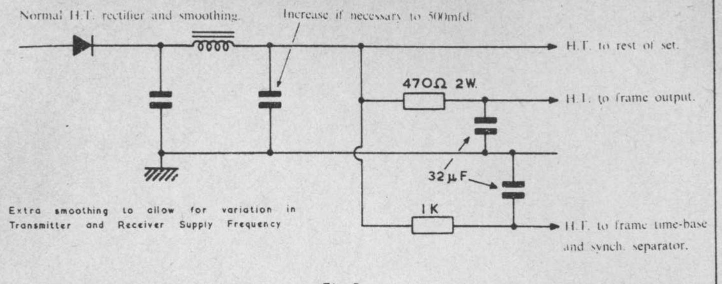


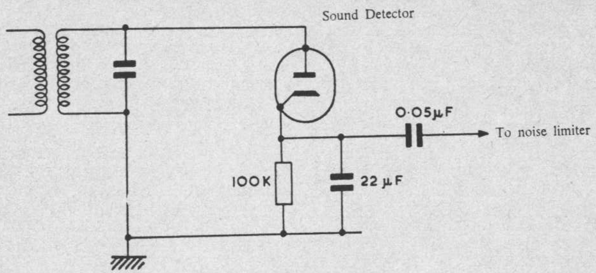
Fig. 8

SECTION 4: AERIALS BEST SUITED FOR SPORADIC "E" TELEVISION RECEPTION

Experiments carried out by the author would indicate that the requirements for aerials designed for receiving Sporadic "E" Television differ from those for fringe areas. Fringe area aerials are designed to concentrate energy received from one direction, usually at low angles, while discriminating as much as possible against signals from all other directions. The usual high gain Yagi array is essentially a narrow band highly directional device, and possibly because of this appears to offer little advantage over simple dipoles. My present theory, which is based on results obtained in practice, is that the signal arrives at an oblique angle diffused as it were over a wide area, making a broad acceptance angle an advantage. A simple horizontal dipole has worked as well as anything yet tried by the author in his particular location, where space does not allow the larger Rhombics or Vee beams which many consider ideal for this job. Other enthusiasts have spoken so highly of the large Vee beam that I would recommend its use if space permits. Fig. 10 shows details of its construction.

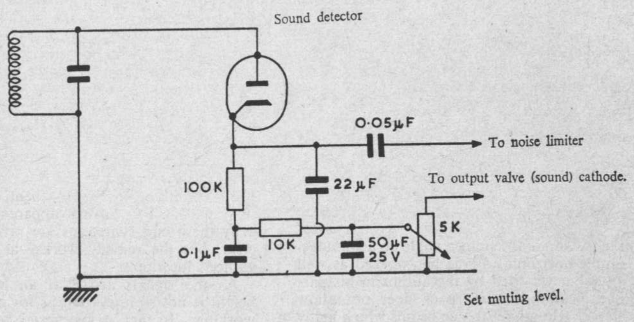
The simple horizontal dipole has the following important factors in its favour. It is light and can therefore be erected high with a simple mast. It has a broad bandwidth if the rods are made wide or constructed as in Fig. 11, and it possesses a good null point. The null points are useful, as shown in Fig. 12, for rejecting a local transmitter on the DX. channel. Although the Continental Standard is mainly for horizontal aerials, it has been found useful to have a vertical aerial as well. Strangely enough, the usefulness of this vertical dipole has been in the occasional improvement of picture quality rather than the signal strength. The picture has been found to slowly turn "smeary" just as though the bandwidth were progressively being reduced. Switching to the Vertical aerial has made an immediate improvement, the propagation polarisation having apparently changed. Why these odd symptoms are produced is not clear, but the remedy works—at least in the author's location.

As the signals arrive at an oblique angle height is not so important as for normal fringe working. In fact, a low aerial behind a local obstruction can be useful for reducing the signal from the local BBC on your DX. channel. A height of up to 40 feet above the ground level does appear to give a corresponding increase in signal, however, and the author has found it convenient to use slender steel masts purchased from the local plumber which can be readily taken down during high winds or when not in use.



ORIGINAL CIRCUIT

Simple modification to vision carrier audible Monitor.



