SERVICING

THE BAIRD DISC MODEL "TELEVISOR"

By H. J. BARTON CHAPPLE, A.M.I.E.E.

THE ordinary Baird disc model "Televisor" (Fig. 1) is essentially quite a simple piece of apparatus capable of reproducing television images of good quality in the home. It serves the eye in a manner similar to that in which the loud speaker serves the ear, but, like the loud speaker, it cannot give of its best unless the signals passed to it are above suspicion.

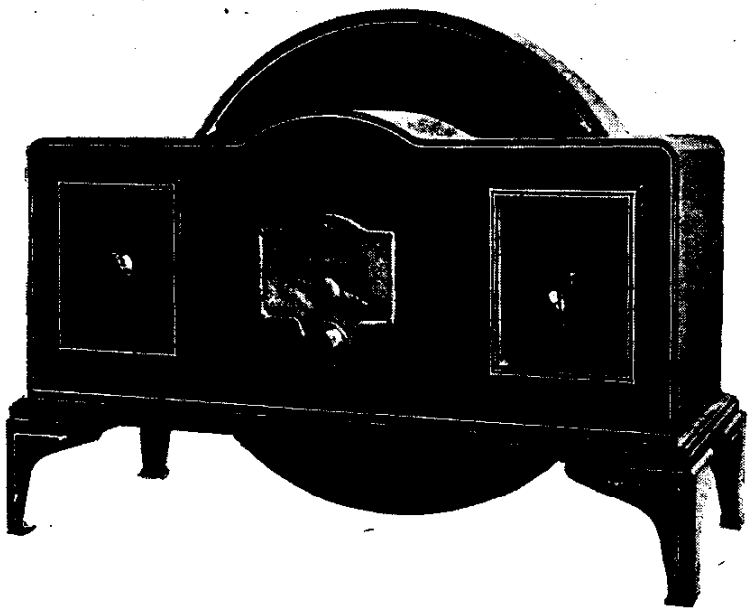


Fig. 1.—THE BAIRD DISC MODEL "TELEVISOR."

Symptoms of Faults

Under normal use, therefore, it is necessary to be able to recognise certain symptoms when the apparatus does not appear to be functioning satisfactorily, as in this way the task of servicing is made much simpler. The numbered list gives the most likely untoward effects which may be observed, and methods of curing them will be dealt with in the same order. In this it will be recognised that many of the faults arise from the wireless set which is receiving the television signals, but in view of the paucity of information associated with the newest offshoot of broadcasting it was felt necessary to include these in the list to make the story quite complete.

1. Vertical black lines on image area.
2. Lateral image movement.
3. Bad image hunting (vertical).
4. Refusal of synchronising mechanism to hold image.
5. Noisy motor.
6. Failure of motor to start.
7. Image area diamond shaped irrespective of speed control knob position.
8. Neon lighting wrong way.
9. Image movements reversed.
10. Neon light intensity effected by switching on of motor.
11. Stationary light splashes on image.
12. Insufficient neon brilliancy.
13. Dark patches on neon plate area.
14. Vertical lines travelling across image.
15. Negative image.
16. Fine mesh pattern over neon area.
17. Indistinct image with light thrown up behind image and beardlike shadows.
18. Blurring or out-of-focus effect.

Essential Parts of a Baird Disc Model "Televisor"

Before dealing with these in turn it is advisable to consider briefly the four essential parts of a Baird Disc Model "Televisor."

The Aluminium Disc

The first of these is a disc of light aluminium perforated by a spiral series of apertures. The last three of these aper-

tures and the first three are rectangles; the others are squares, the effect of this being to give an image with the fine grain concentrated at the centre, where the more important details of the picture are met with, and a rather coarser grain at the edges. This makes the most efficient use of the detail permitted by a 9-kilocycle band, which is all that can be transmitted through the B.B.C. medium-wave stations at present.

