Aug. 20, 1935. J. P. BUCKLEY 2,011,968

COIL ANTENNA

Filed July 22, 1930

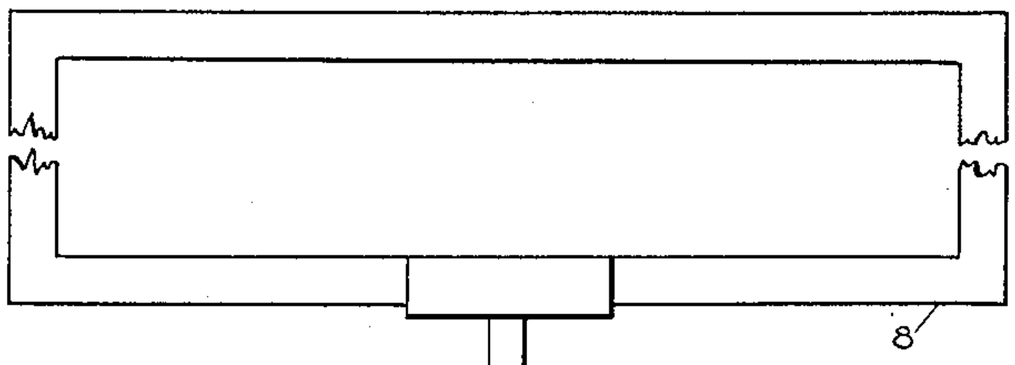


FIG. 1.

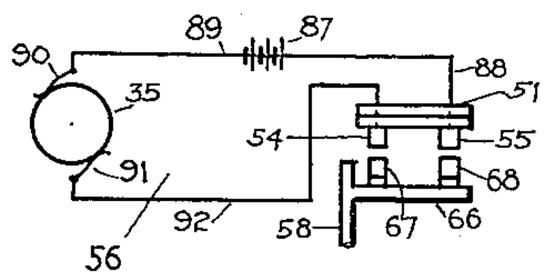


FIG. 4.

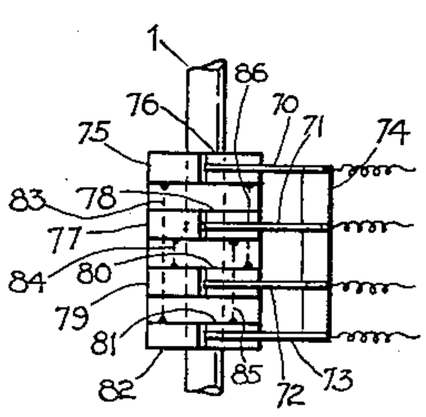
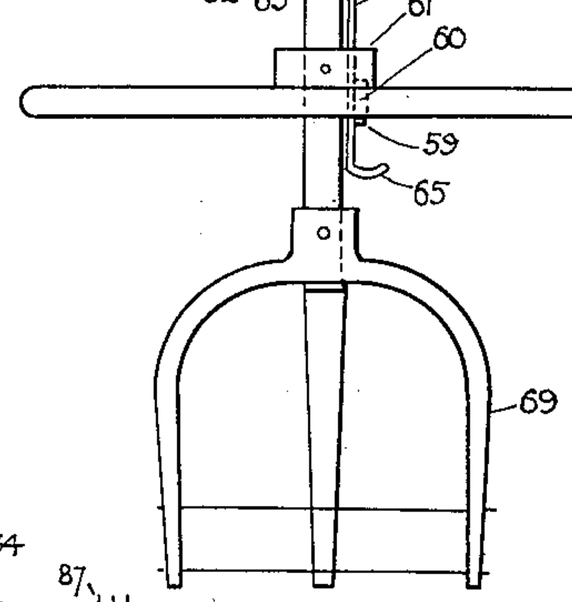


FIG. 5.



