

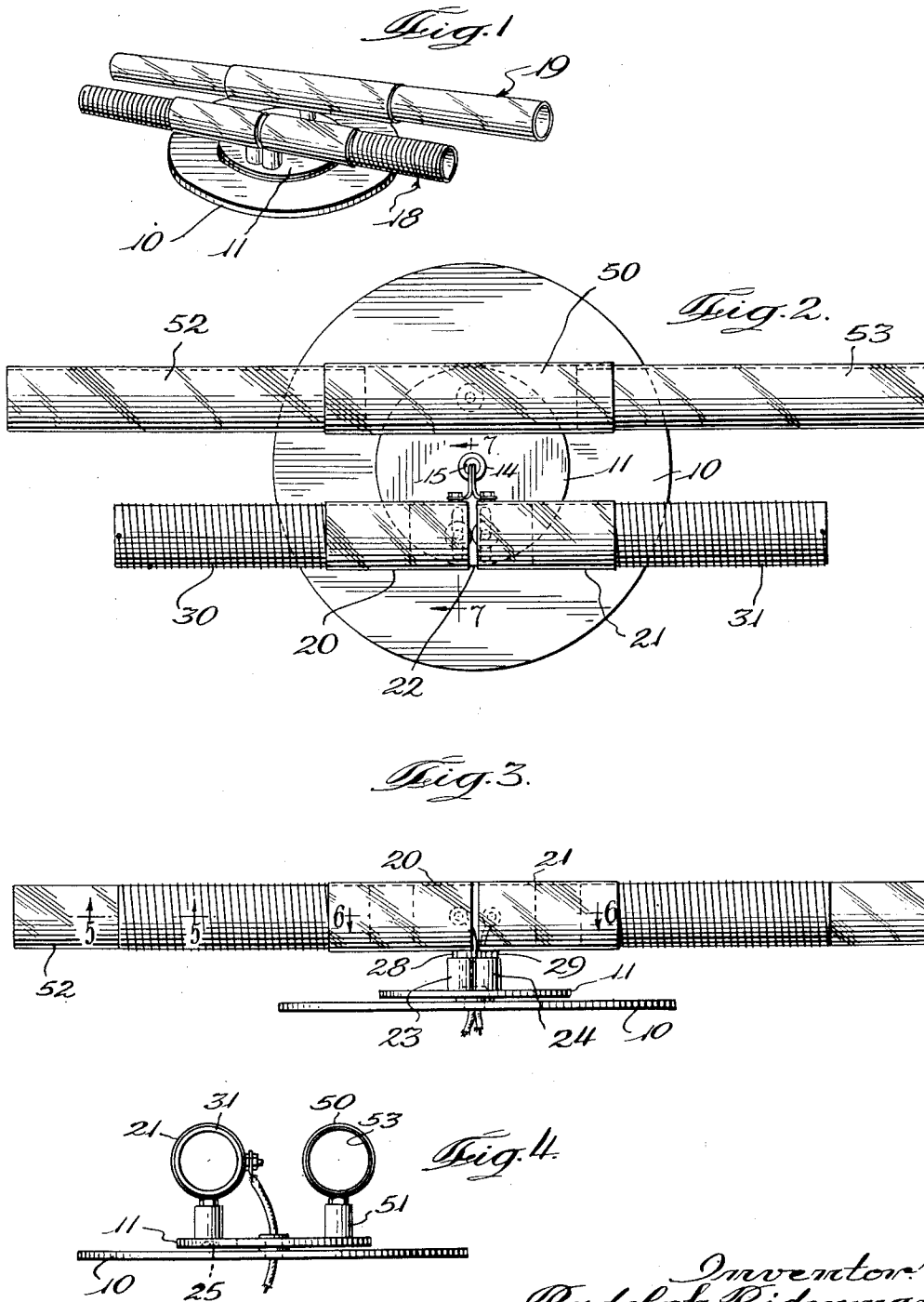
April 28, 1953

R. RIDERMAN
TELEVISION ANTENNA

2,636,986

Filed Oct. 11, 1948

2 SHEETS—SHEET 1



Inventor:
Rudolph Riderman
By *J. Irving Silverman*
Attorney

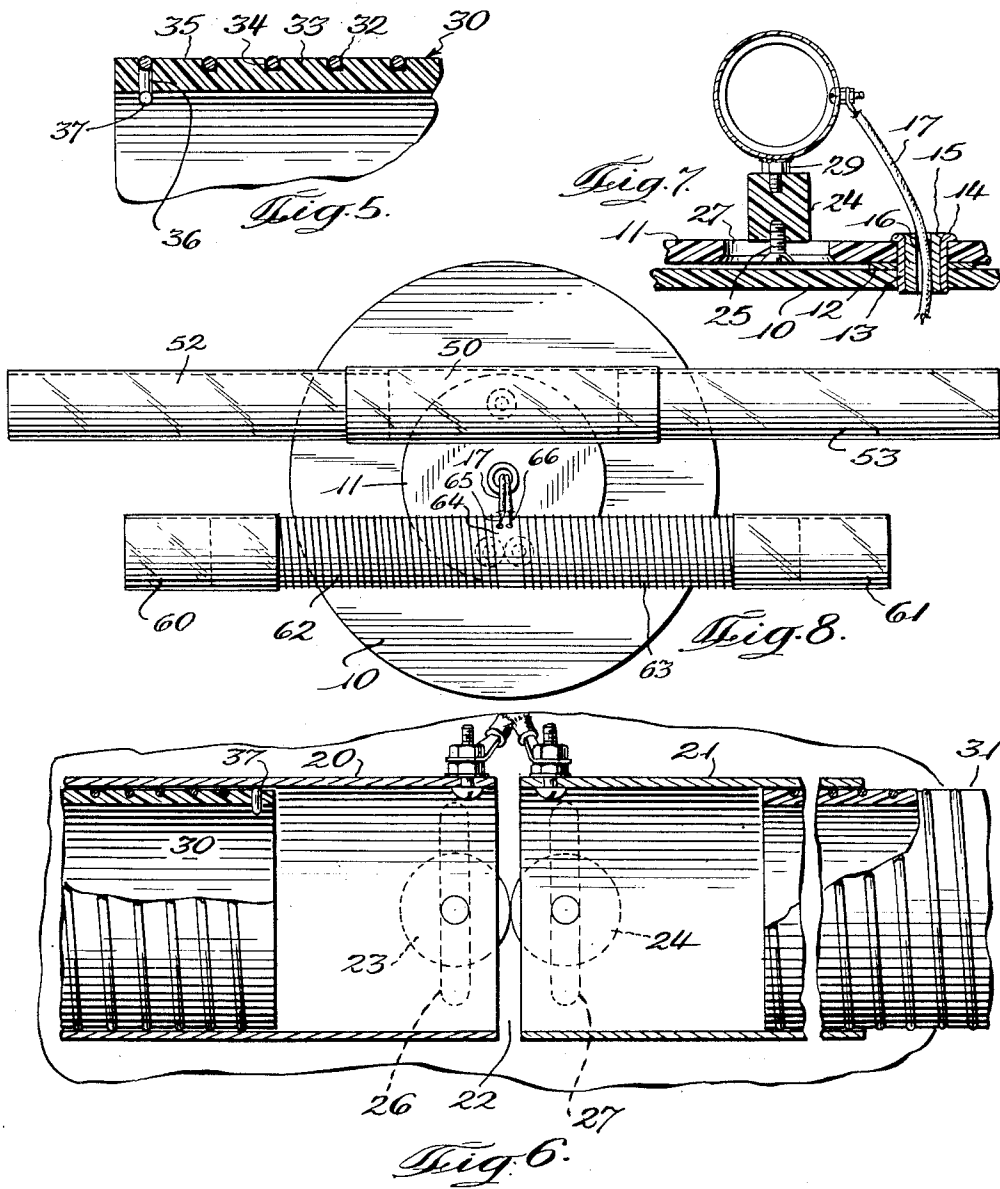
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Inventor,
Rudolph Rideman
By *L. Irving Silverman*
Attorney

UNITED STATES PATENT OFFICE

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TELEVISION ANTENNA

Rudolph Riderman, Chicago, Ill., assignor, by
mesne assignments, to Fred Gold, Chicago, Ill.

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This invention relates generally to antennas for the reception or transmission of electrical radiation and more particularly is concerned with antennas for the reception of high frequency broad band radiation, such as for example, television.

It is known that an efficient transmitting antenna will likewise be a satisfactory receiving antenna and vice-versa, hence, although my new antenna is primarily intended for reception it is nevertheless capable of being utilized for the transmission of television.