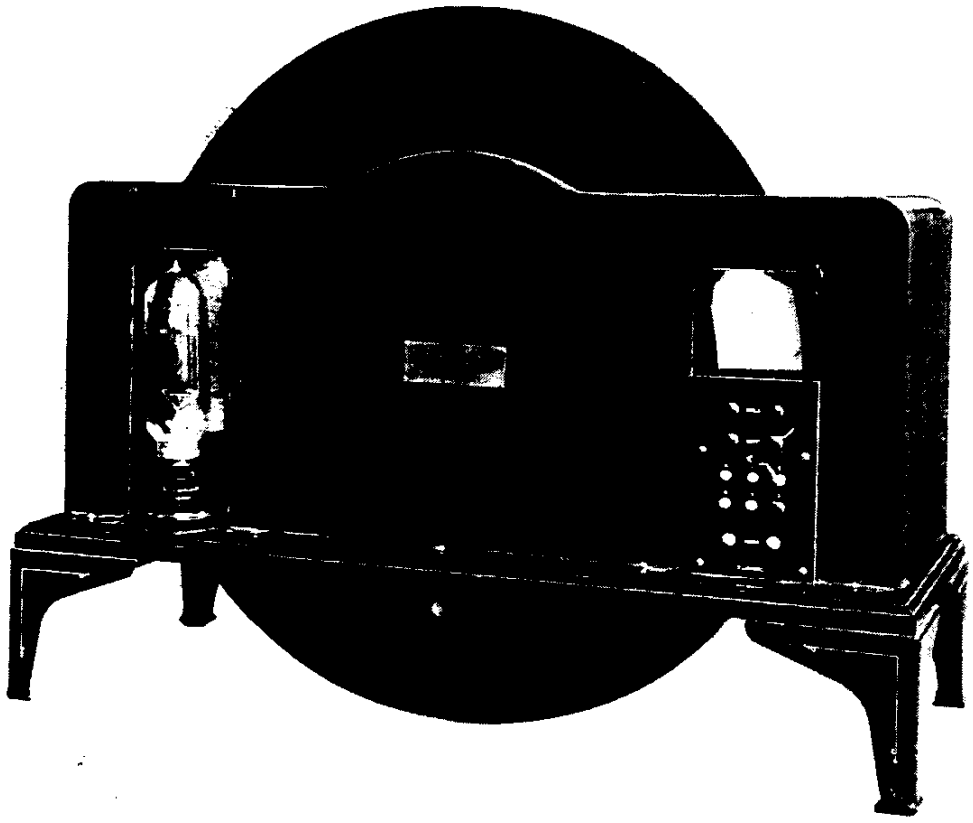


Fig. 2.—THE BACK OF THE "TELEVISOR."

To remove the main casing it is necessary to take out the wood screws passing into the wooden base through the casing lip edge at the back.

If the image area is diamond-shaped with lines sweeping downwards or upwards, the motor is running either too slow or too fast. This can be remedied by altering the position of the wandering lead terminating in a spade tag on the back terminal board which can be seen above.

The Electric Motor

The second essential is the electric motor to rotate the disc, and for this purpose a Universal motor, which can be run from any electric supply, either D.C. or A.C., is employed. This motor rotates the disc at 12½ revolutions per second, a speed which has been decided upon, after very careful investigation, as giving the best compromise with the given waveband permissible. A higher speed reduces the flicker, but tends to sacrifice detail within the allotted sideband.

The Synchronising Gear

The third component is the synchronising gear. It is essential that the receiver should revolve exactly *in step* with the transmitter, and to devise an apparatus which would accomplish this in a commercial form constituted one of the most serious problems in the construction of a commercial apparatus. The Baird Automatic Synchroniser makes use of the thin black strip dividing consecutive pictures to provide a synchronising impulse at the top of each line of the picture. This synchronising impulse of a frequency of 375 is fed to coils actuating electromagnets pulling upon the teeth of a cogged wheel. These teeth are separated from one another by gaps four times the width of the teeth themselves, and it is essential for proper functioning that the air gap between pole face and the tooth face should be as small as possible, something of the order of ·006 inch.

The Neon Tube

We now come to the Neon tube, the fourth item. In the Baird "Televisor" a mica-backed plate is used as the negative-electrode. This glow discharge is viewed by the observer through the

perforations in the rotating disc, and its luminosity is controlled by the incoming television signal. The fluctuations of this lamp as viewed through the disc create the image, which is built up by the moving spot of light—the light being bright at the high lights and dim at the shadows, and moving with such rapidity across the field of view as to create the illusion of a moving image similar to that which obtains at the cinema.

How to Operate the "Televisor"

The method of operation of the "Televisor" is as follows:—

First of all the wireless receiver is tuned in to the television signals, broadcast on a wavelength of 261 metres at present. As, however, the signals must be amplified sufficiently to light the neon tube, and as, furthermore, it is essential that distortion should be reduced to the absolute minimum, good results can only be expected from a first-class wireless set with a properly designed L.F. amplifier.

Starting the Television Receiver

In operation the signals should first be checked by means of a loud speaker, and when the characteristic rhythmic hum is heard at full strength the television receiver can be started. The motor is switched on and then slowly speeded up by means of the rheostat on the extreme left. On looking through the lens, whirling reddish patches will be seen, which, as the motor speeds up, will resolve themselves into a succession of images moving rapidly downwards. As the motor attains the correct speed the motion of the images slows, and gradually comes to rest, being held in position by the synchronising device.

Adjusting the Motor Speed Rheostat

The picture, however, when synchronised may be split vertically, that is to say, you may see a face divided in two.

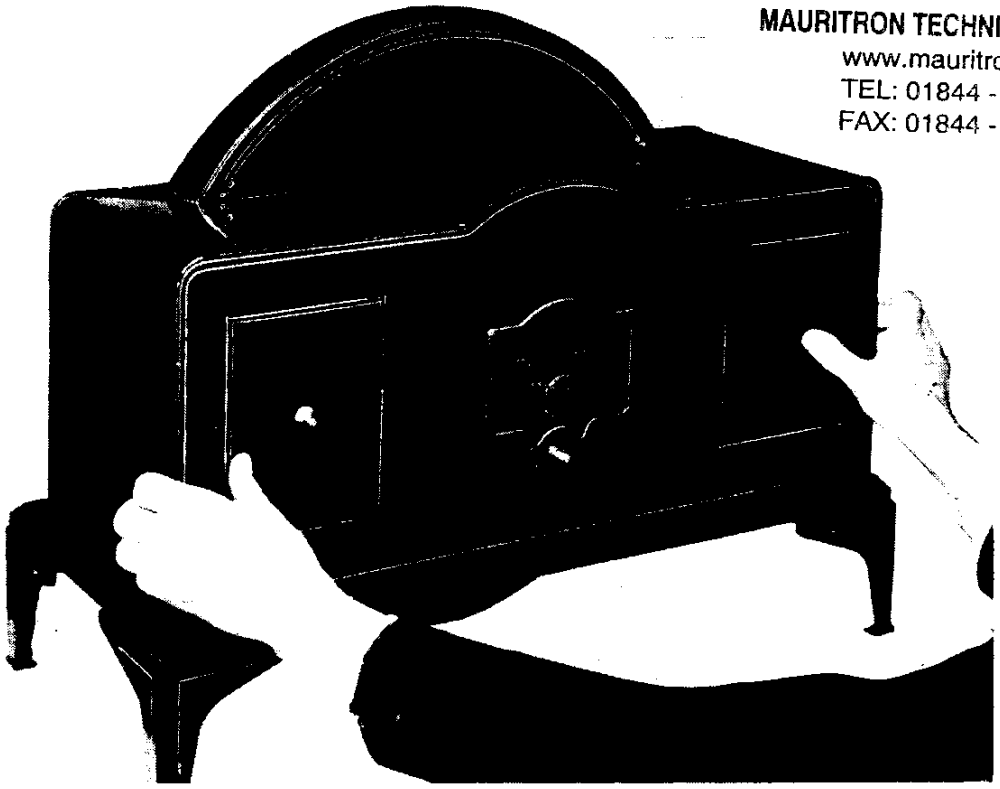


Fig. 3.—How to Remove the Front.

