

April 22, 1941.

C. W. MARTIN

2,239,613

ANTENNA MEANS

Filed Aug. 9, 1937

3 Sheets-Sheet 1

Fig. 1.

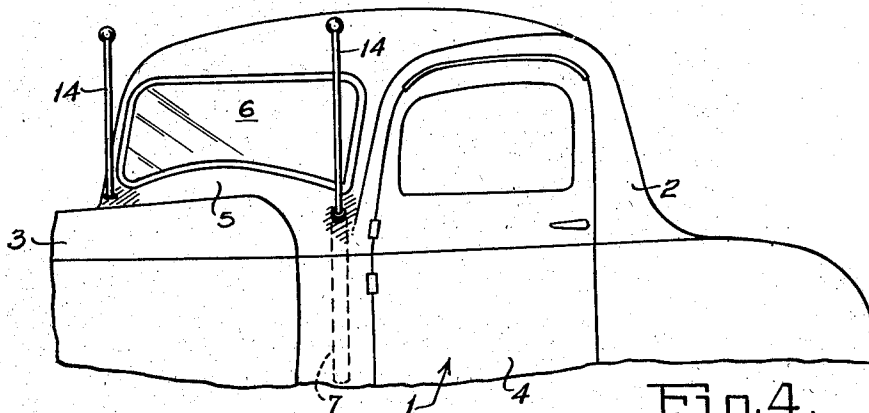
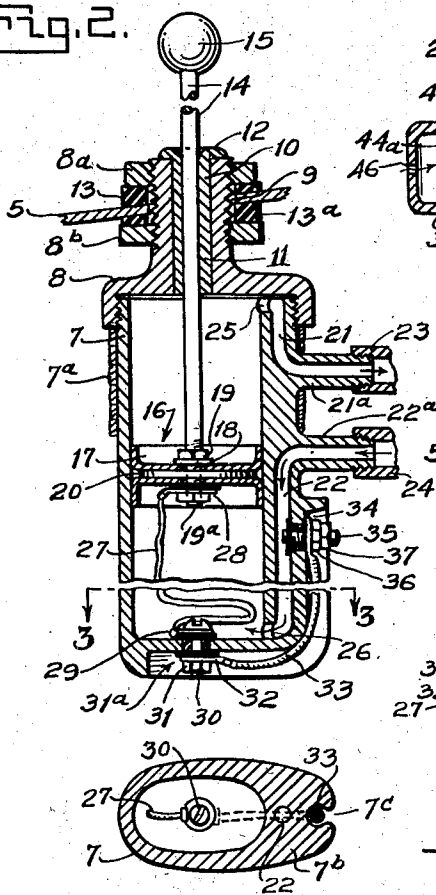


Fig. 2.



Ex 3.

Fig. 4

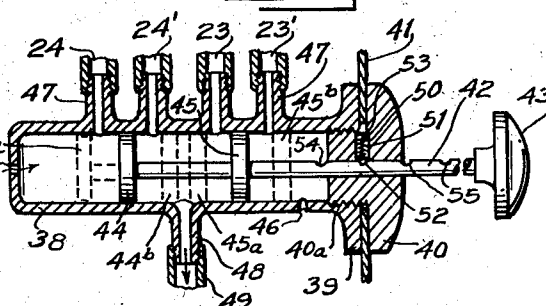


Fig. 6.

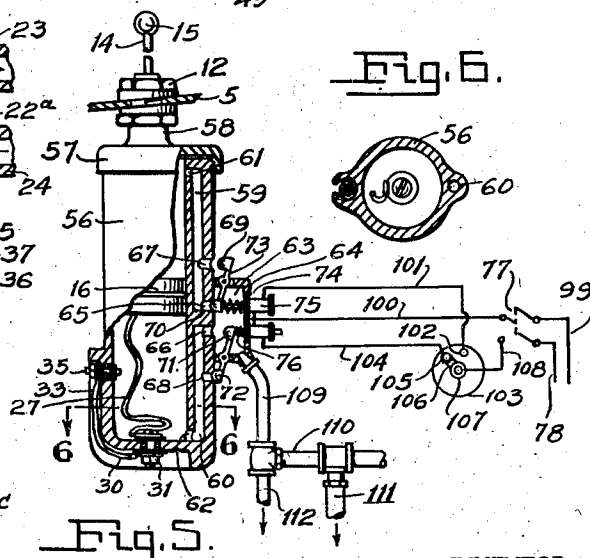


Fig. 5.