Present day television is broadcast at high frequencies in two general bands, one of which is from 44 to 88 megacycles per second, and the second of which is from 174 to 216 megacycles per second. For any given metropolitan area, there are channels in both of these bands, and therefore it is essential that an antenna be capable of receiving the video waves from transmitting stations operating in both bands.

All of the antennas used for the reception of video waves have heretofore been constructed in manners giving rise to objections which have considerably delayed the popularity of television, and hence limited sales of reception equipment and the scope of the benefits to be derived from wide-spread use of television. It is the principal object of my invention to attain the broad result of increased public recognition and acceptance of television by making it more economical, convenient, and desirable for the consumer to obtain, install, use, and enjoy a television receiving equipment.

The video frequency electric waves which are transmitted for reception are considerably shorter than ordinary radio waves. The long antennas of radio are therefore neither suitable nor desirable in television. When frequencies of the order of 40 to 200 megacycles are to be received or transmitted, the amount of energy which can be radiated or received by a given antenna is very small, and hence it is essential that such antennas be directive. In addition, it is also desirable to utilize the best attributes of an antenna in order to enable the maximum energy to be transferred thereby, either from the transmitter to the ether, or from the ether to the receiver. The basic antenna for greatest efficiency, which may be considered an element, since most antennas are made up of such basic antennas, is a di-pole, or half-wave antenna. As its name implies, such an antenna is constructed of a conductor half a wave long. This electrical length is slightly less than the physical length, and gives rise to current and voltage

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distribution which is best for reception and transmission of high frequency energy. The existence of this condition gives rise to a resonance in the antenna so that at the center thereof, to which the lead-in transmission line is usually secured, there is a maximum of current and a minimum of voltage, and the impedance of the antenna is practically pure resistance.

Considering the frequencies of the bands now being used for television, an antenna designed for best reception at the low end of the lower band would be of the order of eleven feet in length; at the high end of the lower band would be of the order of five and one-half feet in length; at the low end of the upper band would be of the order of 2.8 feet in length; and at the high end of the higher band would be of the order of 2.2 feet in length. Two compromises must be made in order to construct a television antenna which is suitable for reception over the entire range of both bands. One compromise must be made in each band in order to choose a length which will be capable of receiving all of the channels in that band, and then an overall compromise must be made so that the antenna will receive stations from both bands. The net result has been that the common television antenna is of the order of three to six feet in length.

A second type of antenna is one which has two sections, one for receiving in each of the present day bands. In the event that there is an increase in allotted bands of the spectrum, another section will have to be added to this antenna.

An important object of my invention is to provide a single antenna, capable of being tuned to any frequency over a wide range including present day television bands.

A further object of my invention is to provide an antenna which is capable of highly efficient reception by reason of the fact that the effective length thereof can readily be adjusted to the frequency of the video signal being received over the entire television frequency spectrum.

In order to achieve the maximum of efficiency it is best to install an antenna as high above ground as possible, hence television antennas are customarily installed on rooftops and towers. In addition, the size of prior antennas makes it impractical to install same indoors. In crowded communities there is objection to the installation of such antennas, whereby a tenant in an apartment building is deprived of the benefits of television because he is not permitted to install an antenna upon the roof.

A further object of my invention is to provide

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a construction of television antenna which is highly efficient and yet so small in physical size that it is readily portable, can be installed indoors and in addition is extremely economical to manufacture.

My invention has given rise to many advantages over prior television antennas. It has eliminated the need for expensive outdoor weather-proof installations. It has eliminated the expense of maintenance of such outdoor antennas. It has eliminated the need for long transmission lines from the antenna to the receiver. It has enabled the antenna, by reason of its being immediately adjacent the receiver, to be made revolvable so that the maximum directional response can be obtained merely by manual orientation of the antenna. Obviously, rooftop antennas cannot be made revolvable without the use of highly expensive equipment.

My new antenna can be placed immediately adjacent the receiving equipment and can be constructed so that it is ornamental in appearance so as not to detract from the esthetic effect of the furnishings in a given room. The elimination of long lengths of transmission line by reason of the location of my new antenna makes better reception possible. In cases where the line is not perfectly matched to the antenna, standing waves are set up which give rise to blurring of the video picture, and sometimes to "ghosts." The shorter the transmission line, the less is the effect of these standing waves. My invention enables transmissions lines to be of the order of inches in length. Short transmission lines also decrease loss of signal due to attenuation, and decrease noise pick-up.

