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TELESCOPIC ANTENNA

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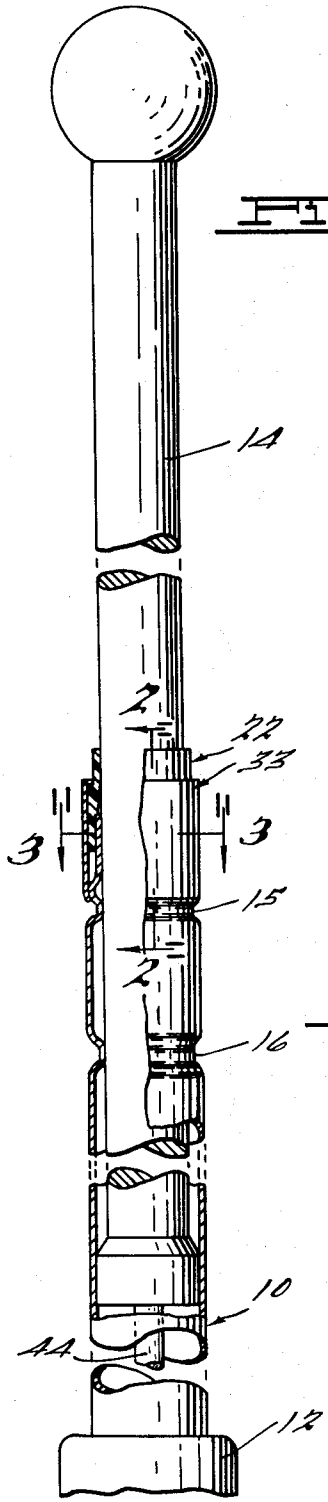



FIG. 1.

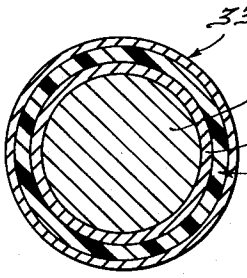



FIG. 3.

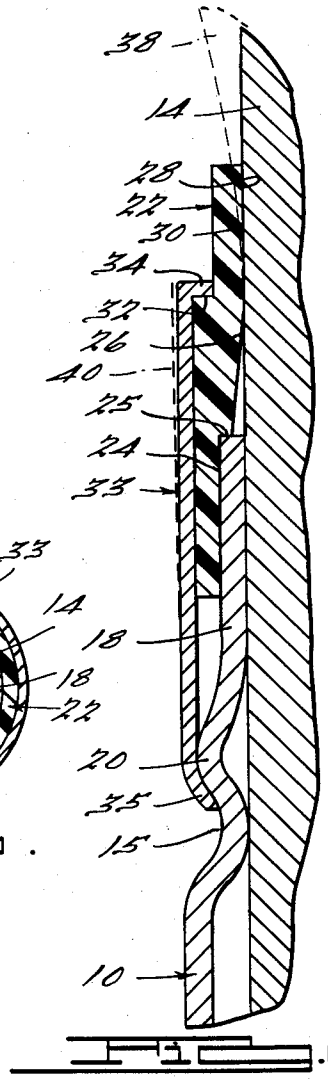



FIG. 2.

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# 3,042,416
# TELESCOPIC ANTENNA

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The present invention relates to improvements in the construction of multi-sectioned telescopic antennas.

It is common to provide, on automotive vehicles, telescopic antennas which are selectively extensible and retractable, in such a manner as to project to a varying extent from, or to be substantially retracted and concealed within, the body structure of the vehicle. In a preferred construction in common use, the telescopic antenna structure itself is preassembled with and forms an extension of the casing of a driving mechanism for powering the extensible and retractile movements of the slidable antenna components. The driving mechanism includes a motor, and power transmitting and gearing means enclosed in a housing structure which is rigidly attached to a lower supporting section of the mast assembly, such lower section and the housing structure being adapted to be rigidly secured with respect to the vehicle body, while one or more slidable sections, operable by such mechanism, are projectable through and outwardly from the first section.