MODIFIED CIRCUIT

Fig. 9

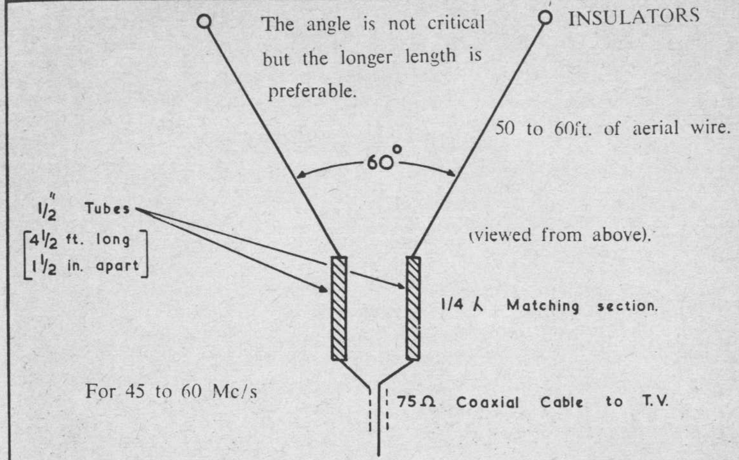


Fig. 10 Vee Beam Aerial

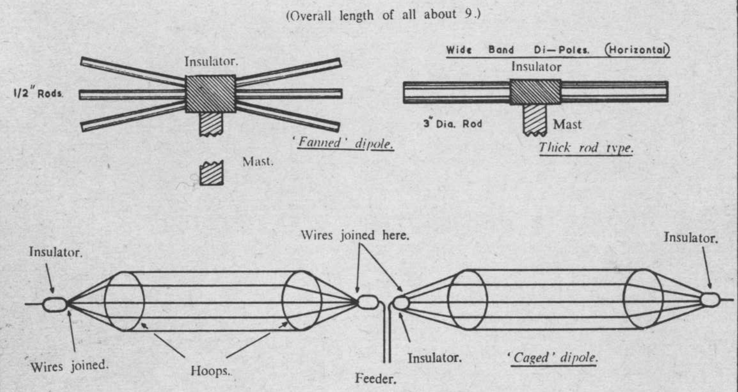
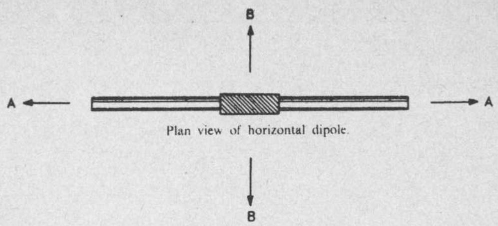


Fig. 11



DIRECTIONS. *A.* Minimum signal when receiving horizontally polarised transmissions.

B. Maximum signal when receiving horizontally polarised transmissions, sharp minimum when receiving vertically polarised transmissions.

Fig. 12

SECTION 5: PHOTOGRAPHING DIRECT FROM THE TV SCREEN

The author is a relative newcomer to photography and has had to rely very much upon the advice of others more experienced in this field. Opinions as to the best procedure to follow within the definite limitations of the equipment available were decidedly varied, however, and in the end it was, as is often the case, a question of trial and error. Mostly error at first, but slowly the picture quality and the consistency of results obtained improved. The principal decisions to be made were between using larger negatives to start with, or the 35 mm. type and subsequent enlargement, and also the advisability of using a relatively cheap close-up lens.

By using the 35 mm., more "shots" could be obtained for a smaller outlay, and this was considered a sufficient reason for choosing this size. The use of the close-up lens enabled the 15-inch screen to fill the available negative and so reduce "grain" for a given size enlargement. The question here was, would the poorer quality close-up lens (compared with the existing camera lens) spoil any improvement attained by this increased negative area. The results in practice were slightly in favour of the close-up lens, taking into account the loss of focus already inherent in the corners of the TV screen. Points which are probably self-evident to photographers were, of course, new to myself and so are listed for the benefit of others in the same category.

Firstly, always use a fast film (e.g. ILFORD H.P.3). Use the widest aperture, provided you are sure of your focus. This can be checked visually by the aid of a piece of *frosted* glass placed, of course, exactly in the position the film occupies. The best shutter speeds were found to be 1/25th or 1/30th of a second. The only other points worth mentioning are to either use a tripod or preferably make a permanent stand, and also to ensure there are no reflections from the CRT or window. Lastly, and probably the most important point of all, perhaps you will be lucky enough (as the author was) to find a local photographic dealer who will take more than usual interest in the development and printing and so contribute greatly to the success of your pictures.

SECTION 6. ADDRESSES OF THE EUROPEAN TELEVISION SERVICES FOR PROGRAMME CONFIRMATION PURPOSES

In order to enable viewers who are interested in foreign television to obtain confirmation of reception etc., listed herewith are the names and addresses of various television broadcasting stations on the continent of Europe.

