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W. J. RACE

2,582,159

UNIVERSALLY ADJUSTABLE ANTENNA

Filed April 20, 1949

2 SHEETS—SHEET 1

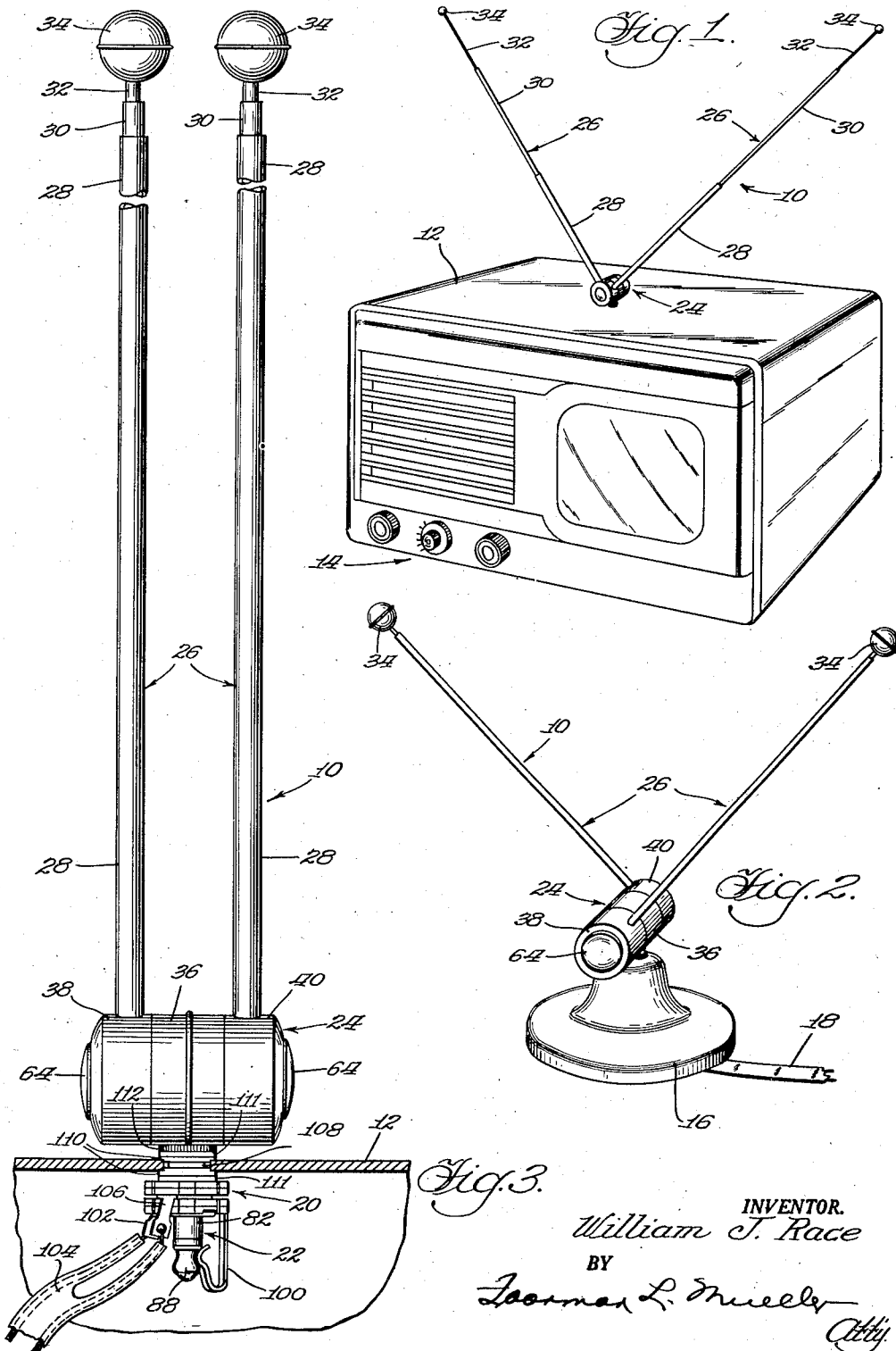


Fig. 3.

INVENTOR.

