March 25, 1969 W. E. ROBB, JR 3,435,456

ADJUSTABLE WHIP ANTENNA FOR PORTABLE RECEIVER

Filed Feb. 1, 1966 Sheet 1 of 2

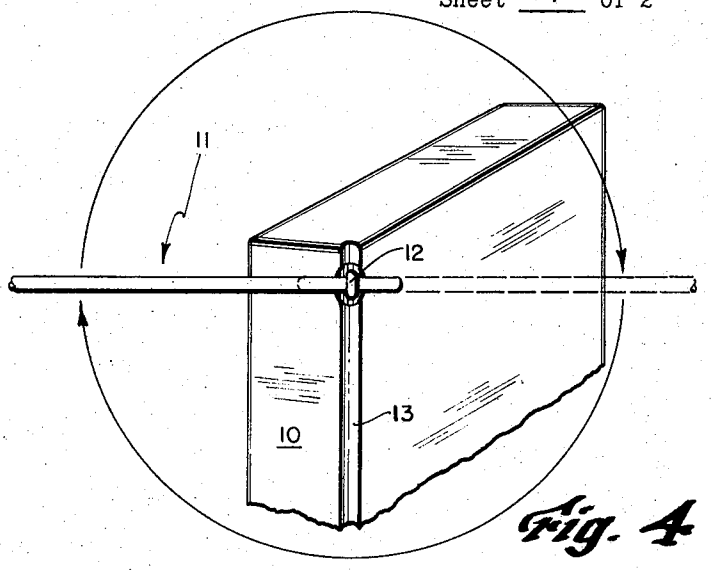


Fig. 4

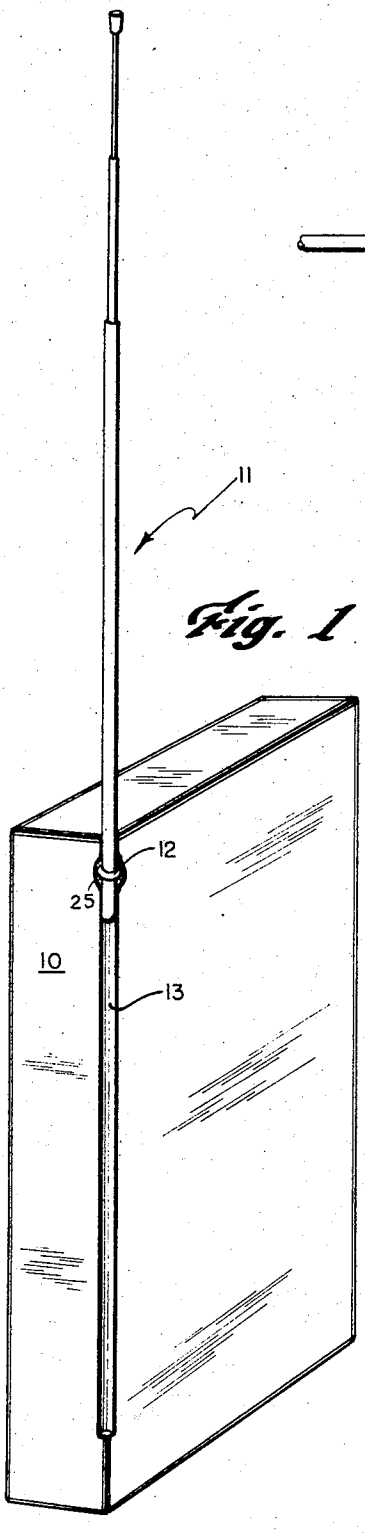


Fig. 1

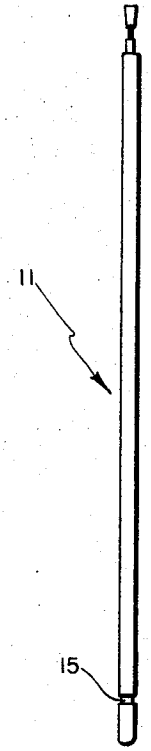


Fig. 2

Winfred Edward Robb, Jr.
Inventor
by Alfred H. Rogers
Thomas R. Tarrant
Attorneys