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3 Sheets-Sheet 2

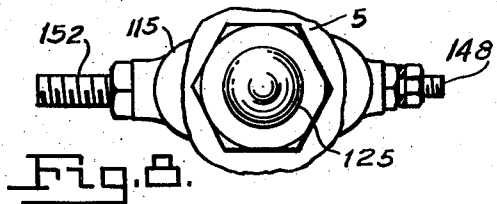
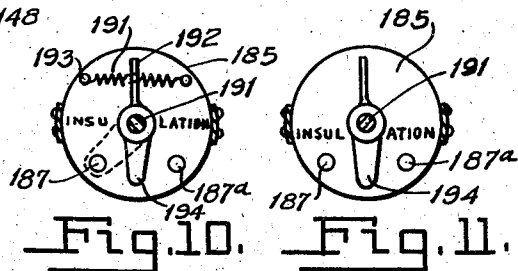
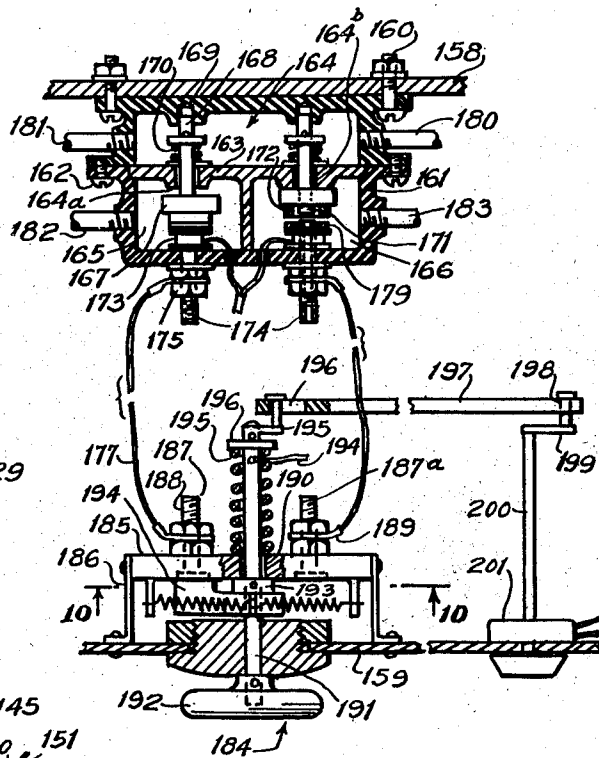
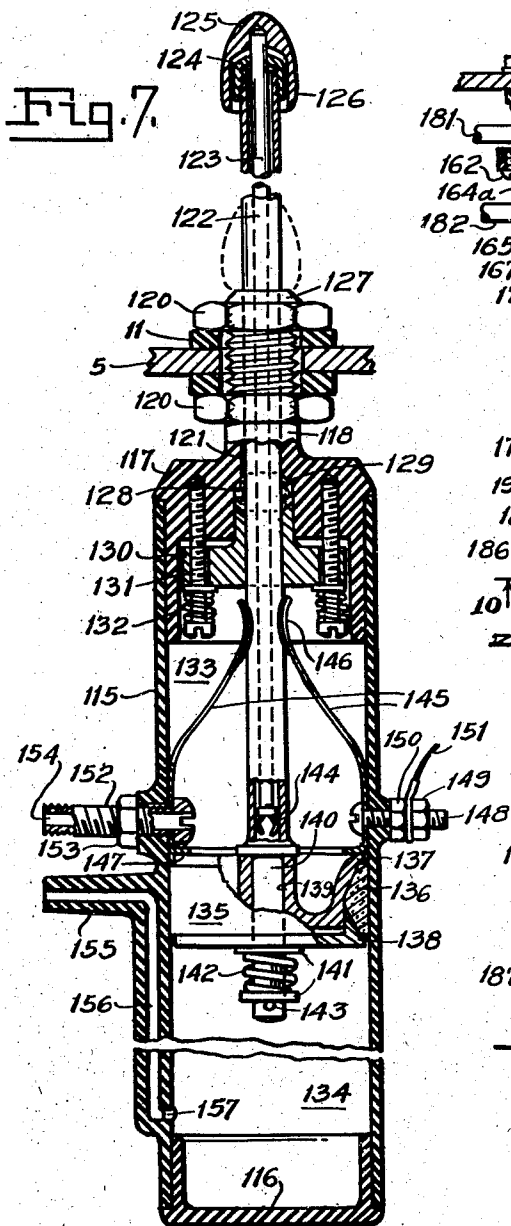


Fig. 9.



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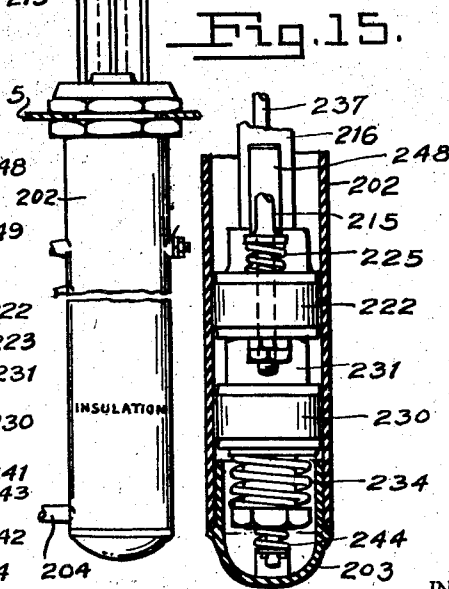
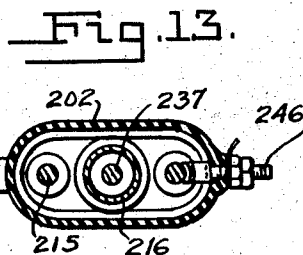
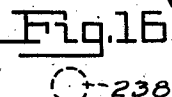
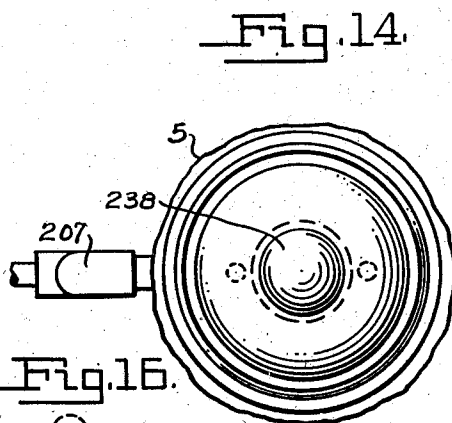
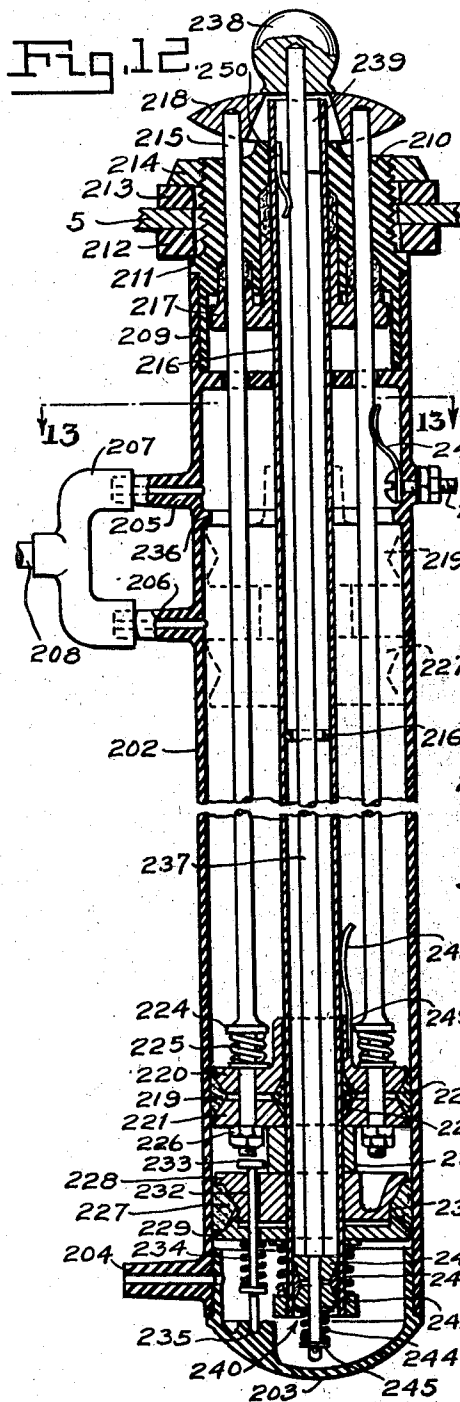
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,239,613