William J. Race

BY

Lawrence L. Mueller

Att'y

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2 SHEETS—SHEET 2

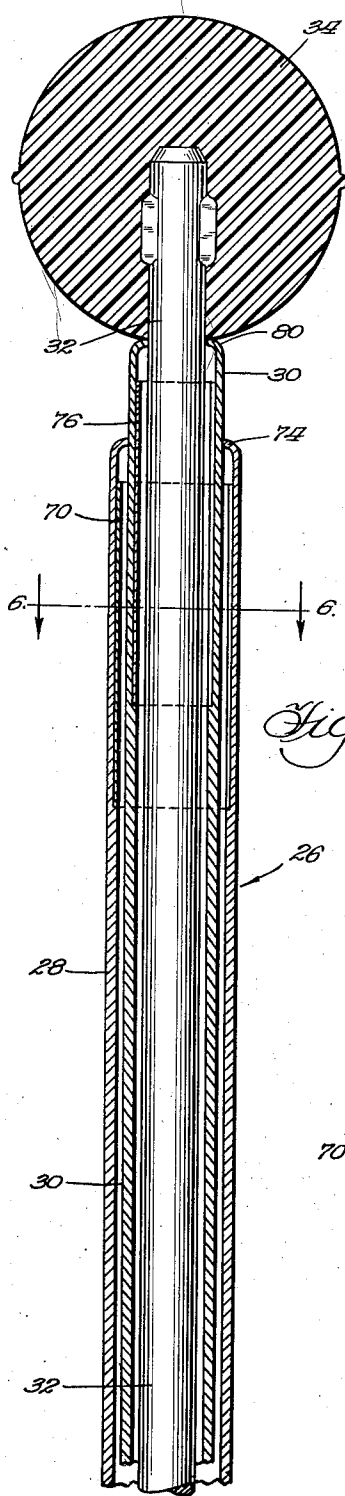


Fig. 5.

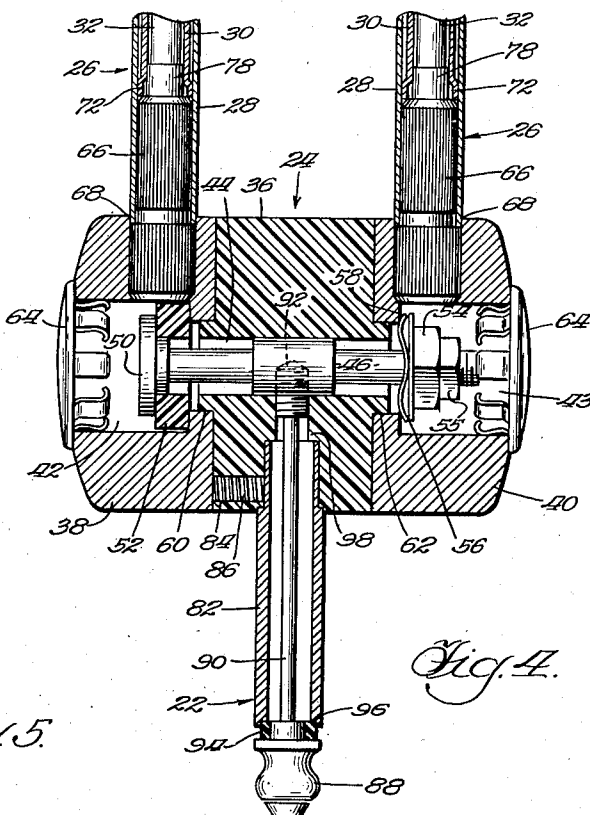


Fig. 4.

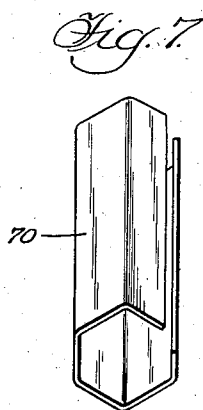


Fig. 7.

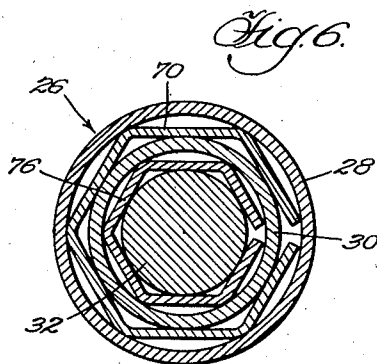


Fig. 6.

INVENTOR.
William J. Race
BY
Forman L. Mueller
Att'y.

