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RETRACTABLE WHIP ANTENNA

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FIG.1.

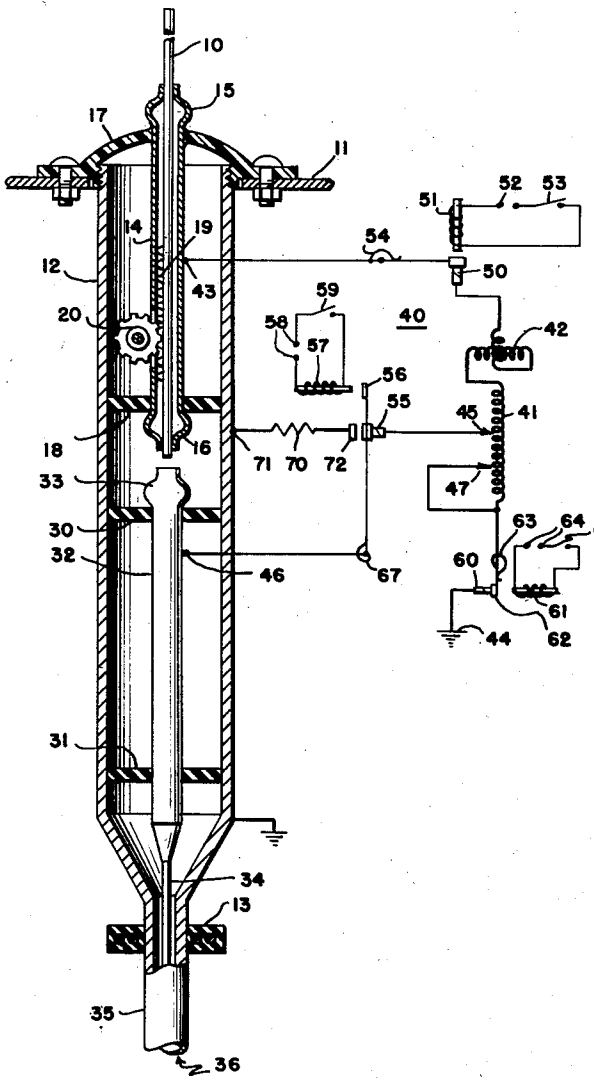
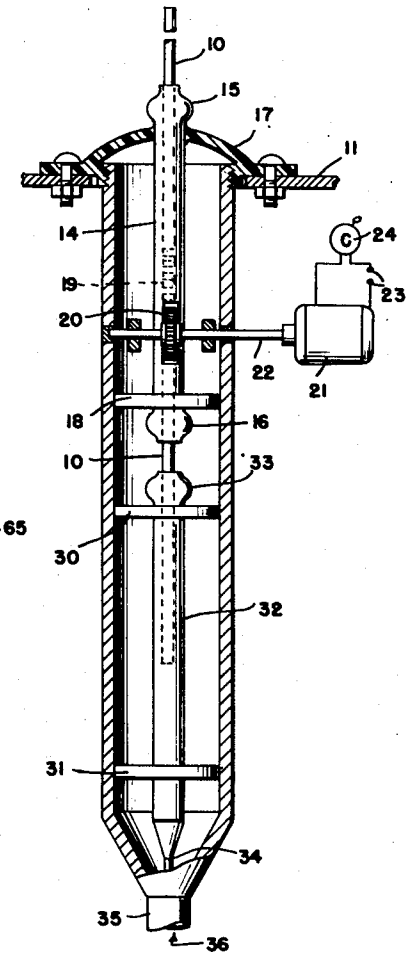


FIG.2.



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RETRACTABLE WHIP ANTENNA

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This invention relates to retractable antenna systems with special reference to novel tuning mechanism.

For many uses, such as on surface or undersurface ships, retractable antenna capable of easy adjustment for widely different resonant frequencies are highly desirable.

A primary object of the invention is to provide a retractable antenna which may be readily adjusted for tuning. An object also is to provide an antenna which efficiently combines antenna adjustment with a coupling circuit to extend the range of normal tuning for a single antenna unit.

A further object is to provide a coupling arrangement which lends itself to easy control of a combined ordinary and "dummy" antenna system. Further objects relate to improved means for remote control and for ship installation.

The mentioned objects are attained by the means exemplified in the following disclosure in which Fig. 1 is an elevation, partly in section, of the antenna, showing the circuit connections; and

Fig. 2 is a similar view of the antenna showing the antenna adjustment mechanism.

Figs. 1 and 2 illustrate application of the antenna 10 to a ship deck, indicated by the numeral 11. In an opening in the deck a well is formed by the tubular metal casing 12, into which the antenna is adapted to be lowered. This casing is secured at one end directly to the deck and at the other end by clamp 13. The casing 12 may extend through several decks if necessary to obtain the required depth.