ANTENNA MEANS

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Application August 9, 1937, Serial No. 158,129

5 Claims. (Cl. 250—33)

This invention relates to radio antennae, and has as its principal object to provide a variable and extensible aerial for vehicles or any type of carrier, incorporating means for remotely adjusting the aerial to vary the capacity between the antenna and ground. Such an aerial has particular application to vehicles having sending and/or receiving radio or wireless equipment and which is adaptable to be mounted within or outside of the vehicle. When mounted within the vehicle, it may be mounted between the outer shell and the lining of the vehicle, or any other suitable place. The variable nature of the antenna facilitates sending and receiving wireless and radio messages and has particular adaptation to passenger type automobiles. It has been found that such an antenna is suitable for installation upon both or either side of an automobile windshield, although it is anticipated that this invention may be applied to various parts of vehicles and buildings or even mounted upon tripods for outdoor use.

Direct switching valve apparatus may be installed upon a dashboard of an automobile to regulate the length of the antenna or antennas as desired, or a remote electrical switching means may be employed to indirectly regulate the length of the antenna or antennas. The switch or valve control may be mounted at any convenient place to suit the operator, and when used in automobiles, the switch has been found very conveniently situated when mounted upon the steering post or steering wheel of the vehicle.

When such an antenna is employed upon a roof of a building, obviously the switching valve mechanism may be installed near the radio sending or receiving set within the building. Such a switch may have any suitable means to indicate the position of its internal parts in order to aid the operator in extending or retracting the antenna.

An object of this invention is the provision of a variable length antenna which may be operated to disappear or to semi-disappear in a convenient manner.

Another object is the provision of a variable length antenna provided with remote means to vary its length which may operate the antenna through or via a fluid means or electrical means.

Another object is the provision of an antenna having variable capacity which can be set in predetermined positions to suit the operator of a radio and/or wireless apparatus.

Still another object is to provide such an antenna with improved means for protecting it

against local electrostatic or electromagnetic influences which would alter or interfere with the normal use of radio apparatus.

Other objects will become apparent in the description of the invention, and in the explanation of the drawings. It is to be understood, however, that the description and drawings are not to limit the scope of the invention in any manner whatsoever except as limited by the appended claims.

In the drawings:

Figure 1 is a fragmentary perspective view of an automobile provided with antennae incorporating my invention.

Figure 2 is a longitudinal vertical section of an antenna rod, cylinder, etc., showing the same installed and with parts centrally broken away.

Figure 3 is a section substantially along the line 3—3 of Figure 2.

Figure 4 shows control valve apparatus in longitudinal section.

Figure 5 is a somewhat diagrammatic view of a modified form of my invention partly in section and partly in elevation.

Figure 6 is a section substantially along line 6—6 of Figure 5.

Figure 7 is a view similar to Figure 2 showing another modified form of the invention.

Figure 8 is a top plan view of the form of Figure 7.

Figure 9 shows a modified form of valve with remote control electric switching means mostly in section.

Figure 10 is a sectional view of the switch taken substantially on the line 10—10 of Figure 9, showing the springs in place.

Figure 11 is a similar view of the switch without the springs.

Figure 12 is a view similar to Fig. 2 showing another form of the invention.

Figure 13 is a transverse section taken substantially on the line 13—13 of Figure 12.

Figure 14 is a top plan view of the form shown in Figure 12.

Figure 15 is a sectional view of the lower part of the construction shown in Figure 12.

Figure 16 is an elevation on a reduced scale and centrally broken away, showing this form of the invention with antenna element extended.

Numeral 1 indicates the body portion of an automobile, having a passenger compartment 2, and an engine compartment enclosed by a hood 3. The doors of the body are designated 4, the cowl 5, and the windshield 6. Reference character 7 indicates a tubular housing or casing for

an antenna 14, vertically slidable therein. The cap 8 of the tubular housing has a neck portion which passes through a hole 9 of the cowl 5. The cylinder and cap may be of metal or of some non-conductive composition suitable for the purpose. Such a material may be "Bakelite," various compounds containing "Bakelite," rubber, "Catalin" and other substances known to have such properties which are also insulators with respect to ordinary currents of electricity.

A metallic shell or wrapping 7a may be placed about the cylinder, the shell or wrapping being grounded to the metallic frame of the vehicle or/and to the earth by a drag chain or metallic ribbon spring. Such a shell or wrapping may not be used, however, unless local electro-magnetic or electro-static discharges make it necessary to use same.