UNITED STATES PATENT OFFICE

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UNIVERSALLY ADJUSTABLE ANTENNA

William J. Race, Franklin Park, Ill., assignor to
Motorola, Inc., Chicago, Ill., a corporation of
Illinois

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8 Claims. (Cl. 250—33)

1

This invention relates to antennas for the reception of television, frequency-modulated and other high frequency signals, and particularly to universally adjustable dipole antennas.

The prior art has made available to the public dipole antennas which are adjustable as to the lengths of their arms, the angular positions of the arms, and the orientation of the antenna as a whole. While such features of adjustability are very useful, they have in the past entailed some sacrifice in the quality of reception. Imperfect electrical connections between relatively sliding or rotating parts, as well as capacitive leakage losses, have attenuated the signal strength to an undesirable extent. All these factors have tended to reduce the popularity of such antennas.

An object of the present invention is to provide an improved adjustable antenna for the reception of high-frequency signals in which good electrical connections between relatively movable conductive parts are insured, and in which the capacitive leakage is kept down to a negligible amount.

A further object is to provide a highly adaptable dipole antenna which can be plugged directly into a receiver or into a separate base, as desired.

A further object is to provide a simple, inexpensive, adjustable dipole antenna which is attractive in appearance and adaptable to many uses.

A feature of the invention is the provision of a unique hub assembly for supporting the two arms of the dipole antenna in any selected angular positions relative to the axis of the hub. Electrical connections from the arms to the receiver are established through fixed conductors in the hub rather than through wires which are likely to flex and change positions and thereby introduce disturbances as the arms are moved.

Another feature is the provision of a novel plug and jack combination, the plug being secured to the hub assembly and the jack being mounted in the receiver or other supporting body. The plug is specially designed to present negligible capacitance between the circuit paths extending through it. The plug and jack together afford a rotatable joint which enables the antenna to be oriented in any desired fashion.

Still another feature is the provision of improved wiper contacts between the telescoped rods or tubes of each antenna arm to establish electrical connections therebetween and also frictionally retain such arms against accidental displacement relative to each other. These wipers

2

consist of polygonal sleeves disposed between adjacent ones of the telescoped rods.

The foregoing and other objects, features and advantages of the invention will be understood more thoroughly from a study of the following description taken in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of a television receiver, with an antenna embodying the invention plugged directly into the receiver;

Fig. 2 is a perspective view showing the antenna mounted on a separate base;

Fig. 3 is an elevational view of the antenna, with the supporting body therefor being shown in section;

Fig. 4 is a longitudinal section through the hub assembly, showing its relation to adjoining parts of the antenna structure;

Fig. 5 is a longitudinal section through the upper end of a dipole arm when the same is in collapsed position;

Fig. 6 is a cross section on the line 6—6 of Fig. 5; and

Fig. 7 is a detail perspective view of a wiper.

The dipole antenna illustrated herein is supported by a plug which is receivable in a jack associated with a receiver. The jack may be provided on the receiver cabinet or in a separate base, as desired. The plug is secured to a stationary insulating member which is part of a hub assembly including two rotatable metallic hub members positioned on either side of the insulating member. The rotatable hub members are held against the stationary member by a spindle or stud, with a substantial amount of friction between the cooperating faces of the stationary and movable hub members. The arms of the dipole are respectively supported by the rotatable hub members. Each of these arms comprises a plurality of telescoped tubes or rods, the outermost one of which is secured to the rotatable hub member. These members are slidable relative to each other for varying the effective length of the arm to correspond with the wave length of the signal that is being intercepted. To afford good electrical connections between the adjacent members and an adequate amount of friction therebetween, wipers are interposed between the members. These wipers are formed out of resilient sheet metal stock and have polygonal configurations so that they will bind tightly against both members of each pair. The spindle in the hub assembly is electrically connected to one of the rotatable hub members and insulated from the other ro-

3

tatable hub member. This other hub member is electrically connected to the outer sleeve of the plug by a coiled spring that extends through the stationary hub member. The inner contact rod of the plug is screwed into the spindle. Thus, the two conductive parts of the plug are electrically connected respectively to the two arms of the dipole through the hub assembly without the use of any flexible wires. The inner contact rod of the plug is cut down to a much smaller diameter than is the contact rod of the conventional plug, and a thick washer of high-quality dielectric material is interposed between the contact rod and the outer sleeve. Both of these factors greatly reduce the capacitance of the plug and thereby render it suitable for high-frequency work. The jack affords a pivotal mounting for the plug whereby the orientation of the entire antenna structure can readily be adjusted.