Difficulty has been encountered in the operation of such antenna assemblies under service conditions due to moisture, soot and other foreign materials which find their way into the interior of the casing by working their way thereinto between the telescopic section or sections and the fixed section of the mast assembly. Such materials are often harmful both electrically and mechanically, and the art has heretofore attempted to meet this problem in three common ways. One approach to the problem has been to utilize conventional sealing devices, such as O-rings, between relatively slidable sections. Another approach has been to use no sealing means whatever, but to provide an open drain at the bottom of the housing, allowing any water which runs down between the mast sections to escape at the bottom, and relying upon such water to carry the other foreign material down with it. The third technique has been to utilize both of above methods simultaneously, that is, to provide means for sealing the mast sections as effectively as possible, while in addition providing a drain for the water which will sooner or later get past such known prior art sealing means.

The conditions encountered in service, and which have made it virutally impossible to provide a lasting seal between the mast sections, are very severe and are peculiar to devices of this type. The mast surfaces become coated with tightly adherent material, including the bodies of insects, and dirt and dust in turn adhere both to the mast itself and to the gummy material formed by the bodies of the insects. In addition, the masts are severely vibrated while in the extended condition, and are sometimes bent in service, and then imperfectly straightened by hand. The adherent material tends to destroy O-rings, by rolling them out of their grooves and distorting them. In addition, with conventional sealing arrangements, the severe lateral forces resulting from sway, vibration and wind effects, are imposed directly upon the sealing means, thereby greatly shortening the effective life and the sealing efficiency of such sealing means.

The fouling materials which are carried into the interior of the antenna and drive system, past the seals, are apt to contain soot, as well as mixtures of organic materials, water and salt, and such materials are sufficiently electrically conductive to destroy the electrical efficiency of the antenna, particularly in view of the fact that the feeble currents in a receiving antenna can leak to ground,



substantially short-circuiting the antenna, through materials which would not carry an appreciable current. For obvious and analogous reasons, it is undesirable to have a vent at the bottom of the assembly which would admit spray or moisture from beneath the vehicle.

In our improved construction the efficiency and life of the sealing means is so greatly increased as substantially to prevent the entry of foreign material and moisture into the interior of such an antenna and driving assembly from above. When our improved sealing means is employed, the vent at the bottom may be eliminated, or a very small vent, covered with a relatively impervious felt pad or the like can be used, so that the assembly need not be sealed from moisture thrown up from beneath the vehicle.

In addition to the objectives implicit in the foregoing indication of the problems dealt with and desiderata of this invention, it is an object to provide improved sealing means which is low in cost, well adapted to the methods employed in large scale production, and which does not objectionably increase the resistance to sliding movement of the telescopic sections of the antenna.

Other objects and advantages will become apparent to those skilled in the art upon consideration of the present disclosure in its entirety.

In the drawings:

FIG. 1 is an elevational view, partly broken away and partly in section, illustrating the upper portion of an antenna assembly constructed in accordance with our invention;

FIG. 2 is a fragmentary sectional elevational view on a larger scale, taken substantially on the line **2**—**2** of FIG. 1, and looking in the direction of the arrows; and

FIG. 3 is a cross-section taken substantially on the line **3**—**3** of FIG. 1.

Referring now to the drawings, reference character **10** designates generally the lower section of the mast assembly of a telscopic antenna of the character used on motor vehicles. The section **10** is adapted to be rigidly supported, as by the supporting means fragmentarily illustrated at **12**, in a position to project upwardly from a motor vehicle body (not shown). A slidable metallic mast section **14**, shown as a solid rod, is movable in the fixed section **10** in such manner as to be retractable into the latter or to project therefrom to varying degree, while remaining at all times in electrical contact therewith. It will be understood that a plurality of sliding sections may be employed, and that the details of construction of the sliding sections may vary.

Near its upper end the wall of the tubular fixed section is embossed inwardly at two spaced annular areas, designated **15** and **16**. Such annular indentations may be effected by rolling, and the depth of the depressions so formed is such that the inner surfaces of the indented annular wall portions substantially correspond in diameter to the outside diameter of the slidable section **14**, thereby furnishing sliding mechanical support for the latter.