The cap 8 has an elongated section having a bore 10 within which is a sleeve 11 having lip 12 which engages an end of the cap 8. The sleeve may be of material which is an insulator or a so-called non-conductor of electricity, such as glass, hard rubber, "Bakelite," "Catalin" or any suitable compounds to prevent leakage of the feeble radio currents therethrough. The sleeve, however, may be of brass or other conductive metal when the cap 8 is made of good insulating material.

To hold the cylinder 7 in position with respect to the cowl 5, the elongated section of cap 8 is externally threaded to receive nuts 8a and 8b. Between the nuts and cowl 5, rubber washers 13 and 13a are placed. By tightly screwing down on the nut 8a, a water tight and rigid connection is made. Straps or other means may also be used along various parts of the cylinder and fastened to convenient parts of the car body in order to avoid unnecessary vibration.

The sleeve 11 has a bore of sufficient size to snugly envelop and provide a slide bearing for an antenna rod 14. The rod 14 may be of any suitable material for the efficient conduction of radio currents and may be copper, chrome plated steel or of any suitable conductive material suitably treated to withstand the corrosive action of the atmosphere, and to have a nice appearance. A ball 15 of material similar to that of the rod is fixed to one end of the rod by any suitable means or may be cast or formed integral with the rod. If desirable, this end fitting 15 may be only a half ball with the dome surface upwardly so that when it is seated upon the lips 12 of the sleeve, it will act as a rain and snow deterrent and thus prevent moisture creeping between the rod and sleeve.

The other end of the rod 14 has fixed thereto a piston 16 of metal which includes cup shape sealers 17 which may be rubber, treated fabric or any other material suitable for the purpose, that is, to prevent leakage of air around the piston. Such sealers are common in air pumps and may be attached to the piston in any well known manner such as by extending the rod 14 through the piston and providing a threaded end as shown and providing the washers 18 and nuts 19. A metal or "Catalin" washer 20 is sandwiched between the sealers 17 to give them stability and complete the piston so as to make it and the rod move rigidly together. Such a piston assembly, therefore, reciprocates with the antenna rod when a vacuum or air pressure is alternately applied to either side of the piston.

The cylinder 7 and the piston assembly 16 are elliptical or oval in cross section so that the cyl-

inder will fit in a relatively shallow compartment within the body of the automobile, or if mounted exteriorly of the body lining, it will not protrude objectionably. Such cylinders, caps and pistons may be very flat, in fact, the cylinder may be so flat as not to be objectionable, if placed anywhere in a vehicle. The cylinder has a relatively thick vertical edge 7b which is longitudinally slotted at 7c to accommodate one of the connecting wires whose purpose will later be explained.

The thickened section 7b also provides for air passages 21 and 22 which have their exterior ends connected to copper, fabric or rubber tubes 23 and 24 respectively. The passage 21 has an opening 25 at or near the top of the cylinder, and the passage 22 has an opening 26 near or at the bottom of the cylinder; the opening 25 permitting the ingress and egress of air from the chamber above the piston 16, and the opening 26 permitting the ingress and egress of air from the chamber below the piston 16.

A very flexible pig tail type of insulated stranded copper wire 27 has a terminal 28 fixed under the nut 19a and makes good electrical contact with the rod 14. The other end of the wire 27 is provided with terminal 29 held under the head of a binding screw 30 which extends through the bottom of the cylinder 7 and has a nut 31 under which is fixed a terminal 32 of a well insulated and/or armored copper wire 33. The wire 33 has a terminal 34 securely held in place by threaded stud 35 and nuts 36. A nut 37 is also provided on the stud to fix the terminal of an aerial lead from a radio set of the automobile, not shown. All connections are securely made so as to avoid vibration of the connected parts, and the wire 27 is of sufficient length so as to maintain its connection between the rod 14 and the screw 30 when the piston 16 is in its uppermost position. When the piston is in its lowermost position, sufficient space is allowed to permit the wire 27 to accumulate at the bottom of the cylinder. 7c is of such configuration as to hold the wire in place and prevent its accidental removal. The metallic armor of the wire may also be grounded to the car or earth. When the antenna cylinder 7 is metal or other conducting material, the binding posts which make electrical connection with the conducting wires would obviously be insulated from one another as shown at 31a; sleeves and washers of insulating material being provided around the binding post in the well known manner.

Figure 4 illustrates a control valve for operating the antenna by positive gas pressure or by vacuum. The one valve may be used to control two antennas, as shown, or more, or merely one, may be operated by the same valve, slight changes being necessary to accommodate any number of antennas.

The valve cylinder body 38 is cylindrical and has a flanged section 39 integral therewith which is provided with threads to receive a threaded cap 40. The valve is preferably mounted upon a dashboard as shown at 41 having a suitable size aperture receive the cap section 40a; the dashboard being tightly clamped between the flange 39 and cap 40. The cap 40 has a central bore to snugly receive a slide rod 42 having a finger grip 43 at the outer end and spaced pistons 44 and 45 fixed to the rod in the cylinder 38. Each end of the cylinder is provided with vent holes 45 to admit air to the cylinder, and also to the antenna cylinder which is determined by the

position of the pistons 44 and 45. Spaced teats 47 are shown at the top of the cylinder connected to tubes which lead to the antenna cylinders 7. Applicant has shown only two antenna cylinders connected with the valve cylinder, which therefore has only four teats, or two pairs; one pair running to one of the antenna cylinders, and the other pair to the other antenna cylinder. The pair having the tubes 23—24 connect with teats 21a and 22a of the antenna cylinder as shown in Figure 2; tubes 23' and 24' connect with the antenna cylinder on the opposite side of the car. In the bottom part of the cylinder 33 is a teat 48 connected with a tube 49 which makes connection with the intake manifold of the engine, or to the suction tube which operates the windshield wiper. If fluid under pressure, gas or liquid, is used for power to operate the antenna cylinders, then the tube 49 connects with the supply of such fluid.