The front must be pulled forward gently to ease it away from the metal strip normally holding it down in place.

To rectify this the image should be allowed to drift by adjusting the motor speed rheostat. When the correct position is obtained the image will hold in place if the rheostat knob is readjusted. A further final adjustment may have to be made by means of the framing knob in the centre. This rotates the synchronising device, and thus moves the picture up and down to get the final correct framing. All synchronising operations should be done slowly.

FAULT FINDING

If all these points are properly understood and the resultant image or func-

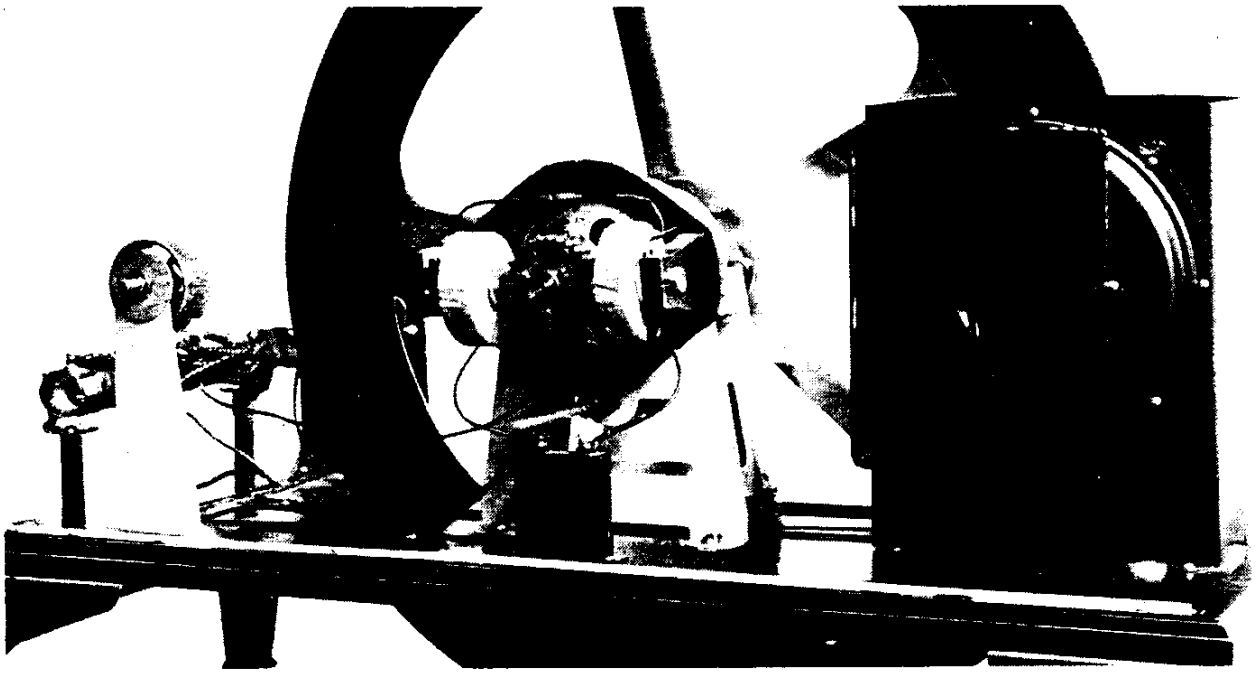


Fig. 4.—THE "TELEVISOR" WITH CASE REMOVED.

tioning of the machine still seems to be at fault, then it must be overhauled.

Vertical Black Lines on Image Area

First of all the presence of stationary vertical black lines on the image may be due to interference from the 50-cycle A.C. mains. To cure this the position of the "Televisor" should be altered in case there is direct pick-up, and, in addition, run the mains leads to the motor in lead-covered cable and earth the lead covering.

Lateral Image Movement

Lateral image movement, that is, a "swaying" to left and right, can arise from a bent motor shaft or a disc out of centre.

Removing the Main Casing

To test this it will be necessary to remove the main casing. Remove both the front knobs by loosening the grub screws and slide off both the neon and terminal casings at the back. Then take out the wood screws passing into the wooden base through the casing lip edge at the back (see Fig. 2). Turn the "Televisor" on its side and loosen the screws passing through the baseboard from the underside into the front edge of the casing.