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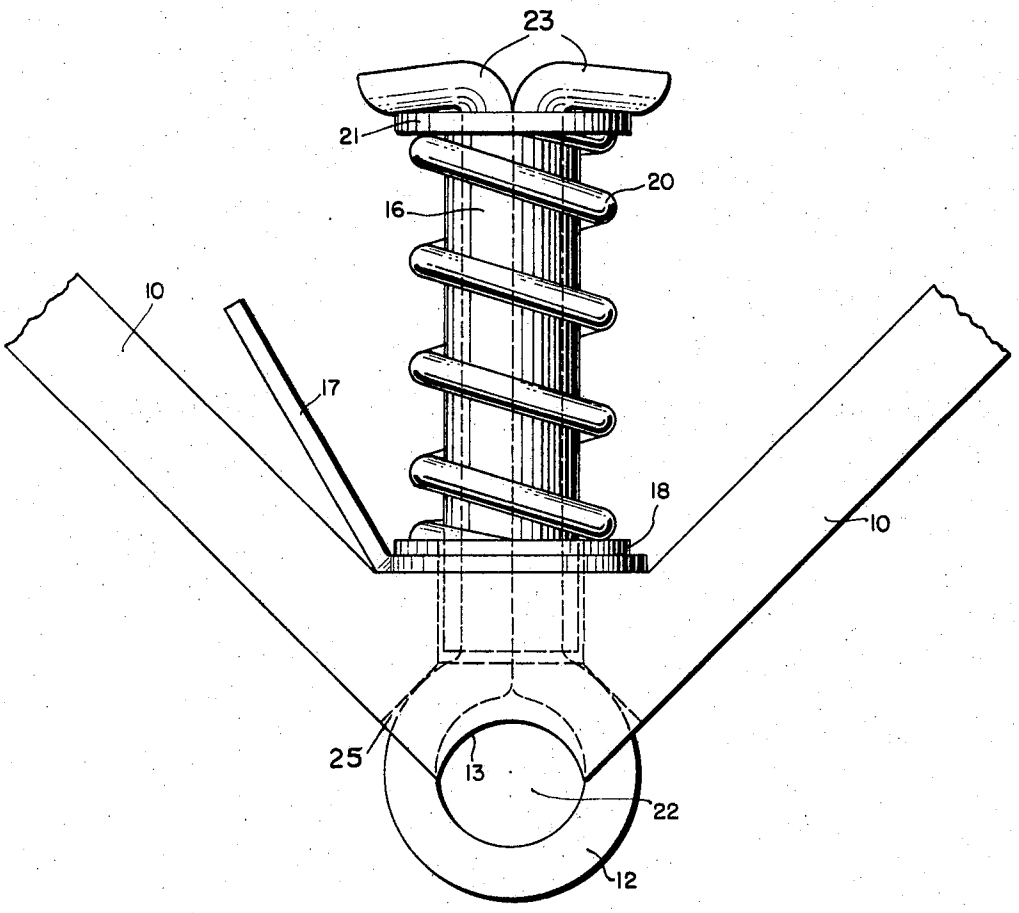


Fig. 3

Winfred Edward Robb, Jr.
Inventor
by Alfred W. Kozy
Thomas N. Tarrant
Attorneys

United States Patent Office 3,435,456
Patented Mar. 25, 1969

3,435,456

ADJUSTABLE WHIP ANTENNA FOR PORTABLE RECEIVER

Winfred Edward Robb, Jr., Acton, Mass., assignor, by mesne assignments, to Kel Corporation, Belmont, Mass., a corporation of Delaware

Filed Feb. 1, 1966, Ser. No. 524,193
Int. Cl. H01q 1/24
U.S. Cl. 343—702 13 Claims

ABSTRACT OF THE DISCLOSURE

An electrical mounting arrangement, especially suited for use on portable radio equipment, holds a whip antenna or other electrical connection in a groove on an edge of the housing. The mounting arrangement includes an eye on a shaft which is rotatable in a bore in the housing, and is spring loaded so that the eye is pulled toward the housing. The antenna is inserted in the eye and can be rotated about the shaft into any position, including a stowed position in the groove.