In the threaded section 40a of the cap, a small bore 50 is provided having a spring 51 which urges a ball 52 downwardly. The top of the bore is threaded to receive a set screw 53 to hold the spring in compression. The rod 42 is provided with a series of cavities 54 which receive the ball 52 when alined therewith, and thus hold the rod 42 in certain releasable predetermined positions. The rod is also graduated as shown at 55 to indicate to the operator the position of the pistons within the cylinder.

When the valve setting is as shown in full lines in Figure 4, a partial vacuum is created between the pistons 44 and 45 because of tube 49, and air is sucked from the tubes 23 and 24' and thus from the chamber above the piston 16 in one antenna cylinder to raise the antenna rod 14. To permit this, however, air must be admitted to the chamber beneath the piston 16, and this is accomplished through the tube 24 which is open to atmospheric pressure by virtue of the vent 46 at the far end of the valve cylinder. The reverse action takes place in the other antenna cylinder because the suction in tube 24' will pull its connected antenna piston down. By this setting of the valve, one antenna is raised, and the other is lowered.

When the valve pistons are moved to the position shown by the dotted lines in Figure 4, and indicated by 44a and 45a, both antennas are down. The tube 24 is then placed under a partial vacuum and air is sucked from beneath the piston 16, and the tube 23 is open to the vent 46 at the dashend of the cylinder 33 and permits atmospheric pressure above the piston 16, thus causing the antenna rod to fall. The same action takes place in the other antenna cylinder.

When the valve pistons are pulled to the far right position as indicated by 44b and 45b, both antennas are raised. In this position of the valve, tubes 23 and 23' are connected to suction and tubes 24 and 24' connected to vent or atmosphere.

A modified form of the invention is shown in Figures 5 and 6, and will now be described.

An antenna cylinder 56 is shown which is very similar to the antenna cylinder 7, except that it is circular in cross section, and has electrical means for remote control of the antenna rod. The cylinder 56 may be made of any kind of suitable insulated material and it has a cap 57 of insulating material screwed upon its top. The cap 57 has a protruded part 58 which extends through the cowl of the automobile and is provided with the sealing means, rubber washers and

nuts similar to the one in Figure 2. This cylinder is also provided with an antenna rod 14, knob 15, piston 16, flexible wire 27, binding screws, nuts, etc. as already described for cylinder 7. The recess for the wire 33, however, is shown on the opposite side of the cylinder from the air passages 59 and 60. Air passages 59 and 60 have openings 61 and 62 respectively leading into the cylinder 56. A suction chamber 63 is provided upon the air passage side of the cylinder having walls 64 enclosing the space of the chamber, and also openings 65 and 66 which lead from passages 59 and 60 respectively into the chamber 63. Openings 67 and 68 are provided to connect the air passages 59 and 60 with the atmosphere. The openings 65, 66, 67 and 68 are provided with valve heads 69, 70 and 72 respectively. Pivoted arms 73 are provided which are pivoted to the wall 64 in any suitable manner, and have valve heads 69 and 70 as shown. A similar pivoted arm joins valve heads 71 and 72 as shown. The valve heads 70 and 71 are fixed to magnetic plungers or armatures 74 which pass through solenoids 75, springs 76 being provided around the plungers to urge the valve heads toward their respective openings.

A double pole switch 77 is connected to a source of electrical current by wires 78 and 79. From the switch leads a common electrical feeder 100 to supply current to both solenoids. A wire 101 leads from one of the solenoids to the point 102 of a hand rotary switch 103, and a wire 104 leads from the other solenoid to a switch point 105 of the switch 103. This switch is provided with an arm 106 pivoted at 107, which may be readily shifted off and on to points 102 and 105. The switch is fed by a wire 108 which leads to the other side of the main switch 77.

The suction chamber 63 has connection with a suction pipe 109 which is connected to a pipe 110 leading to the intake of the engine or to the suction line of a windshield wiper 111 provided with the car. A branch pipe 112 is provided and leads to a cylinder similar to 56, for the operation of another antenna, if desirable. Obviously, any number of antennas may be operated by the same switch or if preferable, a switch for each antenna may be employed.

When the main switch 77 is closed and the switch arm 106 is on point 105, as shown, the under side of the piston will be connected with the suction tube 109. Since the other solenoid is not energized, the upper side of the piston is open to atmosphere, thus forcing the antenna to lowermost position. When the switch arm 106 is placed upon point 102, obviously, the reverse operation takes place.

The modification illustrated in Figures 7-11 inclusive will now be described.

An insulated tube 115 having a bottom insulated closure cap 116 is open at the top to receive an insulated plug 117. This plug has an elongated neck 118 threaded to receive rubber washers 119 and lock nuts 120, the washers and lock nuts being arranged upon both sides of the cowl so as to rigidly hold the entire assembly to the cowl, the cowl 5 having the usual hole to receive the neck. Straps or other means may also be placed around the tube 115 and fastened to the body of the vehicle should more rigid support of the tube be desired. The neck has a bore 121 to provide a slide bearing for the antenna rod or tube 122; the antenna rod 122 being tubular so as to receive a second antenna rod 123 concentrically arranged therewithin. The outer rod has

screwed upon the upper end thereof a perforated cap 124 to receive the inner rod which passes through the perforation. The inner rod has a larger cap 125 which is parabolically shaped and non-perforated and securely fixed to its rod; the depending skirt 126 thereof serving to cover the crevices between the top nut 120 and the outer rod 122 in order to exclude dust, rain, sleet, snow, etc. from the sliding surfaces of the rods when retracted. To make the seal between the cap 125 and the top nut more dependable, a frustum-like resilient washer 127 is employed.

The plug 117 is provided with a packing cavity 128 with suitable packing material 129 forced snugly about the rod 122 by a gland element 130; the gland being provided with screws 131 having springs 132 so as to always urge the gland tightly in position. The plug 117 and tube 115 are hermetically sealed so that the chamber 133 is air-tight. This is also true with regards to the bottom cap 116 and the tube 115 so as to make the chamber 134 air-tight.