ALBANIA.	Radiodiffusion Television Albanaise, Rue Conference de Peza, 3, TIRANA
BELGIUM.	Radiodiffusion-Television Belge, Place Eugene Flagey, 18, BRUSSELS, 5.
BULGARIA.	Bulgarian Television, G. Genov St., 7, SOFIA.
CZECHO-SLOVAKIA.	Ceskoslovenska Televize, M. Gorkeho, 29, PRAGUE, 1.
DENMARK.	Radio Denmark, Television Service, Radiohuset, Rosenornsalle, COPENHAGEN.
EIRE.	Radio Eireann Telefis, 34/7, Clarendon Street, DUBLIN.
FINLAND.	Suomen Televisio, Pasila, Ilmaka, HELSINKI.
FRANCE.	Radiodiffusion-Television Francaise, 107, rue de Grenelle, PARIS, 7.
FRANCE. (Regional Services.)	,, ,, ,, 32/4, rue Ulysse Gavon, BORDEAUX.
	,, ,, ,, 36, Blvd. de la Liberte, LILLE.
	,, ,, ,, 6, Blvd. Victor Hugo, LIMOGES.
	,, ,, ,, 20, Quai Gailleton, LYON.
	,, ,, ,, 2, allee Ray Grassi, MARSEILLE.
	,, ,, ,, 6, av. Hippolyte Maringer, NANCY.
	,, ,, ,, 9, avenue Janvier, RENNES.
	,, ,, ,, Place de Bordeaux, STRASBOURG.
	,, ,, ,, 78, allees Jean Jaures, TOULOUSE.
W. GERMANY	Bayerischer Rundfunk, Rundfunkplatz 1, Funkhaus, MUNICH, 2.
	Hessischer Rundfunk, Bertramstrasse, 8, FRANKFURT AM MAIN, 6.
	Radio Bremen, Heinrich-Hertz-Str. 13, BREMEN.
	NDR-Fernsehen, Gazellkamp 57, HAMBURG-LOCKSTEDT.
	WDR Fernsehen, Wallrafplatz, 5, COLOGNE.
	Saarlandisches Fernsehen A.G., Schloss Halberg, SAARBRUCKEN, P.O. Box 1050.
	Sender Freies Berlin, Fernsehen, Masurenallee 8/14, BERLIN, 19.
	Suddeutscher Rundfunk Fernsehen, Neckarstrasse, 145, 7000, STUTTGART.
	Sudwestfunk, Fernsehen, Hans Bredowstrasse, BADEN-BADEN.
	German Democratic Republic. Deutscher Fersehfunk, Rudower Chaussee, 116, BERLIN-ADLERSHOF.
GIBRALTAR.	28, John Mackintosh Square, Gibraltar.
HOLLAND.	Nederlandse Televisie Stichting, P.O. Box No. 10, HILVERSUM.
HUNGARY.	Magyar Radio es Televizio, V. Szabadsagter, 17, BUDAPEST
ITALY.	Radio-Televisione Italiana, Via del Babuino, 9, ROME.
MALTA.	The Malta Television Service Limited, Gwardamanga, MALTA, G.C.
MONACO.	Tele Monte-Carlo, 16, Blvd. Princesse Charlotte, Monte Carlo.
POLAND.	Polskie Radio I Telewizja, Telewizja Plac Powstancow Warzawy 7, WARSAW.
PORTUGAL.	Radiotelevisao Portuguesa, S.A.R.L., Rua de S. Domingos (a Lapa), 26, LISBON.
RUMANIA.	Radiodifuziunea Televizunea Romina, Studioul de Televiziune, Str. Moliere, 2, BUCAREST.

SPAIN.	Television Espanola, Avenida de la Habana, 77, MADRID.
SWEDEN.	Sveriges Radio, Radiohuset, Oxenstiernsgatan, 2, STOCKHOLM.
SWITZERLAND.	Swiss Television, 26, Kreutzstrasse, ZURICH.
U.S.S.R.	The Sovjet Television, Tsentralnaja studija televidenija, Moskva, ul. Sjabolovka 53, MOSCOW.
	„ „ „ Leningradstaja studija televidenija Leningrad, ul. Malaja Sadovaja 2, LENINGRAD.
	„ „ „ Kijevskaja studija televidenija Kijev, Krestjatik, 24, KIEV.
	„ „ „ Minskaja studija televidenija Minsk, ul. Kalinina, 6, MINSK.
	„ „ „ Rizjskaja studija televidenija Riga, ul. B. Nometnu, 62, RIGA.
	„ „ „ Tallinskaja studija televidenija Tallinn, ul. Krejtsvalda, 14, TALLINN.
	„ „ „ Bakinskaja studija televidenija Baku, Parovaja ul. 1, BAKU.
	„ „ „ Tasjkentskaja studija televidenija Tasjkent, ul. Navoi, 69, TASHKENT.
	„ „ „ Jerenvanskaja studija televidenija Jerevan, pr. Ordzjonokidze 22, JEREVAN.
	„ „ „ Tbilisskaja studija televidenija, Tbilisi, pr. Rustaveli, 12, TBILISI.
	„ „ „ Vilnjusskaja studija televidenija, VILNIUS.
	„ „ „ Alma-Atinskaja studija televidenija, ALMA-ATA.
	„ „ „ Kisjinjovskaja studija televidenija, KISJINJOV.
YUGOSLAVIA.	Television Yougoslave, 70B, Kidrica, BELGRADE.

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