This invention relates to compact whip antennas and means for mounting them on hand-portable radio equipment.

Radio frequency whip antennas on hand-portable equipment suffer from two particular weaknesses. One is susceptibility to damage, the other is sensitivity to noise and loss of gain due to defective electrical contact.

Now, in accordance with the present invention, an electrical coupling arrangement through the wall of a housing and suitable for mounting small whip antennas has been achieved that provides excellent electrical contact and high resistance to physical damage. Spring loading of the coupling connection with electrical contact through the spring by crimping a spring turn permits the antenna whip to be sprung and twisted to any of several positions without disturbance of electrical contact. As will be seen from the following specification, the assembly is simple and inexpensive and facilitates removal, storage and directional positioning of the whip. Thus it is an object of the invention to define a novel swivel arrangement for electrical connection utilizing low-noise electrical contacts.

It is a further object of the invention to define a novel antenna mounting arrangement using a spring-loaded cotter pin as a socket for the antenna element.

It is still a further object of the invention to define a portable radio device in which a whip antenna is mounted on a spring-loaded swivel mount along an edge of the device whereby strong applied pressure in any direction except two 180-degree displaced directions will cause the antenna to shift position before damage occurs.

Further objects and features of the present invention will become apparent upon reading the following specification together with the drawings in which:

FIG. 1 is a projection of a radio device with a whip antenna in accordance with the invention;

FIG. 2 is a view of a whip antenna element in accordance with the invention;

FIG. 3 is a plan view of an antenna mounting device in accordance with the invention; and

FIG. 4 is a partial view of a radio device illulstrating the swivel action of an antenna in accordance with the invention.

Referring to FIG. 1 a radio device such as a hand-held transceiver is depicted having a case **10** upon which is mounted a telescoping whip antenna **11** supported in a groove **13** by a rotatable mounting ring **12**. Antenna **11** can be stored by telescoping the extended pieces together

and rotating the antenna 180 degrees so that it fits compactly into groove **13**.

FIG. 2 shows the whip antenna element **11** separately with an annular restriction **15** for mating with support ring **12**. The butt end of element **11** is slightly rounded so that it may be inserted readily into ring **12**. In some instances it has been found desirable to deform the butt end or add an enlarged end cap so as to prevent accidental removal of the antenna element from ring **12**. Ring **12**, as will be described at a later point, can spring open slightly under pressure for insertion of antenna element **11** or a pin connecting device for a separate antenna. The capability of ring **12** to extend from groove **13** a slight amount with compression of spring **20** permits antenna element **11** to be inserted or disengaged readily and also permits storage of antenna element **11** in groove **13** by forcing the antenna element straight down through ring **12** as an alternative to rotating the antenna for storage.

The assembly of the antenna mounting, including the ring **12**, is illustrated in a detailed view by FIG. 3. A portion of radio device case **10** containing groove **13** along an edge is shown. The word "edge" as used herein is defined as the sharp line where two surfaces meet. Thus in an oblong object the line along which a front surface and a side surface meet is an "edge."

A metal sleeve **16** is mounted as a bushing through case **10** in the center of groove **13**. Sleeve **16** normally may be recessed slightly from groove **13** or it may be flush with the surface of groove **13**. The end of bushing **16** at the interior of the radio device extends over a sufficient length to provide for a spring **20**, as will be understood from the following description.

Antenna support ring **12** is made in the form of a metal cotter pin. This cotter pin is made in a conventional form of a single strip of metal which is bent at its midpoint to form a circular ring containing an eye **22** and two touching or nearly touching tailpieces **23** that can be bent after insertion through a channel to prevent removal.