A piston assembly 135 reciprocates in the tube and is made up of three principal elements, packing 136, piston 137 and the gland element 138. The packing may be any of the well known materials suitable to prevent passage of air or other gas from one chamber to the next; hemp, jute, leather or any properly treated fabric may be used for the purpose. The piston is provided with a central bore 139 in which is securely fixed a post 140. The post 140, however, is not fixed to the piston gland 138, for this gland must slide axially of the post. Spaced washers 141 are provided upon the post extension exterior the piston gland. Intermediate the washers is a compression spring 142 which is held in place by the washer above the pin 143. The antenna rod 122 is securely fixed to the piston 137, as shown, so as to reciprocate therewith in a manner to be later explained.

The antenna rods 122 and 123 are made of material which is a very good conductor of electricity such as copper, chrome etc. whereas all of the other elements heretofore described except screws, nuts and springs in connection with this particular form of the invention are preferably made of insulated material which is a substantial non-conductor of low or high frequency currents. The kind of insulation used will depend upon results desired from the particular installation made but, at present "Bakelite," "Catalin" or hard rubber may be used.

In order to make good electrical connection between the antenna rods, bellied or arched metallic spring strips 144 are provided at the bottom end of the inner rod so as to make constant electrical contact with the outer rod regardless of their relative positions.

In order to conduct current from the outer rod to the radio or wireless apparatus, not shown, a metallic double leg-like or finger-like spring 145 is employed having end shoe pieces 146 in constant contact with the outer rod regardless of its position within the tube 115. The shoe pieces are concaved in horizontal section so as to snugly engage the rod over a substantial area. The spring 145 is integral with a ring 147 so as to give it formed stability. The spring 145 has one of its legs securely held to the side wall of the tube by a metallic bolt 148 having nuts 149 as shown to securely hold thereto a wire terminal 150, the connected wire of which leads to a radio set. The other leg of the spring is securely held by a hollow screw 152 and a nut 153. The bore 154 of the screw permits the egress and ingress

of the air or gas to and from the chamber 133. This screw is also adapted to engage the coupling of a pipe or tube, not shown, thus acting as a teat. Directly beneath the screw is a teat 155 for connection with a pipe or tube, not shown, and which has a vertical passage 156 which connects with the wall aperture 157 leading into the bottom of the chamber 134. Thus it can readily be seen that the alternate suction or pressure above and below the piston assembly 135 will cause the piston and the connected antenna rods to reciprocate in the tube 115.

The means to control the movement of the piston 135 is shown in Figure 9. The numeral 158 indicates the partition between the engine compartment of an automobile and the tonneau, and the numeral 159 indicates the dashboard in front of the driver of the vehicle. Mounted upon the partition by bolts 160 is a housing 161 made up of complementary parts joined together by screws 162. Between the complementary parts are preferably mounted gaskets to make the housing air-tight. A T-shaped partition 163 divides the interior housing into three chambers, 164, 165 and 166. Each chamber is hermetically isolated from the others to form a means of controlling air and vacuum to and from the tubular cylinder 115. The T-shaped partition 163 has apertures 164a and 164b to connect the chambers 165 and 166 with suction chamber 164. The apertures are closed by valve heads 167 which are fixed to valve stems 168 which have sufficient length to ride in guides 169 to hold the valve heads in alignment with their respective apertures or valve seats. The valve heads are continually urged to seat and close the apertures by compression springs 170 in the obvious manner shown and well known. Opposite the valve faces are armature elements 171 and also fixed to the valve head are annular valve elements 172. To open the valves, solenoids 173 are provided having hollow or tubular core elements 174 which are threaded to receive nuts 175 to hold terminals 176 of switch legs or wires 177. By this arrangement, air or gas may be admitted into the chambers 165 and 166 through the hollow cores of the solenoids. The housing is preferably entirely of insulated material, except for the conducting elements, magnetic elements, and nuts and bolts, so that the tubular screws 174 do not have to be insulated from the housing since the housing itself is made of insulated material, preferably, "Bakelite," "Catalin," or other suitable material. To complete the electrical path, the other side of the coils may be connected by wire 178 which leads through the wall of the housing and hence to any suitable supply of electrical energy. A resilient annular valve seat 179 is provided about the protruding core elements of each solenoid so as to make a hermetic seal for the valve elements 172. The suction chamber 164 has connected thereto a duct 180 which has connection with the suction manifold of the engine or any part thereof. In the event that positive pressure is desired to operate the antenna rods, the duct 180 may then be connected to a suitable air or gas pump. The tube 171 on the other side of the chamber may be connected to the windshield wiper or to any other apparatus requiring such services. A duct 182 connects chamber 165 with teat 152 of the antenna tube and a duct 183 connects chamber 166 with teat 155 of the antenna tube.

From the foregoing, it can readily be seen that by connecting suction chamber 164 with chamber

165 as shown in Figure 9, a partial vacuum will be created above the piston assembly 135 to raise it in the tube 115 as shown; the valve head 167 in chamber 165 having been electro-magnetically moved to the solenoid 173. This action caps the hollow screw 174 so as to prevent the admittance of atmospheric air. The valve, however, in the other chamber 166 is shown as closed with respect to the opening between chambers 164 and 166, but open with respect to the hollow tube 174 so as to permit the entrance of atmospheric air into the chamber 166, duct 183, teat and passage 155, 156 to the chamber 134 below the piston assembly 135. This operation of the valves, forces the antenna rods from the tube 115 for reception of radio waves which are transferred to the wire 151 and hence to the radio set. Obviously, the reverse position of the valves 165 and 166 would cause the piston assembly 135 to move downwardly in the antenna tube 115, and thus cause retraction of the antenna rods.

