

UNITED STATES PATENT OFFICE

2,272,431

DIRECTIONAL ANTENNA ORIENTATION
CONTROL

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Application June 17, 1939, Serial No. 279,641

2 Claims. (Cl. 250—11)

My present invention relates to automatic orientation control devices for rotatable directional antennae, and more particularly to a novel method, and means for, automatically orientating a rotatable directional antenna employed for television reception.

As is well known, the signal collector of a television receiver is of the directional type. Such signal collectors are employed to receive television signals usually in the 40 to 80 megacycle frequency range. Maximum signal intensity reception is achieved with a directional antenna of the type used in television when the plane of the antenna is normal to the direction of the transmitter station. In other words, the antenna should be at right angles to the line between the transmitter antenna and the television receiver location. This requirement for maximum signal intensity exists in addition to the requirement that the antenna be in the line of sight of the television signal transmission. In employing a television receiver adapted to receive signals from a plurality of television transmitter stations it becomes necessary to orientate the antenna so that it has a substantially maximum signal amplitude position with respect to each of the transmitter stations.

Accordingly, it may be stated that it is one of the main objects of my present invention to provide a rotatable directional antenna construction for a television receiver, wherein means is employed at the receiver location for automatically orientating the antenna so that it is capable of receiving substantially maximum signal intensity from a selected television transmitter.

Another important object of this invention is to provide in a television receiver, equipped with a station selector mechanism, an additional means for operating a motor device to orientate the antenna so that the latter is normal to the line of sight between the receiver and the television transmitter.

Another object of this invention is to provide a mechanism for adjusting the position of a rotatable antenna of a television receiver simultaneously with the adjustment of the receiver to a desired one of plurality of different television stations.

Still another object of my present invention is to provide a combination of a television receiver of the type equipped with a television station selector mechanism, a device for automatically rotating the antenna of the receiver to a position corresponding to best signal reception from the television station selected.

Still other objects of my invention are to improve generally the efficiency of operation of television receivers, and more especially to provide a rotatable antenna construction for a television receiver which is not only reliable in operation, but is economically manufactured and assembled with a television receiver.

The novel features which I believe to be characteristic of my invention are set forth in particularity in the appended claims; the invention itself, however, as to both its organization and method of operation will best be understood by reference to the following description taken in connection with the drawing in which I have indicated diagrammatically a circuit organization whereby my invention may be carried into effect.

Referring now to the accompanying drawing, there is shown in purely schematic fashion a television receiver 1 which may be of any well known type. For the purpose of the present application it is not necessary to show any of the constructional details of such a receiver, except to point out that such a receiver at the present date embodies a station, or channel, selector which comprises an adjustable element 5 and a plurality of contact elements 1 to 4 inclusive. Those skilled in the art will understand that adjustment of element 5 to any one of the contacts 1, 2, 3 or 4 results in rendering the receiver capable of receiving television signals from television transmitter stations corresponding to these contacts. In other words, the channel selector device functions as a tuning means for the receiver. It is not necessary to explain any further details concerning the construction of the tuning means itself, since those skilled in the art will fully be able to understand the manner of relating the channel selector switch to the actual tuning mechanism of the receiver. The collected television signals may lie in a range of approximately 40 to 80 megacycles, and are impressed upon the input terminals of the receiver. The signals themselves are collected by a directional antenna. It is desirable to use an antenna of uniform response over the signal band.

The antenna is constructed in any manner which is well known, and comprises a pair of conductor elements 6 and 6'. If the various television carrier frequencies to which the receiver is to be tuned to lie in a range of 40 to 80 megacycles, it will be preferable to choose for the physical design of conductors 6 and 6' constructions such as shown by P. S. Carter in any of the following applications: Ser. 190,555, filed Dec. 15, 1938; Ser. 187,594, filed Jan. 29, 1938; Ser. 190,939,

filed Feb. 17, 1938. Of course, it is to be clearly understood that the length and design of each of the antenna conductors may be chosen in any other manner which is consistent with securing maximum signal intensity when the di-pole antenna is rotated to its optimum position at each setting of the channel selector. In other words it is required that the directional antenna have uniform response over the entire signal range. The conductor 6 is connected by lead 7 to one of the input terminals of the receiver, while the conductor 6' is connected to the other input terminal of the receiver by lead 7'. It is to be clearly understood that elements 6-6' are purely schematic and illustrative.