In accordance with the invention eye **22** of the cotter pin is formed to provide a close fit with the barrel of antenna element **11**. This necessarily allows for a loose fit of eye **22** around annular groove **15**. When antenna element **11** is inserted, spring **20** retracts ring **12** tightly clamping antenna element **11** into groove **13** with ring **12** locked in annular groove **15**. When the butt end of antenna element **11** is deformed or capped to prevent accidental removal of the antenna, annular groove **15** is not required. The primary purpose of groove **15** is as a detent. The tailpieces of the cotter pin are made to fit very tightly inside sleeve **16**.

In assembly, a first washer, including a connection tab **17**, is placed over sleeve **16** and against the inside of case **10**. Connection tab **17** is for connection of the antenna to the electrical circuits of the radio device.

As depicted in FIG. 3 the portion of case **10** in which the antenna support is mounted is made of an electrically insulating material such as plastic. In incidences in which this portion of the case is made of a conductive material, electrically insulating washers and inserts are required to provide an electrical insulation of the antenna assembly from the case. Under the washer, including tab **17**, is positioned a second electrically conductive washer **18**. A spiral spring **20** is next positioned over sleeve **16** on top of washer **18**. Prior to placing spring **20** over sleeve **16** the first turn of the spring that is the turn that will be adjacent to washer **18** is slightly crimped into an elliptical form so that this turn has to be sprung in order to force it over the outside of sleeve **16**. This first turn of spring **20** is crimped in the manner to assure positive electrical connection between sleeve **16**, spring **20**, washer **18**, and

connecting tab **17**. It is preferable that the first turn of spring **20** make positive electrical contact because electrical contact skipping to one of the other turns results in the addition of inductance, detuning the antenna.

A further metal washer **21** is positioned over sleeve **16** and forced against spring **20** to elastically compress spring **20** while the ends of cotter pin tailpieces **23** are spread apart to retain the assembly together. Spring **20** in its naturally expanded condition is longer than the portion of sleeve **16** over which it is retained so that when assembled in the antenna assembly it is held in a compressed condition. Pressure from spring **20** maintains electrical contact when the antenna element is moved from one position to another. Antenna element **11** is always pinched tightly between the outer portion of ring **12** and groove **13**.

In addition spring **20** applies pressure against the bent ends of tailpieces **23** tending to retract the cotter pin inside sleeve **16**. Sleeve **16** thus applies a pressure continually trying to force the tailpieces **23** together closing eye **22**. This provides a good electrical contact between antenna element **11** and support ring **12** at all times. Assurance of electrical and mechanical support is also obtained by groove **13** having an additional recess at the location of ring **12** as illustrated in FIG. 3; ring **12** must be withdrawn slightly from this recess on inserting antenna element **11**. After insertion of element **11**, ring **12** is pulled back toward the recess by spring **20** applying strong supporting and electrical contacting pressure.

With reference to both FIG. 1 and FIG. 3, it will be seen that with antenna element **11** extended, a direct pressure exerted on it in a line normal to the center of groove **13** can damage the antenna element. However, pressure even slightly off this line will have a tangential component that will cause the antenna element to rotate away out of the line of applied pressure.

FIG. 4 illustrates the positions to which the antenna may be readily rotated. Referring to FIGS. 1 and 3 it will be seen that ring **12** rotates in recess **25** in groove **13**.

It is a feature of the present invention that when used at the edge of a housing the combination of groove **13** and recess **25** provide snap-locking action on antenna element **11**. Thus if antenna element **11** is deflected from the longitudinal axis of groove **13**, it snaps around at right angles. It will be seen that this is a result of groove **13** lying along an edge and would not happen if groove **13** were recessed into a flat surface.

While support ring **12** is primarily intended for receiving the butt end of a whip antenna element, it is flexible in use permitting the ready removal of the whip and insertion of other connections. For example, inside a vehicle, a pin connection, from an antenna mounted on the exterior of the vehicle, can be made to said support ring. Antennas operable for different frequency ranges or for direction-finding purposes or the like can readily be interchanged with or without physical connections of the antenna element to support ring **12**.

Thus while the invention has been described in relation to specific embodiments thereof it is intended to cover the invention broadly within the spirit and scope of the appended claims.