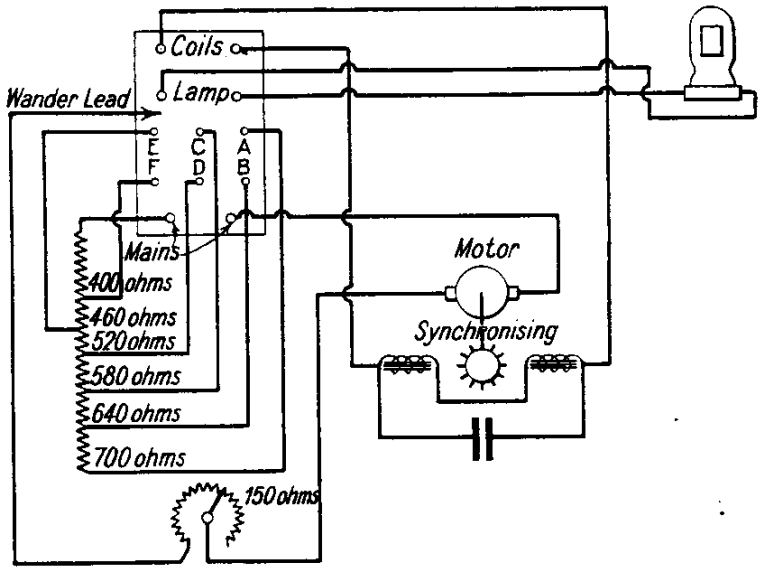


Fig. 5.—THEORETICAL DIAGRAM OF THE BAIRD DISC MODEL "TELEVISOR."

The front must now be pulled forward gently to ease it away from the metal strip normally holding it down in place. This process is seen in Fig. 3, and if any attempt is made to pull the casing too far forward it will foul the disc at the back and possibly damage it.

What to do if the Shaft or Disc is Out of Truth

Once the case has cleared the strip and two control spindles it can be lifted off, and the machine will then be as Fig. 4, the front metal strip on the baseboard, to which reference has just been made, being clearly visible. The motor can now be started in order to see whether the shaft or disc is out of truth. If the former, straighten it with light taps from a wooden mallet, but if the latter, it is advisable to replace the disc with a new one.

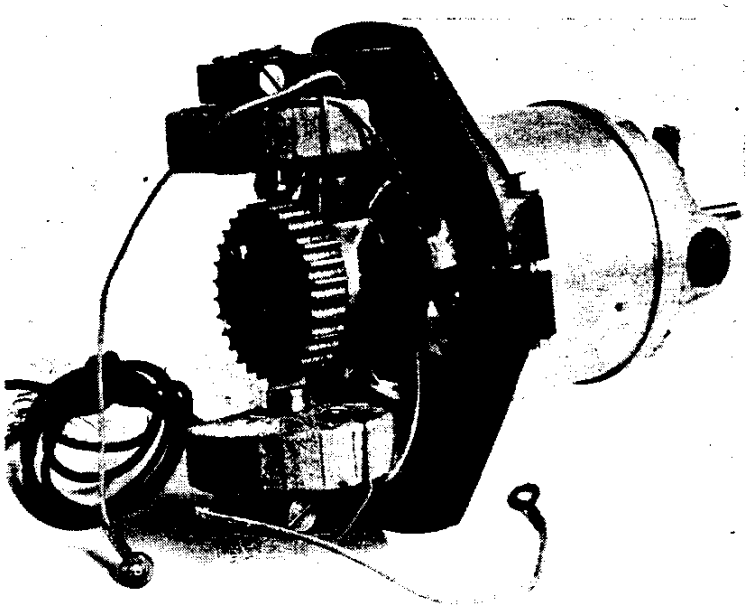


Fig. 6.—THE MOTOR AND SYNCHRONISING MECHANISM.

Bad Vertical Image Hunting

Bad vertical image hunting can arise from a variety of causes, but should be due primarily to an absence of adequate synchronising action. See whether every opposite pair of teeth in the cogwheel is in direct line with the pole pieces. Check the clearance distance between tooth edge and pole tip, this distance being ·006 inch or, as a fair guide, the average thickness of a safety razor blade. If not correct, close the gap by tapping gently the outside of the pole piece after loosening the screws gripping them in place.

Examining the Motor and Synchronising Mechanism

It may be advisable to remove the straps from the bracket holding the motor in place and lift out the motor and synchronising mechanism after having taken off the disc. This section of the apparatus will be seen in Fig. 6, and can now be subjected to closer scrutiny. Pass a direct current of not more than 25 milliamperes through the two coils as then joined in series and test with a compass to prove they are of opposite polarity (see Fig. 7). If not, reverse the windings on one coil. Remove any burrs that happen to be on the cogwheel teeth, using a very fine jeweller's file for the purpose.

Dismantling the Synchronising Mechanism

Try out the framing mechanism, and if this is sticky or has back lash, dismantle the mechanism completely, as in Fig. 8, and examine each part separately. The framework holding the coils must not bind on the cylindrical surface of the motor carcase. Remove any foreign matter and clean up the rubbing or sliding surfaces. When this has been done, reassemble, and the bad image hunting should then be cured. Of course it is assumed that the normal current of 25 milliamperes is being passed through the coils under working conditions and that the picture signal modulation superimposed on this from the receiving set's output valve is a strong one, at least 1½ watts. The secret of successful television reception is bound up in the question of synchronising, and that is why so much attention must be paid to this part of the apparatus.

Refusal of Synchronising Mechanism to hold Image

If the synchronising mechanism refuses to show any tendency to hold the image steady—point No 4—then either one or both of the coils are disconnected (test here for continuity in the usual way) or, alternatively, the ·1 mfd. condenser joined in parallel across the coils may have developed a partial or complete short circuit. Remove the connections to the condenser and test this out in the normal manner and replace if defective.