In the case of television installations where the antenna is a substantial distance from the receiving equipment, there may exist a phase difference between the signal received directly at the receiver and that received from the antenna via the transmission line, giving rise of blurring or "ghosts." This fault can be corrected by shielding the receiver, an expedient unnecessary in case my new antenna is used.

Certain objects of my invention lie in the provision of an antenna whose electrical length is considerably greater than its physical length; to provide a broad band antenna for indoor use; to provide an antenna in which inductive reactance for loading the antenna is distributed along the same; to provide an antenna in which the inductive reactance is capable of readily being varied; to provide an antenna having an inductive reactance coil associated therewith in such a manner that telescopically moving same with respect to another portion of the antenna will vary the inductive effect of such coil; to provide an antenna which can readily be adjusted for optimum tuning and matching.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

For the purpose of facilitating an understanding of this invention, there is illustrated in the accompanying drawings a preferred embodiment

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thereof, from an inspection of which, when considered in connection with the following description, this invention, its mode of construction, assembly and operation, and many of its advantages should be readily understood and appreciated.

Referring to the drawings in which the same characters of reference are employed to indicate correspondence or similar parts throughout the several figures of the drawings:

Fig. 1 is a perspective view of an antenna embodying my new invention.

Fig. 2 is a top plan view of the same.

Fig. 3 is a side elevational view of the antenna.

Fig. 4 is an end elevational view of the antenna.

Fig. 5 is a fragmentary sectional view through the antenna taken along the axis of the antenna di-pole as indicated by the line 5-5 of Fig. 3 and in the indicated direction, and showing the details of construction of the antenna coil.

Fig. 6 is a sectional view through the antenna di-pole along the axis thereof as indicated by line 6-6 of Fig. 3, in the direction indicated.

Fig. 7 is a sectional view taken along the line 7-7 of Fig. 2 and in the indicated direction.

Fig. 8 is a top plan view of a modified form antenna embodying my invention.

For carrying out my invention I have provided an antenna, a part of which consists of a tubular conductor, preferably circular in cross-section although not limited thereto, having a second part formed of a telescoping member of slightly lesser cross section, but having a coil of bare wire wound thereon. The coil form is of some material having high dielectric strength, and the winding is laid on the form, preferably in grooves, so that it extends out of the grooves, and engages the inner surface of the tubular conductor wherever the form is telescoped therein. The windings are spaced apart in order to distribute the inductance along the form and to provide a wide area capable of cutting the incident video waves. In this manner I am enabled to increase the effective or electrical length of my antenna by adding inductive reactance thereto, but in addition I have distributed the coiled conductor along the coil formed thereby increasing the amount of energy the antenna is capable of extracting from the transmitted video wave.

My preferred embodiment includes a di-pole having two tubular central sections arranged with their axes aligned and their ends spaced and connected to the lead-in transmission line, and having coils telescoped into the free ends thereof. A modified form has the central portion of the di-pole formed of coils, while the ends of the coils are capped with telescoping cylindrical sleeves.

For any given frequency, I adjust the antenna for maximum signal and best matching of transmission line impedance by telescopically moving the coils and tubes relative to one another.

The reference character 10 designates generally a platform which may comprise a fixed member, the top of a receiving equipment, a table, or the like, and is not necessarily circular in formation as shown in the drawings. Mounted upon the platform 10 I have provided a turntable 11 separated from the platform 10 by a suitable bearing member or washer 12 and pivoted thereto by means of a bushing 13 (see Fig. 7) having a flanged upper end as shown at 14 overlying the turntable 11. This construction enables the turntable to be rotated although same can be lifted upwardly carrying the bushing 13 therewith. If

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desired the bushing 13 may have its lower end peened over and against the bottom of the platform 10 whereby permanently to associate same therewith and prevent removal of the turntable.

Centrally of the bushing there is provided an insulating member 15 cylindrical in formation, and having a bore 16 through which the transmission line 17 is adapted to pass.

Mounted upon the turntable 11 I provide a di-pole antenna designated generally 18, and a parasitic antenna designated generally 19. Both of these antennas are adjustable as to their physical length, and the distance therebetween is also adjustable as will be described.

The di-pole antenna consists of a pair of thin-walled tubes 20 and 21 arranged with their ends juxtaposed and their axes aligned. There is a space 22 between the ends whereby the tubes 20 and 21 do not touch.