A short metal guide tube 14 having resilient holding end fingers 15 and 16 normally retains the antenna in a given set position. The guide tube in turn is held in fixed position inside the casing 12 by means of the electrically insulating cover plate 17 at the deck level and the inside insulation plate 18 at the other end of the guide tube.

Means for reciprocating the antenna are provided in a rack 19 formed on the antenna, an electrically insulating pinion 20 meshing with the rack, a motor 21 operating through shaft 22 to turn the pinion, a power source 23, and a control device 24 of conventional form for varying the power supply. By this means the antenna is moved up or down in accordance with the desire of the operator.

Within the casing 12, and supported by insulation plates 30 and 31 is a second guide and contact tube 32. This tube is electrically conducting and is placed in axial extension of tube 14 but

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displaced therefrom by an appreciable air gap. Like tube 14 the upper terminal of this second tube is resiliently constructed by the fingers of contact device 33 so that on downward movement of the antenna there is a sliding contact between the tube 32 and antenna thus bridging tubes 14 and 32. (See Fig. 2.)

The base ends of both casing 12 and tube 32, as shown in the drawings, are constricted, tube 32 to form an inside electrical conductor 34 and casing 12 an outside electrical conductor 35 of a concentric conductor unit 36 adapted to lead to the receiving or transmitting equipment. The characteristic impedance of this unit preferably coincides with that of the well unit 12—14—32.

As described to this point it is apparent that the antenna is susceptible of use as an extensible device adaptable for different frequency requirements, provided both contact tubes 14 and 32 are bridged by the antenna. In order to extend the frequency range to include lower frequencies than would result from the limit extension of the antenna, an electrical coupling circuit 40 is provided between contact tubes 14 and 32 which, as desired, may be short circuited by the bridging action of the antenna between these tubes.

Coupling circuit 40 includes two induction coil units, a coil 41 of fixed length constituting the main impedance of the circuit and variable inductor 42 provided with a movable coil. The coils are connected in series, from a point of engagement 43 on tube 14 to ground at 44. A slidable tap 45 also connects various points on coil 41 to a fixed point 46 on tube 32. Rough adjustment of the impedance of coil 41 is secured by a slidable tap 47, the tap having connection to the ground end of the coil. The variable inductor 42 provides fine impedance adjustment.

Suitable switches are inserted in the circuit 40 to control application of the coupling. Between the inductor 42 and connection point 43, pivoted switch 50 is inserted, preferably controlled by electromagnet 51 and associated branch circuit including power source 52 and manual switch 53. Spring 54 normally maintains the switch closed but yields to permit switch opening on energization of the magnet.

Also, in the conductor connecting coil tap 45 and tube point 46 an armature controlled switch 55 is inserted, the armature 56 being operated by electromagnet 57 with its associated branch circuit including power source 58 and manual switch 59. A spring 67 is indicated to maintain the switch 55 normally closed.

A pivoted switch 60 is also inserted, in the con-

ductor connecting coil 41 to ground. This switch is actuated by energization of electromagnet 61 on armature 62 connected to the movable switch arm, spring 63 normally holding the switch closed. Electromagnet 61 is included in a branch circuit with power source 64 and manual switch 65.

Utilizing the electromagnets 51, 57 and 61, remote control of the various switches is attained.

A non-radiating "dummy" antenna circuit is also employed in the coupling circuit to facilitate adjustments and measurements, particularly in the case of lower frequencies and to carry out transmitter tests without radiation of interfering signals. This is indicated by resistor 70, which is connected between point 71 on the casing 12 and a switch 72 operated alternately with switch 55, by armature 56. Thus, when the dummy antenna is in operative connection the control coupling 40 is disconnected.

The value of resistance 70 is such as to produce a matched termination for the transmission system including the unit 12—32 and the coaxial line 36. In the case of a transmitter system the relays are operated to switch in the dummy resistor 70, and the transmitter is then adjusted in the usual way. The switch 72 is then opened and slide 47 and inductor 42 adjusted to obtain the same load impedance value as that of the dummy load. The equivalence of these conditions is determined by the use of meters or the action of the tuning controls of the transmitter in a manner obvious to those skilled in this art.

A description of the antenna operation follows. Assuming a high frequency transmission or reception the antenna is retracted, short circuiting the coupling 40 by connection of tubes 14 and 32 (see Fig. 2) through use of control 24, the desired effective antenna length is secured.

If longer wave length utilization is desired the antenna is moved to the outer limit breaking the direct electrical connection by the antenna of the tubes 14 and 32. Tap 47 is then manipulated for rough adjustment and inductor 42 for fine adjustment, of series impedance values between the antenna and ground. Also tap 45 is adjusted for power take off from the inductor 41.