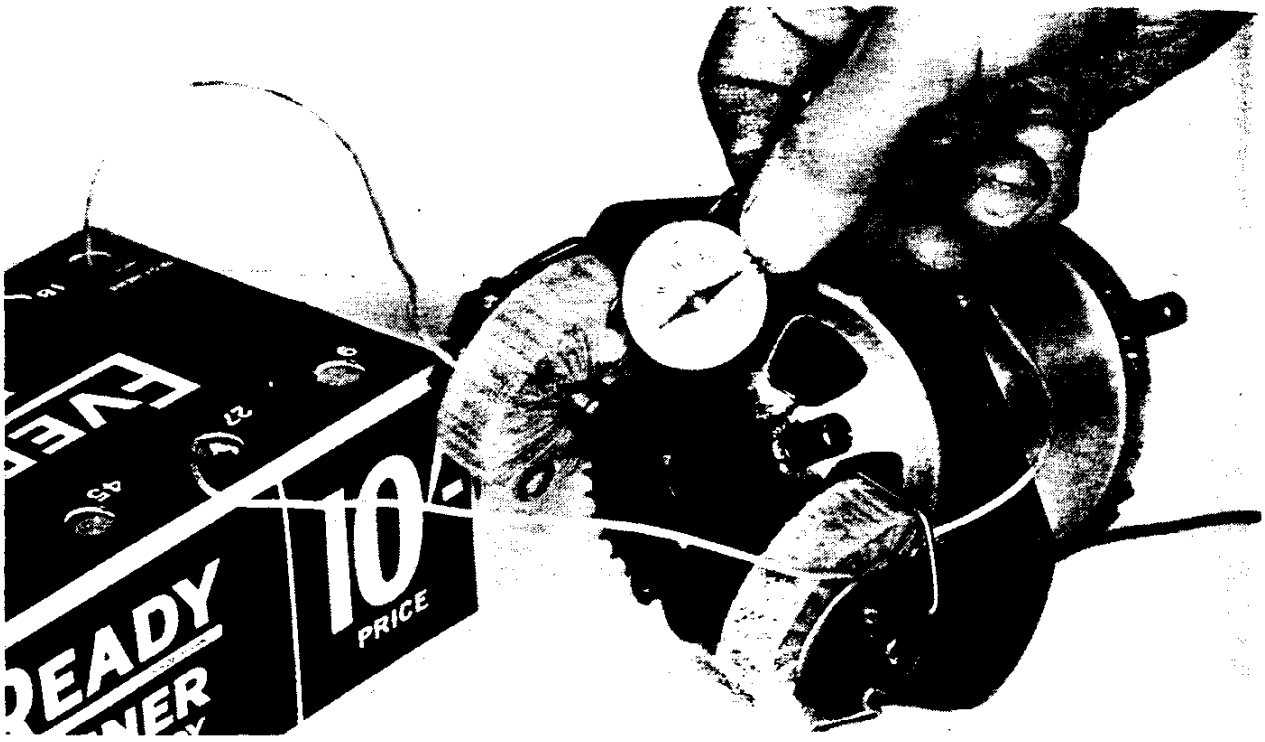


Fig. 7.—How to Test the Coils to see that they are of Opposite Polarity.

A direct current of not more than 25 milliamperes should be passed through the coils. If they are not of opposite polarity, reverse the windings on one coil.