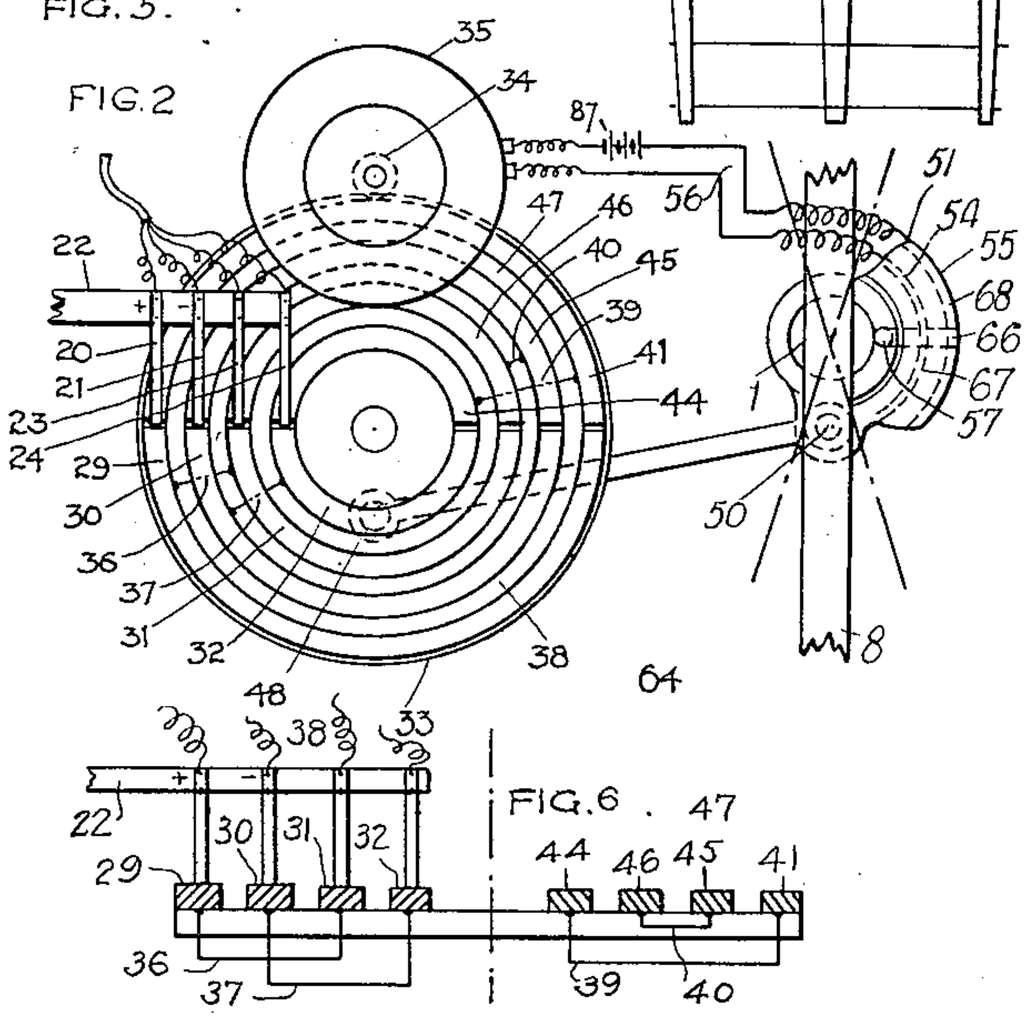


FIG. 2

FIG. 6.

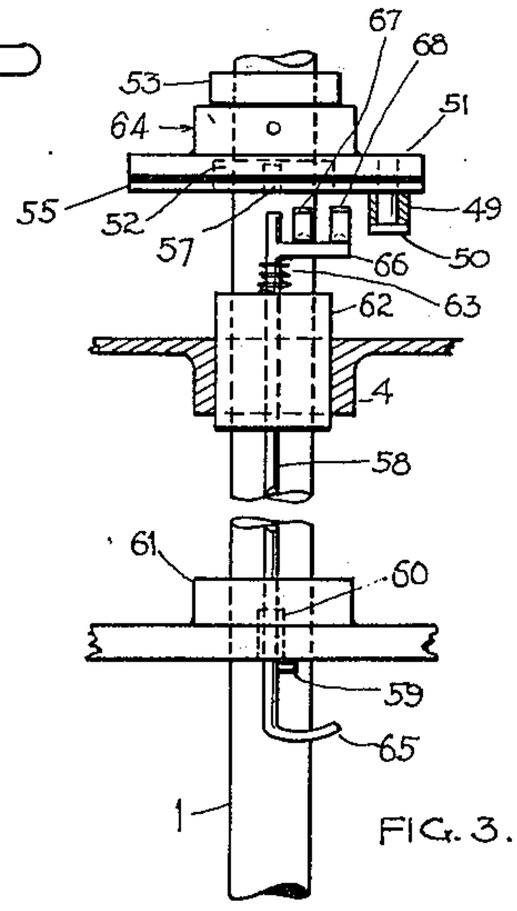


FIG. 3.