A further modification of coupling impedance may be secured by opening switch 60 and thus placing the impedances 41 and 42 in direct series relation as regards tube contact points 19 and 46. In this manner substantial extension of the usable antenna frequencies to lower values is secured.

Where the use of the dummy antenna load is desired for test or adjustment, closure of switch 59 and either fully extending or fully retracting antenna 10 will introduce resistor 70 as substantially the only load circuit.

It thus appears that by use of deck well and by introducing a break in the antenna with utilization of by-pass coupling, substantial frequency variation with a definitely reduced length of antenna may be obtained.

Variations in specific details of the antenna and coupling construction may be made without departure from the substance of the invention as defined in the claims hereto appended.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalty thereon or therefor.

What is claimed is:

1. An antenna comprising a tubular casing adapted for ground connection to a support, an electrical conductor forming an elongated antenna adapted for axial movement along the axis of said casing, a portion of said conductor extending within said casing, means normally holding said conductor in position for axial movement in said casing, mechanism for imparting axial movement to said conductor, antenna conductor contact means in said casing, said contact means being positioned in prolongation of said conductor holding means but displaced therefrom, insulating means for supporting said holding and contact means within said casing, and outlet conductors connected to said casing and contact means.

2. An antenna comprising a tubular casing adapted for ground connection to a support, an electrical conductor forming an elongated antenna adapted for axial movement along the axis of said casing, a portion of said conductor extending within said casing, electrically conducting means normally holding said conductor in position for axial movement in said casing, mechanism for imparting axial movement to said conductor, antenna conductor contact means in said casing, said contact means being positioned in prolongation of said conductor holding means but physically displaced therefrom, insulating means for supporting said conductor, and impedance coupling means between said holding and contact means.

3. An antenna comprising a tubular casing adapted for ground connection to a support, an elongated antenna electrical conductor adapted for axial movement along the axis of said casing, a portion of said conductor extending within said casing, electrically conducting means normally holding said conductor in position for axial movement in said casing, mechanism for imparting axial movement to said conductor, antenna conductor contact means in said casing, said contact means being positioned in axial prolongation of said conductor holding means but displaced therefrom, insulating means for supporting said conductor, and holding and impedance coupling means between said holding and contact means, said coupling means including series and parallel connections, and said mechanism shorting out said coupling on imparting axial movement to said conductor to bridge said conductor holding means and said contact means, whereby the antenna tuning may be modified.

4. An antenna system comprising a grounded member, an antenna having a contact end section, electrically conducting holding means for holding said antenna end section for slidable movement relative to said member, contact means displaced from said holding means and electrically insulated therefrom for engaging said antenna end sections in electrical contact therewith on movement of said antenna end section, means for moving said antenna end section into and out of engagement with said contact means, and circuit connections between said holding and contact means for inserting an impedance therebetween.

5. An antenna system comprising a grounded member, an antenna having a contact end section, electrically conducting holding means for holding said antenna end section for slidable movement relative to said member, contact means displaced from said holding means and electrically insulated therefrom for engaging said antenna end section in electrical contact therewith on movement of said antenna end section, means for moving said antenna end section into and

out of engagement with said contact means, circuit connections between said holding and contact means for inserting an impedance therebetween, and change means for modifying said impedance.

6. An antenna system comprising a grounded member, an antenna having a contact end section, electrically conducting holding means for holding said antenna end section for slidable movement relative to said member, contact means displaced from said holding means and electrically insulated therefrom for engaging said antenna end sections in electrical contact therewith on movement of said antenna end section, means for moving said antenna end section into and out of engagement with said contact means, circuit connections between said holding and contact means for inserting an impedance therebetween, and change means for modifying said impedance, said change means including a fine impedance changer, a medium impedance changer and a coarse impedance changer whereby the resonance of the antenna may be closely controlled.

7. An antenna system comprising an antenna rod, electrically conducting holding means for holding said antenna rod for slidable movement relative thereto, contact means electrically disconnected from said holding means and physically displaced therefrom in the direction of rod movement whereby electrical contact between said holding and contact means may be established by rod movement, means for moving said rod into electrical contact with said contact means, an output terminal connected to said contact means, an impedance, and circuit connections between said holding and contact means and said impedance.

8. An antenna system comprising an antenna rod, electrically conducting holding means for holding said antenna rod for slidable movement relative thereto, contact means electrically disconnected from said holding means and physically displaced therefrom in the direction of rod movement whereby electrical contact between said holding and contact means may be established by rod movement, means for moving said rod into electrical contact with said contact means, an output terminal connected to said contact means, a first impedance, circuit connections between said holding and contact means and said first impedance, and a second grounded impedance connected to said contact means.

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