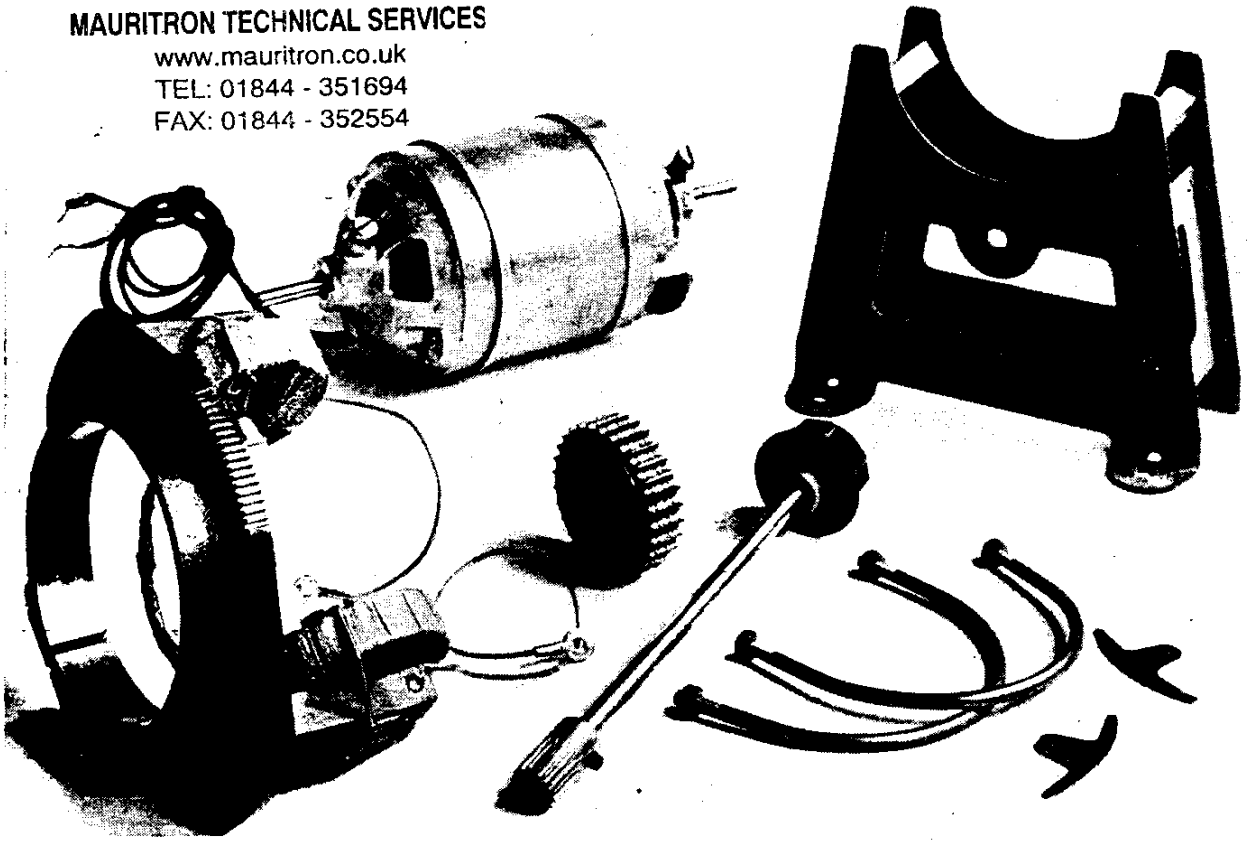


Fig. 8.—The Synchronising Mechanism Dismantled.

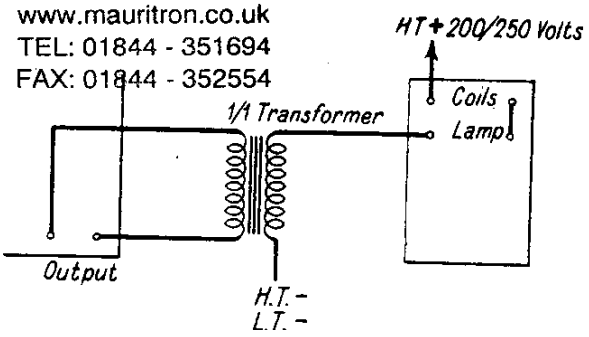


Fig. 9.—WIRING UP THE "TELEVISOR" AND WIRELESS RECEIVER.

With a receiver having direct or choke output the connections should be made in conjunction with an output transformer.

Noisy Motor

A noisy motor may be due to a tooth or teeth of the cogwheel striking a pole piece, and the remedy lies in resetting the position of the cogwheel, or the motor shaft may be slightly out of truth. Furthermore, a little lubricant may be called for, the cups for this purpose being at the top of the motor. The brushes may be chattering on the commutator, or one of the "micas" may be raised. Re-bed the brushes and thoroughly clean up the commutator with fine sandpaper.

Motor Fails to Start

Should the motor fail to start, trace through the main leads passing to the motor. The tapped fixed resistance and the variable resistance on the left-hand right-angled bracket are included in one of these leads, so continuity must be traced in both these. The moving contact on the resistance may be failing to make contact, or there is, perhaps, a break in one of the leads, which can be readily remedied.

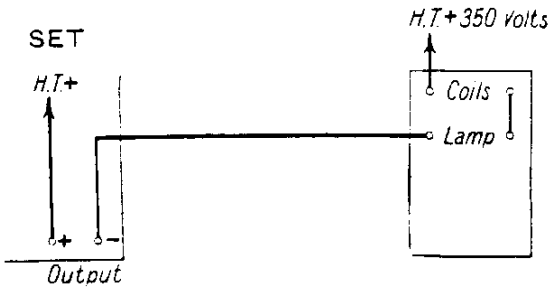


Fig. 11.—WIRING UP THE "TELEVISOR" AND WIRELESS RECEIVER.

This shows the connections used when a high voltage is available.

What to do if the Image Area is Diamond Shaped

If the image area is diamond shaped with lines sweeping downwards, then the motor is running too slow, while if diamond shaped with lines sweeping upwards, the motor is running too fast. This can be remedied by altering the position of the wandering lead terminating in a spade tag on the back terminal board, seen in Fig. 2. These terminals are marked A to F, and the tag should be inserted under each in turn so that the normal speed of 750 revolutions per minute is obtained with the moving contact of the variable speed control in approximately its central position.

Neon Lighting Wrong Way

The flat-plate neon lamp consists of a mica backed flat-metal plate with a

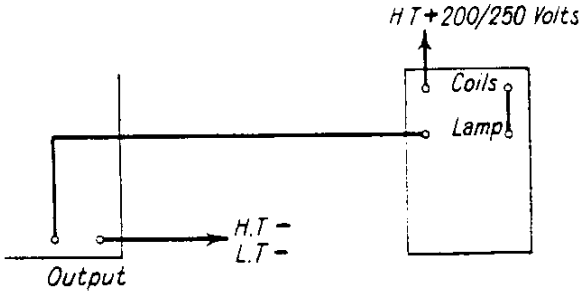


Fig. 10.—WIRING UP THE "TELEVISOR" AND WIRELESS RECEIVER.

This shows the connections when the wireless receiver includes its own output transformer

second electrode taking the form of a rod, seen in Fig. 2. The plate should glow evenly over the whole of its area with the characteristic reddish orange neon colour. If the bar is luminous and not the plate, remove the batten neon lamp holder and reverse the leads and the matter will be rectified.

Image Movements Reversed

When the image movements are reversed, that is to say, a head moved to the right at the transmitting end is shown as one moved to the left at the receiving end, it shows that the disc is mounted the wrong way round on the shaft. Loosen the grub screw in the disc boss, lift off disc and place back in same position on shaft

but with the disc reversed to enable correct scanning direction to be made when disc is rotating.

Neon Lighting Intensity effected by Switching on of Motor

Sometimes it is noticed that the intensity of the neon lighting is affected by switching on of motor. This is caused by the leads to the motor being in electrical contact with the neon leads at the back of the terminal board. Take steps to separate them, adding a layer of insulating or binding tape, if felt desirable, to ensure they do not touch, and wholly or partially short through one to the other.