Assuming now that the four television transmitter stations are located at different points of the compass with respect to the receiver, it is highly desirable to be able to rotate the antenna about a vertical axis so that the line running through conductors 6 and 6' will be at right angles to the line joining each transmission station and the television receiver. This normal position of the antenna is, of course, the position for receiving substantially maximum signal intensity from the selected television station. Furthermore, it is desirable to adjust the antenna to such normal position in response to, and concurrently with, adjustment of the channel selector element 5. There is, therefore, provided an arrangement for automatically orientating the antenna so that it will be set for optimum normal position, with respect to a desired television station, upon adjustment of the channel selector 5 to such desired station setting.

The aforesaid automatic arrangement comprises a vertical tube 8, which may be fabricated of metal or some insulation material which is water resistant, and the leads 7 and 7' are run through the interior of the tube 8. The conductors 6 and 6' will pass through small bores 9 located at the upper end of the tube. If desired, the upper end of the tube may be closed off by a cap 10 in order to prevent foreign bodies, such as rain, snow, or soot, from entering the tube interior. The lower end of the tube 8 is mechanically coupled to a motor 11. The motor is provided with a split field winding 12 so that it may rotate tube 8 in clockwise or counterclockwise directions. The numeral 13 denotes schematically "Reduction gear" means, and it is to be understood that this symbolizes any well known form of reduction gear arrangement for coupling the motor 11 to the lower end of tube 8. The advantage of using the reduction gear resides in the fact that a very small motor may then be employed for actuating the tube 8.

The mid-point of winding 12 is connected by lead 14 to one terminal of the alternating current supply source for the motor. The opposite terminal of the alternating current supply source is connected by lead 15 to the contact arm 16 of the antenna orientator control switch. The numeral 17 denotes any desired mechanical coupling for operating arms 5 and 16 concurrently. Any device well known to the art may be used for this uni-control adjusting means for simultaneously actuating arms 5 and 16. The tube 8 is provided with a pair of metal rings 20 and 21. Each of these rings functions as a slip ring for its associated metallic brush element 22 and 23. The slip ring 20 is rigidly secured to tube 8, but is insulated therefrom by an insulating ring 20', while an insulation ring 21' insulates the slip ring 21 from the tube 8. It is to be understood,

however, that the slip rings 20 and 21 rotate as a unit with the tube 8. The metal brush 22, which is in sliding contact with the periphery of slip ring 20 is connected by lead 24 to one end of winding 12, while the other metallic brush element 23 is connected by lead 25 to the opposite end of the motor winding 12.

The tube 8 is further provided with a circular plate, or disc, 30 composed of any desired type of insulation material, such as a phenol condensation product, and the disc 30 is disposed above the slip rings and rotates with the tube 8 concurrently with the slip rings. The upper face of disc 30 is provided with a pair of opposed semi-circular metallic plates 31 and 32. These plates are spaced from each other at the inner edges thereof to provide the space 33. It is to be understood that the plates 31 and 32 can be rigidly secured to the upper face of disc 30 in any desired manner so that rotation of tube 8 will result in simultaneous rotation of the spaced plates 31 and 32. The metallic plate 31 is connected by lead 40 to the slip ring 20, while the plate 32 is connected by lead 41 to the slip ring 21, it being noted that the lead 41 is run through a vertical bore provided in the insulation ring 20'.

The contact arm 16 has associated therewith four contacts which are designated 1' to 4' inclusive, since they correspond respectively to the contacts 1 to 4 inclusive of the channel selector switch of the television receiver. In other words when arm 5 is in electrical contact with element 4 of the channel selector, then the arm 16 is in electrical contact with element 4' of the antenna orientator control switch. Each of contacts 1' to 4' inclusive is electrically connected to a corresponding tap element 1'' to 4'' respectively. Thus, the metallic brush, or tap 4'' is connected by lead 50 to contact 4'; the brush 3'' is connected by lead 51 to contact 3'; the brush 2'' is connected by lead 52 to contact 2'; and the brush 1'' is connected by lead 53 to contact 1'.

The brushes 1'' to 4'' inclusive are schematically represented, since those skilled in the art will readily be able to construct such elements. It is sufficient for the purposes of this application to point out that each of brushes 1'' to 4'' inclusive will be positioned in fixed relation to rotatable plates 31 and 32. For example, the upper ends of each of the brushes can be mounted in a support, or holder, made of some well known insulation material provision being made for adjustment of each brush with respect to the holder thereof. It is, of course, necessary to locate each of the elements 1'' to 4'' inclusive so that as the tube 8 rotates the metal plates 31 and 32 are rotated relative to the fixed brushes 1'' to 4'' inclusive. When the antenna is installed each of the brushes 1'' to 4'' inclusive is so adjusted relative to the plates 31 and 32 that when the plates are rotated to a position such that a given brush slides into the space 33 between the pair of plates, the motor 11 is stopped and the conductors 6 and 6' are orientated to optimum normal position with respect to the television transmission station corresponding to the brush located in the space 33. It will only be necessary to make this adjustment of each of the brushes 1'' to 4'' inclusive but once when the antenna is installed, and thereafter it will not be necessary to make any further adjustments to these brush elements.

