Synchronization Still Is a Television Problem

A Suggestion for a Simple Method of Keeping Receiver and Transmitter Discs in Step

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THERE may be many problems to be solved and difficulties to be overcome before television becomes as commonplace as the radio set of today, but it is doubtful if any are of greater importance than that of synchronizing. And, judging from the advances made in this field, there is no obvious solution of the problem. Synchronizing might be compared to the weather, in that everybody talks about it but few do anything about it.

We find that the systems suggested to date are either too difficult or complicated to use, such as the idea of using an alternating current motor on the same shaft as the motor driving the disk, the frequency of the current operating the former, or a control motor being controlled by the transmitter to provide synchronous operation of both transmitting or scanning disk and the disk at the receiver.

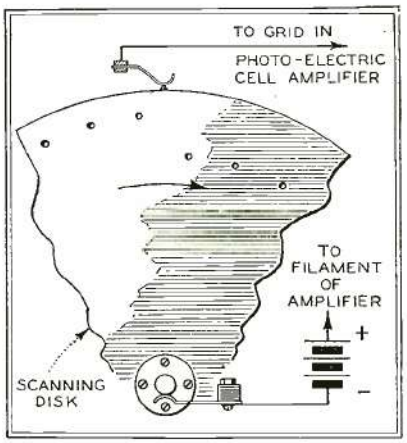


FIG. 1. ARRANGEMENT OF TRANSMITTER DISC FOR SENDING THE SYNCHRONIZING SIGNAL

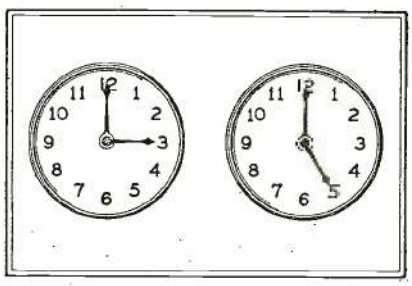
It might be well to point out that this system, as developed by the Bell laboratories and mentioned by Baird, possesses the same disadvantage as the plan relied upon by some designers of television apparatus. The latter plan is based on the use of synchronous motors where both transmitter and receiver are operated from the same power network with the assumption the motors will then stay in step. This is true to a certain extent but the promoters of this scheme forget that the motors operate isochronous, which does not always mean synchronous. To make this clearer it might be said the motors will operate at the same speed as two clocks may be running at the same rate, but the motors may be out of step as the two clocks may show a difference in time. See Fig. 3. The motors must be put in step manually and they of course should retain their synchronism, but here we meet with the trouble of overcontrolling encountered in the more common system of full manual control of motor speed. It is quite some trick to frame a picture and keep it there . . . even if one can drive a car (which operations have been often compared in speaking of full manual operation of motor speed).

What television needs is a system whereby the disks can be brought to approximate synchronism. Then, once the correct speed has been obtained, they will get in step and stay there automatically. And the equipment to do this must be simple, inexpensive and if to meet with wide application at this stage of development must be within the ability of the average experimenter to construct. As a step to that end the writer proposes the system of synchronism to be described herein which to all appearances meets the above condition.

At this point let it be understood the device has not been brought to final, complete development. It is offered as a basis for further development work along this line. It follows, of course, that any system of true synchronism necessitates cooperation of the transmitter, but the system described herein requires but a minor change in the transmitter to make possible its use.

The first requirement is that the transmitter send a strong impulse at each revolution of the scanning disk. This of course could be done by a simple contact arranged on the edge of the disk which touches a light metal spring at each revolution. The edge of the disk is preferred because the length of time the circuit is closed will then be very short, simply a pulse of current being the synchronizing signal. As shown in Fig. 1, the contacts close a circuit that acts to impress a small voltage on one of the grids of the tubes in the amplifier normally used to amplify the currents from the photo-electric cell or cells used with the scanning disk. Thus for each revolution of the disk a strong impulse will be transmitted, this impulse occurring when the lower scanning hole is leaving and the upper hole is approaching the scanning aperture. It will be evident that when the receiving disk is in synchronism with the transmitter this strong impulse giving a light spot will not intrude upon the picture except in the extreme upper left and lower right corners of the received picture and then but slightly.