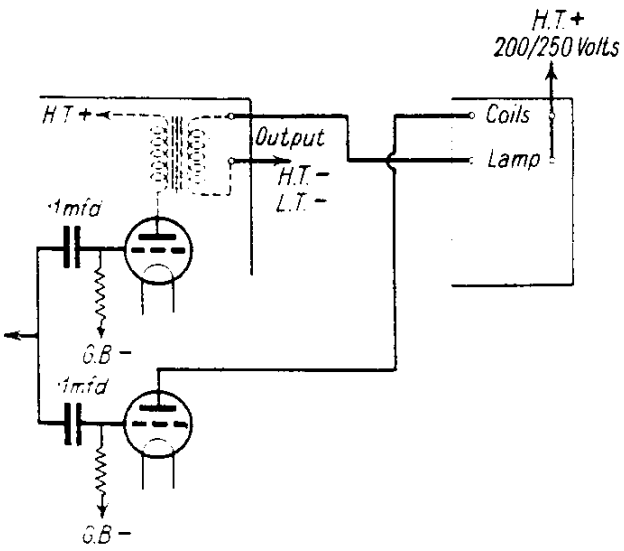


Fig. 12.—Using an Additional and Separate Synchronising Valve to Feed the Coils of the "Televisor" when the Set incorporates its own Output Transformer.

The same method is employed with receivers having direct or choke output, except that an output transformer is included in the connections to the lamp.

Stationary Light Splashes on the Image

Stationary light splashes on the image something like that shown by the white spots on Fig. 14 (by the way, the white spots may be black) are caused by the sparking on the commutator of the disc motor. Clean up the commutator with fine glass-paper, see that the brushes are properly bedded down and not broken, and under proper tension. If worn too far down, replace the brushes with new ones and bed down.

Clearing Motor Interference

In addition, another excellent way to clear motor interference is to place two 4-mfd. fixed condensers in series across the motor brushes. Then join the junction point of the two condensers either to the motor carcase or earth, or both. Each of the three possibilities should be tried in turn to learn which is the most effective. A convenient place on the motor, if the main casing is not taken off, is the bolt which passes right through the base-board for holding down the motor support.

Fine Mesh Pattern over Neon Area

Since Fig. 14 illustrates another possible defect, namely, Item No. 16 on our list, which is a fine mesh pattern over the neon area, we will deal with that now. This is due, generally, to heterodyning from an interfering station, and can only be cut out by using a heterodyne filter on the wireless receiving set. High-frequency machines as used by hairdressers, have a somewhat similar effect, and must be cured by prevailing on the user of those machines to install anti-interference devices. Sometimes the neighbour oscillating will cause a pattern of various shapes to flick across the screen, and the cure is obvious in this case.

Other Image Disturbances caused by Atmospherics

Dealing with other image disturbances, atmospherics show themselves as violent black or white flashes, which *momentarily* blot out part or all of the image. Then, again, if it is found that spots appear at different places on the picture, the trouble is most likely to be something other than the disc motor. Faulty light switches often cause mysterious black or white splashes.

Fine Rippling Interference

Sometimes a peculiar fine rippling interference, rather similar to the grain one can see if close to a cinema screen, is present. This effect is probably more noticeable as the distance from the transmitting station is increased. It is due to the minor atmospheric disturbances, and

Fig. 13.—THE CORRECT FEATURES AS SEEN ON THE BAIRD DISC MODEL "TELEVISOR."

Fig. 14.—HOW TO IDENTIFY FAULTS.

Stationary light splashes on the image are caused by the sparking on the commutator of the disc motor. (The white spots may be black.)

in sound reception can often be heard when the carrier wave is tuned in.

Insufficient Neon Brilliancy

Coming now to Item 12, insufficient neon brilliancy will arise from an inadequate current or voltage being fed to the neon lamp. Check over with meters to see that it has 200 volts across it and that the current passing through it is 25 milliamperes. If not, use an eliminator or super-capacity battery feed that will ensure this, otherwise the resultant image cannot be watched in comfort.

Dark Patches on Neon Plate Area

Dark patches on the neon plate area are a sure sign that the lamp is worn out and needs replacing, or has been over-run and thus damaged, so that a new one is called for.

Vertical Lines travelling across Image

When vertical lines are noticed to be travelling across the image this will, no doubt, be due to motor boating in the wireless set. Employ any of the standard methods for curing this (principally decoupling), but do not forget that if both the neon lamp and wireless set are being fed from the same H.T. source, it may be that the relatively large neon lamp load has caused a big drop in the available voltage. In consequence the valves are not being fed in the proper manner and a low-frequency oscillation will result. The only sure cure is an eliminator or large batteries capable of delivering a bigger output.

Negative Image—

We now come to a negative image, that is, one in which all the light parts are dark, and *vice versâ*, just like a photographic plate from which a contact print is made.

Whereas in aural reception no account has to be taken of phase, in television this is most important. A reversal of current direction will change a positive television image into a negative one, and since under working conditions these reversals take place in the wireless set as part of its normal functioning, at the output stage the current direction must be correct.

—And How it can be Cured

To rectify matters one can interchange the output terminals on the set, reverse *either* the primary or secondary windings on the transformer preceding the last valve, while if the set is R.C. coupled throughout on the L.F. side, then change the method of rectification, that is anode bend to leaky grid, or *vice versâ*, or add another stage of L.F.

Fig. 15.—How to Identify Faults.

This somewhat exaggerated effect of a white background behind a person's head, while the white background on either side had become almost black on the top, is one of the first things one notices in images lacking low-frequency. Other causes are overloading and too little high tension, or the neon or output valve incorrectly biassed.