To explain now the operation of the automatic orientation device, let it be assumed that the channel selector arm 5 has been adjusted to be in

electrical contact with element 4, and that a transmitter known as station 4 is desired to be received. In such case the arm 16 is connected to contact 4', and, therefore, there has been automatically selected the brush element 4''. Prior to the positioning of the lower end of brush 4'' in the space 33 the motor 11 was energized, because the motor energizing circuit was closed through the following path: lead 14, winding 12, lead 25, brush 23, slip ring 21, lead 41, plate 32, brush 4'', lead 50, contact 4', arm 16, lead 15. The motor being energized, the tube 8 was rotated through gearing 13 until the lower end of brush 4'' slid into the space 33. Since contact between plate 32 and brush 4'' is essential to keep the motor circuit closed, it is obvious that the motor will be deenergized, and, therefore, the tube 8 will have its motion stopped. As explained previously, in this position of brush 4'' the conductors 6 and 6' are normal to the line connecting transmitter 4 and the receiver.

Suppose now it is desired to receive station 1; in such case the arm 5 is adjusted to be in electrical connection with contact 1. This causes arm 16 to connect with contact 1' thereby selecting brush 1''. It will be realized that the motor circuit is now energized through the electrical connection between plate 31 and brush 1'', and, therefore, the motor 11 rotates tube 8, say in a counterclockwise direction, until the lower end of brush 1'' slides into the space 33. At this point the motor circuit is broken, and the motor 11 is prevented from rotating tube 8 any further. It will be understood that if any of the brushes are located in contact with plate 31, then selection of an orientator control switch contact corresponding to such a brush will result in closing the motor circuit through slip ring 20 with consequent desired orientation of the conductors 6 and 6'. The direction of rotation of tube 8 will be reversed in this case, because the motor circuit will now be closed from plate 32 through lead 40, slip ring 20, brush 22 and lead 24. In other words, the opposite half of the split field winding 12 will be energized in this case, with the result that the direction of rotation of the motor will be reversed thereby reversing direction of rotation of tube 8 and disc 30. It will, therefore, be seen that upon selection of a desired television carrier channel with the receiver selector switch, there occurs automatically, in response to channel selection, orientation of the antenna to optimum normal position with respect to the desired television transmitter.

It is to be understood that the orientator con-

trol switch may be located at the television receiver, while the remainder of the automatic orientating mechanism may be located at a remote point with the antenna. Additionally, it is to be clearly understood that in place of utilizing simple switch constructions of the type shown for the channel selector and the antenna orientator, push-buttons of the type used in automatic push-button tuning may be employed. In such case depression of a particular station push-button at the television receiver will simultaneously close an orientation control switch.

While I have indicated and described a system for carrying my invention into effect, it will be apparent to one skilled in the art that my invention is by no means limited to the particular organization shown and described, but that many modifications may be made without departing from the scope of my invention, as set forth in the appended claims.

What I claim is:

1. In combination with a television receiver provided with tuning mechanism for selecting reception from a desired one of a plurality of television transmitter stations, a directional antenna for collecting signals from such stations, electrical means operative independently of the received signals for automatically orientating said antenna to an optimum signal receiving position with respect to the selected television transmitter, and means mechanically connected to the station selecting mechanism for initiating operation of the electrical orientating means.

2. In combination with a radio receiver provided with tunable means for selecting reception from any one of a plurality of radio transmitter stations, a directional antenna, and means for orienting said antenna to an optimum signal intensity position with respect to each selected transmitter station, said means comprising an upright support upon which the antenna is carried, a reversible motor for rotating said antenna support, means carried by said support and electrically connected to the motor for determining the direction of rotation of said support, antenna position-determining means cooperatively related with said direction-determining means, and means mechanically connected to said station selecting tunable means for selecting the antenna position-determining means corresponding to the selected station, whereby upon operation of the station selecting tunable means the antenna position-determining selecting means is actuated to energize the motor.

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