Referring now to the detailed disclosure in the drawing, the dipole antenna structure 10 is adapted to be mounted directly on the cabinet 12 of a receiver 14, Fig. 1 (a portable television receiver being shown in this view), or on a separate base 16 as shown in Fig. 2. In the latter case the antenna 10 is connected to the receiver through a line 18. The construction of the antenna and the provisions for orienting the same are identical in the two embodiments. As shown in Fig. 3, a jack 20 is mounted on the cabinet 12 or other supporting base. This jack is of a standard type except that it has a much lower capacitance than the conventional jack, the reduction of capacitance being effected by the use of high-quality dielectric separators. A low-capacitance plug 22 on the antenna 10 is received in the jack 20 and is rotatable therein to facilitate orientation of the antenna 10.

A hub assembly 24 is supported by the plug 22, and a pair of dipole arms 26 extends from the hub assembly 24. Each of these arms 26 has three telescoping sections consisting of an outer tube 28, an intermediate tube 30 and an inner rod 32. Each of the rods 32 terminates at its outer end in an insulating ball 34 of high-quality dielectric material which serves as a convenient handle for extending or collapsing the telescoped sections and for orienting the antenna.

The hub assembly 24, shown best in Figs. 3 and 4, comprises a central stationary insulating member 36 of high-quality dielectric material and two outer rotatable members 38 and 40 of metal which are disposed on either side of the stationary member 36. Axial cavities 42 and 43 in the hub members 38 and 40, respectively, communicate with an axial opening 44 which extends through the stationary hub member 36. A stud or spindle 46 extends through the axial opening 44 and serves to hold the three hub members 36, 38 and 40 together. The stud 46 has a head 50 disposed in the cavity 42, and this head 50 is spaced from the adjacent portion of the hub member 38 by an insulating washer 52. The other end of the stud 46 is threaded to receive a pair of nuts 54 and 55 disposed in the cavity 43. As the nut 54 is tightened on the stud 46, it exerts pressure through the flat washer 56 and the spring washer 58 against a portion of the hub member 40. The nut 55 serves to lock the nut 54. The hub members are pivotally mounted on annular bosses 60 and 62 extending laterally from the stationary hub member 36. Each of the rotatable hub members 38 and 40 has face-to-face contact with the stationary hub members 36 over a relatively large

4

surface area. The nut 54 is tightened sufficiently so that a substantial amount of friction exists between these cooperating faces. The end cavities 42 and 43 in the hub assembly 24 are closed by friction buttons 64.

The outer tube 28 in each of the antenna arm assemblies 26 is secured by a stud 66, Fig. 4, to a rotatable hub member 38 or 40. Each stud 66 is force-fitted into the lower end of the antenna tube 28 and into a suitable opening in the hub member 38 or 40. Also, it will be noted in Fig. 4 that the lower ends of the antenna tubes 28 are driven for short distances into the openings in the hub members 38 and 40 which receive the lower ends of the studs 66, thereby affording additional rigidity.

The intermediate antenna tubes 30 are slidable within the outer antenna tubes 28. Interposed between each pair of tubes 28 and 30 is a resilient contact sleeve or wiper 70, Figs. 5, 6 and 7. This wiper consists of flat spring stock, such as phosphor bronze, formed into a polygonal shape. A longitudinal gap or slit in the wiper 70 permits a limited amount of flexing. As shown best in Fig. 6, the flat inner faces of the wiper 70 frictionally grip the exterior of the antenna tube 30, and the outer corner portions of the wiper 70 frictionally engage the inner surface of the antenna tube 28. The wiper 70 performs two functions; namely it holds the antenna tube 30 in a tight frictional grip and it affords a good electrical connection between the antenna tubes 28 and 30. The lower end of each antenna tube 30 is expanded slightly, as indicated at 72, Fig. 4, and the upper end of each antenna tube 28 has an intumed lip 74, Fig. 5, thereby preventing the tubes 28 and 30 from becoming disengaged when the antenna arm 26 is extended.

In similar fashion, a polygonal wiper 76, Figs. 5 and 6, is interposed between the antenna tube 30 and the inner antenna rod 32 of each antenna arm 26. This wiper 76 has the same functions as the wiper 70; that is, it establishes a good electrical connection between the rod 32 and the tube 30, and it affords a frictional binding connection between these parts. The lower end of each rod 32 is expanded slightly as indicated at 78, Fig. 4, and the upper end of each tube 30 has an intumed lip 80, Fig. 5, preventing disengagement of the rod 32 and the tube 30. The balls 34 are forced onto the upper ends of the rods 32.