The tubes 20 and 21 are firmly mounted upon stand-off insulators 23 and 24 formed of some material having very high dielectric strength, such as for example polystyrene, or methyl methacrylate resin. These insulators 23 and 24 are in turn mounted upon the turntable 11 by means of screws 25 which are engaged into the bottoms of the stand-off insulators through slots 26 and 27 for a purpose presently to be described. The means for mounting the tubes 20 and 21 upon the insulators 23 and 24 may consist of any suitable fasteners such as for example the bolts shown at 28 and 29 which I have welded to the bottoms of the tubes 20 and 21 respectively.

Telescopically mounted within the tubes 20 and 21 I provide the coils 30 and 31 respectively. These coils consist of relatively heavy diameter wire 32 wound upon tubular forms 33 of polystyrene or similar insulating material. In the embodiment shown, the wire 32 is laid in spiral grooves 34 cut in the surface of the forms, the depth of the grooves 34 being such that the turns of the wire 32 protrude slightly therefrom, and hence rise above the exterior surface 35 of the forms 33. Both forms used in the coils 30 and 31 are identical, hence the description of coil 30 illustrated in Fig. 5 should suffice. The ends of the wire 32 are inserted through openings 36 formed in each end of each form 33 and bent under as shown at 37 on the interior of each form in order to hold the windings in place.

From the above description it should be obvious that the coils 30 and 31 are readily slidable within the tubes 20 and 21, and that when the coils are engaged within said tubes 20 and 21, the outside diameter of the coils comprising the outermost surface of the windings will engage the inner surface of the tubes 20 and 21, giving rise to a metal to metal contact.

The tubes 20 and 21 are provided with contacts at 38 and 39 adapted to be connected respectively to the wires of the transmission line 17. Obviously the line 17 should have an impedance matching that of the antenna.

I have thus far described the important portion of my invention and it will be seen that it consists of a di-pole antenna having distributed inductance therealong. The coils 30 and 31 provide inductance, and by arranging the coils so that their axes are aligned with those of the tubes 20 and 21 I have provided a physical antenna di-pole as well as inductance. The efficiency of such an antenna is greater than a short antenna having lumped inductive loading because the coils 30 and 31 are also in the electrostatic and electromagnetic fields of the video

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waves and are enabled thereby to extract additional energy therefrom.

The antenna illustrated utilizes cylindrical tubes having a diameter of approximately two inches, whereby the antenna can receive broad band of frequencies without the discrimination against any portion of a channel. The effect accompanying such construction is a reduction of signal pick-up from the incident waves, but the coils 30 and 31 having added considerable inductance, the loss due to reduced Q is not as great as it otherwise would be.

Many advantages accrue as a result of the arrangement that I have described, irrespective of the construction including the turntable and adjustable stand-off insulators. The necessity of using a large and unwieldy antenna is eliminated thereby enabling the entire antenna to be maintained within the room containing the receiving set. In the case of television receiving sets, my new antenna is so small that it can be mounted immediately upon the top of the cabinet of the television receiving set, thereby reducing transmission line length, cost, and losses. In addition to the above, since the antenna is immediately available to the observer, the same may be rotated so that it is properly oriented for maximum reception, that is, with the axis of the antenna dipole at right angles with a line from the transmitting station. In permanently mounted antennas, this cannot be done unless the installation is highly complicated, and consequently very expensive. With my new invention, the observer merely rotates the antenna turntable 11 until optimum signal is obtained. Permanently mounted antennas must be oriented so that the direction in which they are arranged for reception is a resultant of directions of all the stations it is desired to receive. In such case, it is obvious that the signal to noise ratio for some stations may be prohibitive. Obviously, the great advantages of having a highly directive receiving antenna are lost if the antenna must be designed to remain fixed.

The advantage of ready orientation is achieved by reason of the antenna being so small as to readily be mountable in the immediate vicinity of the receiving equipment so as to be capable of manipulation by the observer. In addition to this, other great advantages accrue. Thus, permanently mounted antennas require tuning circuits in order to cause same efficiently to receive all stations, since their physical size cannot readily be varied. On the other hand, my new antenna has means for tuning the antenna by varying the physical size as well as adjusting the distributed inductance thereof so that the optimum effective length of the antenna can immediately be achieved for any given station and condition of reception. The manner of accomplishing this will be explained hereinafter.