Indistinct Image

We now come to the last two effects, which bring about imperfect images. These are shown in a somewhat exaggerated effect in Figs. 15 and 16. The first thing one notices in images lacking L.F. is a light thrown up behind a person's head, while the white background on either side has become almost black on the top of the picture on either side. As the artiste moves from side to side the white flare above the head will follow, but in most cases will be much less intense if the artiste turns side face. In some cases of L.F. loss a dark flare like a shadow will be present on the forehead, as in Fig. 15, just above the nose, also two beardlike shadows on the lower jaw either side of the mouth will be observed.

Effect of Overloading or too little H.T.

Other causes of these very objectionable shadows or throw-ups are overloading and too little H.T., or the neon or the output valve incorrectly biassed. As a general guide, any continual streaky shadows appearing to travel up the picture are a definite indication that the lower frequencies are not compatible with what is being broadcast, and the receiving apparatus is capable of improvement in an orthodox manner familiar to all readers.

General Blurring or Out-of-focus Effect

Lack of the higher frequencies is not nearly so objectionable as that of the lower. It has the pictorial effect of a general blurring or out-of-focus effect. Note the eyes, for example, in Fig. 15. One can well consider them as losing all the H.F. permissible. The sure cure is to broaden the tuning, that is, see that the high-frequency circuits are not ultra-selective.

Excess of High-Frequency

Another fault, though one which occurs somewhat rarely in broadcast reception of television, is an excess of high-frequency, which results in haloes above certain lines running horizontally, or nearly so, across the picture (see Fig. 16). Note the white halo followed by a secondary of the original image across the top of the head, the eyebrows, mouth and shoulders. These effects are due to methods employed to prevent the attenuation of the higher frequencies. All frequency boosters are

some form of tuned circuit, and if too drastic in action will definitely oscillate, resulting in a negative image, the white halo, followed by a weaker positive one, being spaced according to the various factors of the circuit.

Resonance in Intervalve Transformers

This form of trouble is sometimes found when an ordinary sound-receiving apparatus has been connected to a "Televisor," and, while not apparent to the ear, the eye quickly detects the fault.

Fig. 16.—How to Identify Faults.

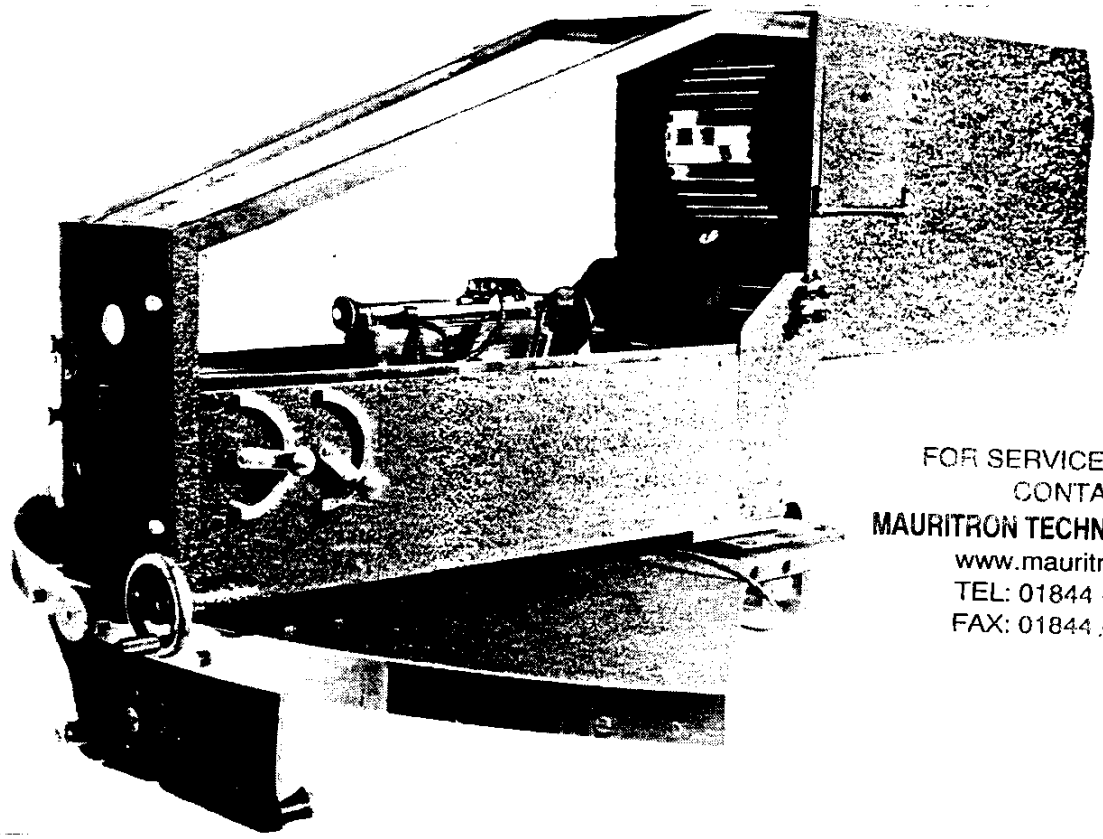
An excess of high-frequency sometimes results in haloes above certain lines running horizontally, or nearly so, across the picture.

The Cause of Resonance

The cause is due generally to a resonance in the intervalve transformers, and may be cured by suitable damping.

Feed Back in H.F. Sections of a Receiver

The halo effect may also occur from feed back in the high-frequency sections of a receiver. Most receivers, unless of the band-pass type, will give a better picture when slightly out of resonance with the transmitting station.



The Newest Type of Televisor Transmitter made by the Baird Co. for the B.B.C. and used for the regular Television Transmission.