To control the movement of the valve heads, an electrical switching device 184 is used. This device includes an insulated disc 185 supported upon the dashboard by brackets 186. The disc is provided with countersunk contact screws 187 and 187a which are provided with nuts and terminals 188 and 189. One of the contact screws is electrically connected to one of the solenoids and the other contact to the other solenoid so that when the electrical contact is made with the heads of the screws 187 and 187a either valve 167 may be opened so as to place its chamber in communication with the suction chamber 164. The insulated disc 185 has a central aperture through which passes a shaft 191 having at one end, fixed thereto, a finger knob 192, and at the other end a crank 195 (to be explained). Intermediate the ends of the shaft is a thrust bearing ring 193 fixed to the shaft and which carries a switching arm 194 to make contact with the heads of screws 187, 187a. In order to insure proper pressure between the switch arm and the heads of the contact screws, a compression spring 195 is provided, as shown, held by the fixed washer 196.

In Figure 11, the switch is shown without any means to keep the switch arm in any predetermined position but so that the antenna device will not be constantly connected to the vacuum system of the engine, springs 197 are provided, as shown in Figure 10, and in Figure 9. This arrangement causes the switch arm to return to a neutral position and the valves to seat themselves. These springs are fixed to an extension 192 of the switch arm and also to pins 193 in the manner shown. The switch may be fed by a flexible wire 194 fixed to the shaft 191.

In order to operate a radio set in the vehicle so as to turn it on for operation when the antenna is extended, the crank pin 195 is provided fixed to the shaft 191 of the switch. The pin thereof having loose sliding connection in a slot 196, of a connecting link 197. The other end of the link having pivoted connection at 198 with a crank pin 199 which is fixed to the shaft 200 of the radio power switch 201. Since such radio power switches are so well known, no attempt will be made to describe same, but it is to be understood that the shaft 200 may be connected to any moving part of a radio power switch for controlling its "on" and "off" position.

From this arrangement, it can readily be seen that when the knob 192 is turned clockwise so as to make electrical contact and open the valve

passage connecting chambers 164 and 165, the antenna will be raised to a position depending upon the length of time contact is maintained between the switch arm 194 and contact 187. By turning the knob in this manner, the link 197 is moved to the left, as shown in Figure 9, causing the radio power switch 201 to turn on power to the radio set. When the operator's hand releases the knob 192, the switch arm 194 will immediately and automatically return to neutral position providing the springs 191 are used. The radio power switch setting will not be changed when the arm 194 returns to neutral position, as the pin of crank 195 will merely slip in the slot 196 of the link, and, therefore, not move the link 197. Now if, however, it is desired to discontinue the use of the radio, the finger knob 192 may be turned so as to throw the contact arm 194 into connection with screw 187a and thus operate the solenoid of the valve controlling the communication between the chambers 164 and 166, thus causing suction beneath the piston assembly 135 and the admittance of atmospheric air above the piston assembly 135 so as to lower it to the bottom of the tube 115. Note that this action will cause the link 197 to move to the right, and thus open the power circuit to the radio set.

The link 197, however, may be modified so that the turning on and off of the radio power switch 201 will extend and retract the antenna or antennas, respectively. Due to certain events or specific conditions, it may be to the operator's advantage or convenience to operate the antenna device by manipulating the power switch of the radio apparatus instead of the switch 184; obviously such a reverse control is within the contemplation of applicant's invention.

The modification shown in Figures 12 to 16 will now be described: This manifestation of the invention consists of an insulated tube or cylinder 202 having an insulated cap 203 for hermetically closing its bottom opening. Teats 204, 205, and 206 are provided, the teat 204 being located near the bottom, and teats 205 and 206 near the top spaced a predetermined distance apart. Teats 205 and 206 are connected to a single pipe 208 by a Y-connector 207. The open top of the tube 202 is hermetically closed by a threaded plug 209 which has an extension 210 passing through an aperture in the cowl 5 of an automobile. Between the shoulder 211 of the plug and the cowl is a resilient washer 212 and another washer 213 between the cowl and a nut 214 threaded to the plug. By tightening the nut, the tube can be rigidly held in place.

The plug has spaced bores to receive a plurality of antenna rods 215 and a hollow antenna rod 216. Packing cavities are provided around each of said rods and packing material snugly placed about the rods to fill the cavities. A gland element 217 having protrusions, as shown, enter the cavities and force the packing material tightly around the rods. Any suitable means may be employed to hold the gland element in place, and to adjust it and to keep it adjusted in any manner, or in the manner described for pistons 219 and 227.

The tops of the antenna rods 215 are held in spaced position by a connector 218 to which they are fixed. The connector has a central bore to permit the passage of the hollow rod 216 there-through. The bottom ends of the rods 215 are fixed to a piston assembly 219 as shown having a top element 220 and bottom element 221 shaped

to provide packing chambers for packing 222 and 223. The rods have shoulders 224 against which rest compression springs 225. These rods pass through bores in the piston top and bottom and extend a predetermined distance to receive nuts 226 and for a purpose to be later explained. By adjusting the nuts 226, proper pressure may be applied to the packing to prevent air passing around the piston, and between the piston and tube 216. The springs 225 continually urge the piston parts 220 and 221 together so as to insure good air tight contact between the various surfaces and packing in order to compensate for wear of the packing.

The tubular antenna element 216 pass through the central bore of the piston assembly 219 and also through a central bore of a piston assembly 227 to which it is affixed in any suitable way.

The piston assembly 227 also has top and bottom elements 228 and 229 and packing 230 similar to the one shown in Figure 7. A resilient ring 231 is provided upon the assembly 227 to prevent damaging shocks when both piston assemblies come into contact. The tubular rod 216 slides through the piston assembly 219 but is fixed to the piston 227 and reciprocates with it. To keep the packing 230 in gas tight contact with the walls of tube 202, a collar is screwed upon the lower end of the tube and a compression spring placed between the collar and piston element 229.

In order to provide for the admittance of atmospheric air between the pistons when suction is applied over the top side of piston 219, a bore 232 is provided through the piston elements 228 and 229 to receive a valve rod and head 233. Near the lower end of the valve rod is mounted a spring 234 and a fixed washer to urge the valve head to seat and close the bore to prevent passage of air therethrough. The extreme lower end of the valve rod comes into contact with a stop element 235 a little before the piston 227 is at its lowermost limit in order to assure the opening of the bore passage 232 when the piston has reached its lowest position. In order to limit the upward limit of piston 219, a flange 236 is provided.