FIG. 3. TWO DISCS MAY RUN AT THE SAME SPEED JUST AS TWO CLOCKS MAY RUN AT THE SAME SPEED AND YET BE OUT OF STEP WITH ONE ANOTHER



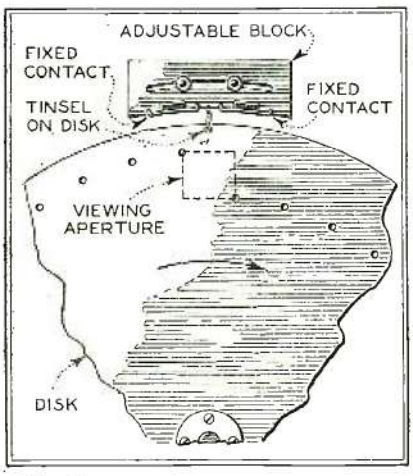


FIG. 2. DETAIL OF THE ARRANGEMENT SUGGESTED ON THE RECEIVER DISC

Having obtained the synchronizing impulse, the problem is to make it control the receiving disk, which is a little more complicated but entirely practical. At the same relative point as the scanning disk, that is, midway between the so-called first and last holes of the spiral, the receiving disk has a few strands of tinsel fastened to the edge. It is important that the disk be kept well balanced and any additional weight, slight though it may be, should be counterbalanced by a small drop of solder at a point diametrically opposite.

Just clear of the top edge of the disk a block of wood is mounted which car-

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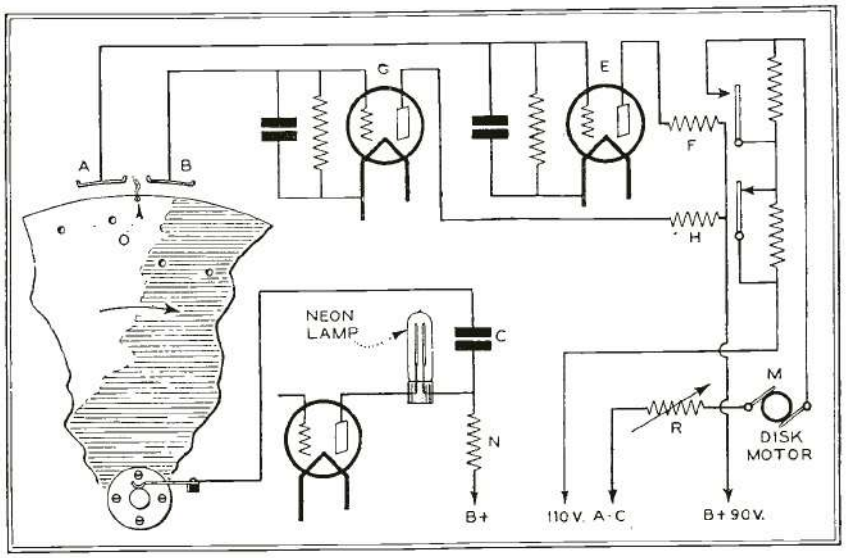
ries two curved metal strips as shown in Fig. 2. These strips are equal in length to the width of the viewing aperture and are separated about ⅛ inch in the center. The block has a curved slot as shown for mounting to permit it being shifted as will be explained a little later. The arrangement thus provides two contacts which the tinsel on the disk will touch as the disk revolves and closes the circuits that control the motor speed.

The controlling apparatus is connected as shown in Fig. 4. It will be seen that a resistance of comparatively low value to be found by experiment is connected in series with the Neon lamp. This resistance is shown at N and a condenser, C, is placed in a lead to the disk to which contact is made by a light spring. The contacts mounted above the disk are connected to resistances in the grid leads of two vacuum tubes as shown. The plate circuits of these tubes contain relays, one of which serves to increase the motor speed and the other decrease it by adjusting the resistance in the motor circuit. And that completes the synchronizing mechanism.

FIG. 4. THE CONTROLLING APPARATUS FOR OBTAINING SYNCHRONIZATION AND FRAMING OF THE RECEIVED PICTURE



As to its operation. Let us assume that the transmitter has sent the synchronising impulse with the result that the neon tube receives likewise an increase in current. This increase of current which should be appreciably greater than the picture impulses causes an increase in the drop of voltage across the resistance N and this voltage change acts across the condenser C to impress an increased voltage on the moving tinsel contact on the receiving disk. Should the receiving disk be in synchronism with the transmitter the contact C will be midway between fixed contacts A and B and no further action results because a change in speed of the disk is unnecessary.

However, should the disk be a little slow then the synchronizing impulse on passing through the condenser finds the contact C touching fixed contact A which causes the grid of Tube E to receive additional voltage resulting in the relay F closing and shorting out a resistance in the motor circuit and speeding up the motor.

Again we find that should the disk be running too fast the other vacuum tube G will be caused to function and its associated relay will break and place additional resistance in the motor circuit to reduce the speed.

The transfer of the controlling impulse in the circuit of the neon tube to the control tubes takes place in accordance with the usual resistance coupling phenomena and it would require some experiment to get the proper values and the resultant voltages correct. The only disadvantage is the lag in the relays. To offset this the contact strips are made adjustable so the block can be shifted to compensate for relay lag.