The coils 30 and 31 of my antenna are capable of being moved in and out of the tubes 20 and 21 by the observer. The turns of the coils that are enclosed within the tubes are short circuited since the wire 32 thereof is in engagement with the inner surface of the said tubes. This not only decreases the physical length of the di-pole antenna that cuts the video waves, but as well decreases the inductance of the coils 30 and 31, and hence further decreases the effective length of the antenna. Obviously, not only is the antenna readily tunable, but it is readily tunable over an extremely wide range of frequencies so that it

is a simple matter to tune the antenna to any station in the presently used television bands.

Although manual movement of the coils is described herein, it should be obvious that any method of moving said coils, mechanically or electrically could be used, and in addition, the exact position of said coils for certain frequently received stations could be calibrated thereon, or otherwise indicated. In addition the azimuth may be marked upon turntable 11 to properly orient the antenna.

It is well known that the directivity of antennas can be improved by the use of parasitic antennas. I have consequently determined that the efficiency of my new antenna is greatly increased by the use of a parasitic antenna serving as a reflector to cause the antenna to be unidirectional. I have therefore mounted a parasitic antenna 19 to the rear of di-pole 18, and have provided for adjustment of the distance between the antennas by means of the screws 25 and the slots 26 and 27. The distance between antennas can thus be adjusted to one tenth the wave length of the received frequency, or whatever is optimum. This dimension is not critical, however, especially in the case of broad band reception where the thickness of the antenna proper is of the order of that dimension, and hence adjustment between the parasitic and di-pole antennas may be eliminated, or the antenna may be adjusted for best reception over the entire band, and then fixed.

The parasitic antenna consists of a fixed central tube 50 mounted upon a standoff insulator 51 and having telescoping tubes 52 and 53 on the ends thereof. This provides for tuning of the parasitic antenna 19. This type of parasitic antenna acts as a reflector, serving to pick up additional energy from the passing video waves and reflect same, at proper phase into the di-pole 18.

It will be noted that the coils 30 and 31 are not directly connected to the transmission line 17. They are each produced as a unit and then telescoped into respective tubes 20 and 21. This enables shipping the antenna in a small container.

In Fig. 8 I have shown a modification of my invention which reverses the positions of the coils and tubes of the antenna heretofore described. The efficiency of such antenna and the advantages are generally the same as those of the antenna described. In the modified form of antenna the tubes 20 and 21 are formed as sleeves 60 and 61 which slide over the ends of the coils 62 and 63 respectively. The coils are both mounted upon a single form 64 which is attached to the turntable 11, and each has its inner terminus connected with the transmission line 17 as shown at 65 and 66. In all other respects the device is the same as described and is turnable in the same manner.

Although the parasitic antenna has been shown

constructed from tubing it should be obvious that same could also be formed of coils and tubes in the same manner as I form my di-poles. In addition, for high impedance transmission lines, various combinations of coils and tubes could be arranged in the form of a folded di-pole to provide increased antenna impedance.

It is believed that this invention, its mode of construction and assembly, and many of its advantages should be readily understood from the foregoing without further description, and it should also be manifest that while a preferred embodiment of the invention has been shown and described for illustrative purposes, the structural details are nevertheless capable of wide variation within the purview of this invention as defined in the appended claims.

What is claimed and desired to be secured by Letters Patent of the United States is:

1. A broad band television receiving antenna comprising horizontally arranged driven and parasitic elements spaced one in back of the other with their axes parallel and both perpendicular to the direction of the incident waves, the driven element comprising a pair of hollow metallic cylindrical tubes with a common axis, spaced one from the other along the axis and rigidly supported in such spaced position, a rotatable standard mounting said tubes, lead-in means electrically connected to said tubes to transmit the signal received when same are resonating as the halves of a dipole, each tube having a telescoping member in the outer end thereof, said member being formed of insulating material and having wire helically arranged on the exterior thereof so that as the member is moved in and out of the respective tube, the tube will short circuit or uncover turns to tune the dipole, said parasitic element being a hollow cylindrical metal tube electrically continuous along its length secured to said standard and insulated therefrom.

2. A construction as described in claim 1 in which the parasitic element is formed of a central fixed cylindrical tube, and the ends thereof are formed as adjustably telescoped tubes in metallic contact therewith.

RUDOLPH RIDERMAN.

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