Spacedly above the uppermost groove portion **15**, and extending to its upper extremity, the material of the tube **10** is swaged or otherwise necked inwardly, in an area designated **18**, to such extent that the inside diameter of the upper necked portion in section **18** also conforms closely to the outside diameter slidable rod **14**. The spacing between the necked portion **18** and the groove **15** provides an annular bulged area **20**, but the outside diameter of the bulged area **20** is preferably slightly less than the outside diameter of the main portion of the tube **10**, as best shown in FIGURE 2.

The sealing of the upper end of the tube **10** with respect to the slidable section **14** is effected by an annular sealing member generally designated **22**, formed of a

suitable flexible and impervious material such as a synthetic rubber or other elastomer. The sealing member **22** is of generally hollow cylindrical form and is provided at its lower end with an enlarged opening in the nature of a counterbore **24** proportioned to fit snugly over the reduced upper end of neck portion **18**. The upper end of counterbore **24** defines a horizontal shoulder **25** which partly overlies and fits against the upper end of neck portion **18**, although the internal diameter of the sealing member, at this position, somewhat exceeds the outside diameter of the slidable section **14**. From the position of the shoulder **25** upwardly for a distance which, in a typical antenna assembly designed to respond to broadcast frequencies may be of the order of ½ inch, the sealing member **22** is provided with a coaxial continuation of its internal opening, the inner wall being of gradually reduced diameter and defining a generally conic internal wall portion **26**. Above the reducing conic section **26** the sealing member is provided with a cylindrical internal sealing wall **28** proportioned to fit snugly but slidably against the outer surface of the slidable section **14**.

The upper extremity of the sealing member, surrounding the sealing wall **28**, is designated **30** and is of cylindrical form and is reduced in thickness by an external shoulder **32** which joins the upper extremity **30** to the lower, thicker portion of the body of the sealing member.

A sheet metal retaining sleeve **33** tightly embraces the lower portion of the sealing member **22**, having an inbent flange **34** at its upper end overlying the shoulder **32** and extending downwardly beyond the lower end of the sealing member and below the bulge **20**. The lower end of the sleeve **33** is bent inwardly, as indicated at **35**, into the groove area **15**. The sleeve **33** thus locks the sealing member onto the end of the mast section **10**. Preferably, the thickness of the sleeve **33** is substantially equal to the difference between the outside diameter of the bulge **20** and the outside diameter of the main portion of the mast section **10**, so that the sleeve **33** appears as a smooth continuation of the mast section **10**.

The portion **30** of the sealing element **22**, which projects above the sleeve **33**, is free to bend with swaying movements of the upper portion of the mast. All of that portion of the upper section **14** above the upper extremity of the main section **10**, that is, above the shoulder **25**, tends, when the aerial sways, to bend about a shorter radius than does the lower section **10**, generally as indicated by the dotted line **38**. Such swaying causes the upper section **14** to tend to compress the sealing material radially against the edge of the flange **34**, on one side (left, in FIGURE 2), and would tend to cause the mast section **14**, on the other side (right) to move away from the sealing material and permit leakage. With our improved construction, however, if such force reaches a sufficient value, the compressive force transmitted to the flange **34** (on the left, as the parts are viewed in FIGURE 2) causes the entire sleeve **33** to rock to the left in FIGURE 2, as indicated in dotted lines at **40**. The inturned lower retaining flange portion **35** of the sleeve **33** is curved in a partly spherical form, as also is the portion of the bulge **20** which the flange **35** overlies, so that these parts form in effect a universal joint, to permit such rocking movement of sleeve **33**. The elasticity of the rubber-like material of which the sealing element is formed is such as to permit the sleeve **33** to move in the indicated manner before the rod **14** can separate from the opposite side of the sealing inner wall portion **28**. Thus not only the upper extension **30**, but the entire seal assembly, including the retaining sleeve **33**, can follow the swaying movements of the upper section **14** sufficiently to maintain an effective seal at all times.