The antenna arms 26 can be made in as many sections as desired to secure the necessary amount of extension thereof. The length of each arm, the angularity between the arms, and the orientation of the antenna as a whole are adjusted to secure the optimum reception of a desired signal. The electrical connections from the antenna arms 26 to the receiver are made through the plug 22 and the jack 20.

The plug 22 has an outer tube or sleeve 82 which is received in a vertically extending socket in the lower portion of the stationary insulating member 36. A horizontal hole 84, Fig. 4, extends from this vertical socket to the face of the member 36 which adjoins the rotatable hub member 38. Disposed in the hole 84 is a small coiled spring 86 which bears at its opposite ends against the hub member 38 and the tube 82. This spring 86 serves as a contact member to establish an electrical connection between the tube 82 and the hub member 38 for all angular positions of the latter. This electrical connection is continued through the hub member 38 and the stud

66 mounted therein to the antenna arm 26 that is connected to this hub member 38.

The plug 22 has an inner member or contact rod 88, the shank 90 of which extends through the tube 82. At the upper end of the shank 90 is an integral threaded portion 92 which is threaded into a tapped opening in the spindle 46. In order to keep the capacitance between the contact rod 88 and the outer tube 82 down to a negligible value at high frequencies, the shank 90 is made very much smaller in diameter, relative to the inner diameter of the tube 82, than is done in the conventional telephone plug. Furthermore, a thick insulating washer 94 of high-quality dielectric material is interposed between the lower end of the tube 82 and the protruding lower portion of the contact rod 88. The lower end of the tube 82 is recessed slightly, as indicated at 96, Fig. 4, to receive the insulating washer 94. Substantially the entire space between the contact rod 88 and the tube 82 is therefore occupied only by air so that the capacity between the rod and the tube is a minimum. Thus, the contact rod 88 is effectively insulated from the outer tube at high frequencies, and it is electrically connected to the rotatable hub member 40 through the medium of the spindle 46. The hub member 40, in turn, is electrically connected to the antenna arm 26 which is mounted on this hub member.

The jack 20, Fig. 3, which receives the plug 22 has a contact spring 100 formed to cooperate with the protruding lower portion of the contact rod 88. This spring 100 is insulated from contact with the outer tube 82 of the plug 22, and it is electrically connected to a terminal 102, to which one of the conductors in a two-wire parallel line 104 is soldered. The other conductor of this line 104 is soldered to a terminal 106 which is electrically connected to a portion of the jack 20 that cooperates with the tube 82 of the plug 22. The line 104 leads to the antenna input terminals of the receiver. The jack 20 has a threaded shank 108 which extends through a suitable opening in the cabinet 12 or other support member and is insulated from contact therewith by insulating washers 110. Flat washers 111 are positioned adjacent the washers 110. A knurled nut 112 is threaded on the protruding upper end of the shank 108 for securing the jack to the supporting body 12. The jack 20 permits the plug 22 to be rotated therein for swinging the antenna structure about a vertical axis to vary the orientation of the antenna.

The disclosed antenna structure is simple, sturdy and economical and it affords three degrees of adjustment of the antenna, namely, length of the arms 26, angularity of the arms 26 and orientation of the antenna 10. The antenna, when collapsed, occupies very little space and can be packed into the lid of a carrying case, for example. It can be mounted either on the receiver itself, as shown in Fig. 1, or on a separate base as shown in Fig. 2. In either event it presents a very attractive appearance.

The disclosed details of the antenna structure may be modified without departing from the principles of the invention as set forth hereinabove. It is intended, therefore, that all modifications coming within the spirit of the invention shall be included within the scope of the appended claims.

I claim:

1. An adjustable dipole antenna comprising a stationary insulating member, a pair of ro-

tatable metallic hub members respectively disposed on opposite sides of said insulating member, a spindle supported by said insulating member and extending at opposite ends thereof into said hub members, said hub members being rotatable about said spindle as an axis, means electrically connecting said spindle to one of said hub members, means insulating said spindle from the other of said hub members, a stationary spring contact member supported by said insulating member and engaging said other hub member, a pair of extensible antenna arms respectively connected to said hub members, each of said arms comprising telescoped metallic members slidable relative to each other and spring contact means interposed between said members, and rigid electrical conductors secured to said stationary insulating member and respectively connected electrically to said spring contact member and to said spindle.