What is claimed is:

1. A mounting assembly for an antenna or the like comprising:

(a) a mounting support wall having an interior side and an exterior side;

(b) an electrically conductive sleeve inserted in a bore through said wall;

(c) a cotter pin tightly fitted within said sleeve with its eye protruding at one end of said sleeve on the exterior side of said wall and its two tailpieces protruding at the opposite end on the interior side of said wall;

(d) a first washer with an electrical connecting tab fitted over said sleeve on the interior side of said wall;

(e) a spiral spring fitted over said sleeve against said first washer; and

(f) a second washer fitted over said sleeve so as to compress said spiral spring and secured in position by bends in the ends of said tailpieces, whereby said eye can serve as a plug-in connection for a whip antenna.

2. A mounting assembly according to claim **1** in which said metal sleeve is inserted through said wall at an edge where two wall surfaces meet.

3. A mounting assembly according to claim **2** in which said edge contains a hollow groove along its longitudinal axis, whereby a whip antenna mounted in said eye can be semi-concealed along said edge.

4. A mounting assembly according to claim **3** in which said edge is notched along an axis at right angles to said groove, whereby said eye and an antenna element mounted in said eye can be locked in any one of four positions, two of said positions defined by said groove and the other two of said positions defined by said notch.

5. A mounting assembly according to claim **2** in which said two wall surfaces meet at a right angle.

6. A mounting assembly according to claim **1** in which said spiral spring has a first spiral turn crimped so as to bind against said sleeve making positive electrical contact therewith adjacent to said first washer.

7. A mounting assembly according to claim **1** in which the butt end of a whip antenna element is fitted into said eye, said butt end having retainer means mating with said eye.

8. A mounting assembly according to claim **7** in which said retainer means is an annular groove.

9. A mounting assembly according to claim **1** in which said eye is continuously rotatable.

10. A portable radio device comprising:

(a) a generally oblong radio housing containing a groove along one longitudinal edge;

(b) antenna support means within said groove consisting essentially of a member having an eye and attached tailpiece means, the housing having a bore on an axis extending substantially perpendicularly from said groove toward the interior of the housing, and the tailpiece being located in said bore, with means resiliently to urge said eye toward said bore, said tailpiece being rotatable in said bore; and a whip antenna element mounted in said eye of said antenna support means in semi-concealed fashion within said groove; and

(c) said antenna whip element being rotatable with said eye about the axis of said bore so as to project out of said groove beyond the perimeter of said oblong radio housing.

11. A portable radio device according to claim **10** in which said antenna support means is a spring-loaded cotter pin which is extended by insertion of said antenna element and is then retracted under the control of said spring to provide positive electrical and mechanical connection.

12. A portable radio device according to claim **11** in which said antenna support means is rotatable, whereby said antenna element can be rotated out of said groove to any position around a 360 degree arc.

13. An electrical connection assembly comprising:

(a) a mounting support wall having an interior side, an exterior side, and a bore through said wall, said bore having an electrically conductive sleeve at the interior side of said wall extending from said wall;

(b) connector means comprising an eye larger than said bore and at least one tailpiece extending from the eye and inserted within said bore and sleeve with said eye protruding at one end of said bore on the exterior side of said wall and said tailpiece having a

portion protruding through said sleeve from the opposite end of said bore;

(c) a spiral spring fitted over said sleeve cooperating with said portion of said tailpiece protruding through said sleeve on the interior side of said wall and secured in a stressed condition by said portion for urging said portion in the direction tending to pull said eye into said bore; and

(d) means including an electrically conductive washer with an electrical connection tab fitted over said tailpiece and sleeve and under said spring resting against the interior side of said wall for making an electrical connection to said connector means on the interior side of said wall while freely permitting rotation of said tailpiece about its axis relative to said washer, whereby said eye can serve as a plug-in electrical connection on the exterior side of said wall for connecting to said connection tab in any position to which

said eye may be rotated about the axis of said tailpiece; said spring having a first spiral turn crimped so as to provide an electrical path from said connector means through said sleeve to said spring and from said spring to said washer.

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ELI LIEBERMAN, *Primary Examiner.*

U.S. Cl. X.R.

343—900; 339—255