By virtue of the ability of our approved sealing structure to bodily tilt and bend, so as to follow and maintain effective engagement with the sliding section **14** at all times, the rubber can be and preferably is of a softer character than would otherwise be required. Thus, the rubber tends to flow around or envelop any particles adhering to the rod, and maintain sealing engagement with the rod **14** all the way around any such particles. A further benefit results from the fact that it is not necessary to design the structure to have as high a frictional engagement pressure between the rubber and rod **14** as would otherwise be required.

Reference numeral **44** designates a driving device in the form of a flexible rod of nylon or the like for moving the slidable antenna section inwardly and outwardly of the fixed section **10**. Rod **44** extends downwardly through support **12** to suitable driving mechanism which is not shown but which is well known in the art. While it will be apparent that the preferred embodiment of our invention above described is well calculated to fulfill the objects and advantages stated hereinabove, it will be apparent that various changes and modifications can be introduced without departing from the true spirit and scope of our invention as defined in the subjoined claims.

We claim:

1. In a telescopic structure, a pair of slidably interfitted members including a radially inner extensible member which is laterally flexible and a radially outer supporting mast member in which said extensible member is slidable to extend to a varying extent from said mast member, an axially projecting extremity of said mast member encircling said extensible member relatively closely, an elastic sealing element having one portion secured to said extremity of said mast member and another portion projecting axially outwardly from said mast member and slidably peripherally overengaging a surface portion of said extensible member beyond said extremity of said supporting mast member, said other portion of said elastic sealing element having an internal diameter slightly less than the external diameter of said extensible member for providing a slight interference fit therewith upon projection of said extensible member therethrough, and retaining means exteriorly engaging said sealing element at a surface located axially from the extremity of said other portion of said sealing element and having an arcuate portion located axially beyond the termination of said one portion of said sealing element and being matable with and in rockable engagement with a complementary arcuate portion of said mast member for retaining said sealing element to said mast member.

2. A structure as defined in claim 1 wherein said sealing element is of tubular form, the first-mentioned portion thereof encircling and being secured to the exterior of the supporting member.

3. A structure as defined in claim 1 wherein said extremity of said mast member includes a substantially flat transverse end and with said complementary arcuate portion being an annular protrusion spaced from said end, said sealing element being of tubular form and having an internal shoulder overlying said end, the first-mentioned portion of the sealing element extending around said extremity of said mast member between said end thereof and said protrusion, and said retaining means rockably overengaging said protrusion and extending axially exteriorly of said sealing element and mechanically secured thereto at a position spaced outwardly beyond said end.

4. A structure as defined in claim 1 with said complementary arcuate portion on said mast member being an annular protrusion spaced from the end of said extremity, said sealing element being of tubular form, the first-mentioned portion of the sealing element extending around said extremity of said mast member between said end thereof and said protrusion, and said retaining means rockably overengaging said protrusion and extending axially exteriorly of said sealing element and mechanically

secured thereto at a position spaced outwardly beyond said end.

5. A structure as defined in claim 1 wherein said extremity of said mast member includes a substantially flat transverse end and with complementary arcuate portion being an annular protrusion spaced from said end, said sealing element being of tubular form and having an internal shoulder overlying said end, the first-mentioned portion of the sealing element extending around said extremity of said mast member between said end thereof and said protrusion, said sealing element having an external shoulder outspaced axially from said internal shoulder, and said retaining means rockably overengaging said protrusion and extending axially exteriorly of said sealing element and interengaging said external shoulder.

6. A structure as defined in claim 1 wherein said extremity of said mast member includes a substantially flat transverse end and with said complementary arcuate portion being an annular protrusion spaced from said end, said sealing element being of tubular form and having



an internal shoulder overlying said end, the first-mentioned portion of the sealing element extending around said extremity of said mast member between said end thereof and said protrusion, said sealing element having an external shoulder outspaced axially from said internal shoulder, and said retaining means rockably overengaging said protrusion and extending axially exteriorly of said sealing element and interengaging said external shoulder, said sealing element being formed of relatively soft rubber-like material and said external shoulder and the interengaging portion of said retaining means being spaced from the axially outer end of said sealing element.

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