2. An adjustable dipole antenna comprising a stationary insulating member, a pair of rotatable metallic hub members respectively disposed on opposite sides of said insulating member, a spindle supported by said insulating member and extending at opposite ends thereof into said hub members, a pair of antenna arms respectively secured to said rotatable hub members, said hub members being rotatable about said spindle as an axis, means electrically connecting said spindle to one of said hub members, means insulating said spindle from the other of said hub members, a contact supported by said stationary insulating member engaging said other hub member, and electrical conductors insulated from each other and leading respectively from said spindle and said contact.

3. An adjustable dipole antenna comprising a pair of arms, a pair of metallic hub members rotatable about a common axis and connected respectively to said arms, a stationary insulating member interposed between said hub members and having bosses on opposite sides thereof for supporting said hub members, a stud passing through said insulating member and having opposite ends thereof disposed respectively within said hub members, a nut threaded on said stud to draw said hub members into tight frictional cooperation with said stationary member, said spindle being electrically connected to one of said hub members and insulated from the other of said hub members, contact means supported by said stationary member cooperating with said other hub member, and electrical conductors insulated from each other and leading respectively from said spindle and from said contact means.

4. A universally adjustable dipole antenna adapted to be plugged into a jack or the like associated with a receiver, such antenna comprising a pair of extensible arms, a pair of rotatable metallic hub members respectively supporting said arms, a stationary insulating member interposed between said rotatable hub members, a spindle joining said rotatable hub members to said stationary insulating member, said spindle being electrically connected through one of said rotatable hub members to the antenna arm supported thereby and being insulated from the other of said hub members, a plug secured to said stationary member and receivable in said jack, said plug comprising an outer tubular member insulated from said spindle and an inner contact rod secured to said spindle, and spring contact means supported by said stationary member for

7

electrically interconnecting said tubular plug member with said other hub member.

5. A high frequency antenna of the dipole type including a pair of adjustable arms and supporting means therefor, each of said arms including an elongated conducting tube secured at one end thereof to said supporting means, a cylindrical conducting member slidable within said conducting tube, and a wiper within said tube at the end thereof opposite to said one end providing both a frictional coupling and an electrical connection between said tube and said member, said wiper being formed of resilient metal and having a polygonal configuration.

6. A high frequency antenna of the dipole type including a pair of adjustable arms and supporting means therefor, each of said arms including an elongated conducting tube secured at one end thereof to said supporting means, a cylindrical conducting member slidable within said conducting tube, and wiper means interposed between said tube and said member and providing both a frictional coupling and an electrical connection therebetween, said wiper means comprising a polygonal resilient sleeve like member, said conducting tube including means for retaining said wiper at the end of said tube opposite to said one end.

7. A high frequency antenna including at least one adjustable arm and supporting means therefor, said arm including an elongated conducting tube secured at one end thereof to said supporting means, a cylindrical conducting member slidable within said conducting tube, and wiper means interposed between said tube and said member and providing both a frictional coupling and an electrical connection therebetween, said wiper means comprising a polygonal resilient

8

sleeve-like member, said conducting tube including means for retaining said wiper at the end of said tube opposite to said one end.

8. Antenna apparatus including in combination, a jack, a base supporting said jack, a plug receivable in said jack, and a high frequency dipole antenna structure supported by said plug, said plug including inner and outer spaced coaxial conductors separated substantially entirely by air so that the capacity therebetween is a minimum, said antenna structure including a stationary insulating portion secured to said plug, a pair of rotatable conducting hub portions disposed on opposite sides of said insulating portion, and a spindle supported by said insulating portion and extending at opposite ends thereof into said hub portions with said hub portions being rotatable about said spindle as an axis, a pair of antenna arms individually supported on said hub portions, means electrically connecting said spindle to one of said hub portions, means insulating said spindle from the other of said hub portions, said spindle being electrically connected to said inner conductor of said plug, and contact means supported on said insulating portion connecting said other hub portion to said outer conductor of said plug.

WILLIAM J. RACE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,701,666	Diener	Feb. 12, 1929
2,259,628	Fener	Oct. 21, 1941
2,317,023	Bird	Apr. 20, 1943
2,344,425	Snyder	Mar. 14, 1944