To give the antenna device still greater capacity and effectiveness, another rod 237 is provided within the tubular rod 216. This rod 237 has a ball 238 fixed to the upper end thereof which has sufficient diameter to close the bore of the element 218 when it is retracted. A guide 239 is inserted and fixed to the tube 216 to assure operating ease of the rod 237. The other end of this rod has a piston assembly 240 fixed to a reduced part thereof and this assembly also has upper and lower piston elements 241 and 242 with packing 243 between the beveled perimeters thereof. To keep these elements under constant and predetermined pressures with respect to one another to assure proper sealing between piston and the tube wall, a spring 244 and fixed washer 245 are provided.

To conduct the feeble radio currents to the binding post 246, a metallic spring 247 having constant contact with the rod 215 is used. The rods 215 are electrically connected through the metallic piston parts 220 and 221. A metallic spring clip 248 is soldered or otherwise electrically connected to the piston element 220 at 249 and the shoe thereof rides along the tube-rod 216. On the inner surface of the rod 216, a similar spring clip 250 is soldered or welded and the shoe thereof designed to ride along the inner

antenna rod 237 and constantly makes electrical contact therewith. By this arrangement, it can be seen that the rods 237, 216 and 215 have good electrical contact with one another, and also the binding post 246 which is connected by wire to the radio set.

To raise all the rods, suction is applied to the pipe 208 and thus above the piston assembly 219. Atmospheric air is admitted below the piston assembly via the teat 204 and passage 232 which is open; this raises the piston 219 to the position shown in dotted lines at 219' and extends the rods 215 well above the plug 210. Since these rods are fixed to the connector 218, it too is extended and pushes the ball 238 and the inner rod 237 in extended position. The piston 240, therefore, rides to near the top of the tube 216 and engages the stop 216a which is fixed to the tube 216, thereby partially lifting piston assembly 227 to close air vent valve 233. When the piston 219 passes the opening of teat 206, suction is applied above the piston 227 which immediately rises to the position shown in dotted lines at 227'. The valve 233 of this piston closes immediately when the piston is partly lifted as described, and when this piston is elevated by suction, it carries with it the tube 216 and the already extended rod 237 so that substantially the entire rod area is exposed to the atmosphere in the manner shown in Figure 16.

When suction is applied to the teat 204 and atmospheric air pressure to teats 205 and 206, all rods are retracted into the tube or cylinder 202 in an obvious manner.

Pistons 219 and 227 will fall together. Suction beneath and atmospheric pressure above, the piston 240 will retract the rod 237 and thus remove from view all rods above the cowl 5 of the vehicle.

I claim:

1. An antenna device, an insulated cylinder having a piston, means hermetically sealing the top and bottom of the cylinder, a rod vertically movable through the top and attached to the piston, means to conduct electricity from the rod exteriorly of the cylinder for the connection to a radio apparatus, said rod being hollow to accommodate another rod movable along the axis thereof and having means to conduct electricity between the rods, means to control the movement of the rod, said means including magnetically controlled valves and an electric switch having a neutral position to allow the valves to close.

2. An antenna apparatus, a casing, a plurality of spaced rods in the casing reciprocable therein and projectable therefrom, a plurality of pistons in the casing fixed to certain of said rods, means to apply a differential of pressure upon either side of said pistons to cause them to reciprocate and extend their respective rods exteriorly of the tube, one of the rods being hollow and having a reciprocable rod therein, means for raising some of the rods in advance of other rods to predetermined positions.

3. In combination with an automotive vehicle having body sheathing defining sections of different heights, including a lower section incorporating an engine compartment, a passenger compartment having a higher portion adjacent and projecting above the engine compartment, an engine within said engine compartment having a portion within which pressure changes occur during operation, said engine also having means appurtenant the same which during operation creates radio interference, radio apparatus within the passenger compartment, an

antenna assembly including a tubular housing formed at least partly of metal grounded to the body to provide a shield and arranged within the body in substantially vertical position, said housing being open at its top outside the body, an antenna element insulated from the body and slidable in said housing to positions in which it extends upwardly to variant extent from the body, said antenna element also being movable to retracted position inside said housing, means providing continuous electrical connection between said antenna element and the radio apparatus within the passenger compartment, actuating means powered by the aforementioned pressure changes to move the antenna element to extend and retract the same, and control means within the passenger compartment for controlling said actuating means.

4. Means as set forth in claim 3 including friction means tending to hold said antenna element in any position to which it may be moved, said actuating means including piston means within said tubular housing, said control means including valve means for selectively connecting said engine portion within which pressure changes occur to either side of said piston to urge the antenna element in either direction, said valve means being actuatable by said control means within the passenger compartment and having two independent "on" positions for providing said connections to opposite sides of said piston means, said valve means also being movable to a shut-off condition in which no actu-

ating pressure is applied to either side of the piston means, and means including a resilient element normally returning said valve means to the shut-off condition.

5. In combination with an automotive vehicle having a body including an engine compartment and a passenger compartment, an engine within said engine compartment having electrical ap-purtenances which create radio interference, radio apparatus within the passenger compartment, an antenna assembly including a shielded tubular housing arranged in the body in substantially vertical position, said housing being open at its top outside the body, an antenna element slidable in said housing to a projected position in which it extends upwardly from the body, and movable to a retracted position in which it lies in the housing in the body, means providing continuous electrical connection between said antenna element and the radio apparatus within the passenger compartment, actuating means for said antenna element, control means located in the passenger compartment for selectively regulating projection and retraction of said antenna element, friction means tending to hold said antenna element in any position to which it may be moved, said actuating means including means for positively urging said antenna element in either direction, and means normally returning said control means to a neutral position in which said antenna element is urged in neither direction.

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