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2,011,968

COIL ANTENNA

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Application July 22, 1930, Serial No. 469,671

6 Claims. (Cl. 250—11)

This invention relates to the use of a coil antenna and more particularly to the means for automatically controlling a predetermined movement of the coil antenna when on a beacon course, which, in conjunction with other simple means for indicating "right" and "left" position of said course, enables a pilot to steer centrally and more sensitively over a radio beam than has heretofore been possible.

Certain devices have already been provided for guiding a mobile body over a radio course, such as, for instance, the "A", and "T" code system, vibrating reeds, or the like, all of which methods however, appear sluggish and slow of action unless well off the center of the beam, at which time the pilot is then apprised of his position; as a consequence, instead of a straight central run over a course, the pilot must necessarily zig-zag along the way until the beam narrows on nearing a very close approach of the beacon, when such device then becomes fairly sensitive as to position.

Another object is to provide suitable means whereby a single coil and its receiving circuit, such as are employed as direction finders or radio compasses aboard ships, may perform the work of a double coil and its circuits, thereby rendering the use and application of the single coil more effective than is now practiced in the art.

With these and other objects in view the invention consists of the novel construction, arrangement and formation of parts as will be hereinafter more specifically described, claimed and illustrated in the accompanying drawing in which:

Fig. 1 is an elevation view of the antenna coil and the control apparatus associated therewith;

Fig. 2 is a top view of the circuit controlling switch and shaft actuator looking downward from line "*a*—*a*" in Fig. 1;

Fig. 3 is an elevation view of the electrical contacting means for the driving motor and the locking provision for engaging the compass shaft;

Fig. 4 is a schematic view of the motor circuit and the switching means for completing the circuit;

Fig. 5 is a fragmentary view of a modified form of circuit controlling switching mechanism which I may employ in lieu of the structure shown in Fig. 2; and Fig. 6 is a cross-sectional view showing the electrical connection for the members constituting the switching mechanism of Fig. 2.

The numeral 1, designates the shaft which is free to revolve in bearing 2, securely attached to the roof 3, of the pilot house, and the lower bearing 4, of housing 5. The housing is threaded to the member 2, as at point 6. The thrust bearing or collar 7, pinned to the shaft supports the shaft longitudinally.

Rigidly fixed to the upper end of the shaft is coil antenna 8, which is electrically connected up in the usual manner to the receiving set 9, through slip-rings 10, brushes 11 and cable 12.

The receiving set shows two outlets 14 and 15, both of which outlets may be controlled by the switch 16, as shown.

When the switch is upwardly thrown the receiver 13, becomes energized; when thrown downwardly the circuit 17 is completed through rectifier device 95 and wires 18 and 19 leading to brushes 20 and 21, on insulation arm 22, attached to the housing, is engaged. Adjacent thereto and fixed to the arm are brushes 23 and 24, as terminals for circuit 25, having wires 26 and 27, which electrically contacts to the binding posts of meter 28, of the zero central type.

With reference to Figure 2, I have shown contacting with the four brushes the four insulated metallic half-rings 29, 30, 31 and 32, held normally fixed to the face of the gear 33, which meshes with the spiral gear 34 on the shaft of shielded motor 35. Electrically linking the metallic half-rings 29 and 31, and metallic half-rings 30 and 32, are insulated wires 36 and 37, of segment 38, and oppositely opposed, as a double pole switch effect, are the insulated wires 39 and 40, connecting metallic half-rings 41 and 44, and half-rings 45 and 46 of segment 47, forming the other half of the half-rings.

Projecting from the under face of the gear is pin 48, revolvably supporting link 49, which, in turn, is rockably supported by pin 50, of freely mounted flange 51, normally held in alignment with the link by fixed collars 52 and 53 of the compass shaft. The flange carries the two insulated metallic strips 54 and 55, as terminals for the motor circuit 56.

Centrally located in the under surface of the flange is recess 57. The upper end of the rod 58, is free to engage the recess when the projecting pin 59, at the lower end of the rod is turned around before the recessed portion 60, in wheel hub 61. In this position the rod, slidably journaled in shaft sleeve 62, and wheel hub 61, shoots upwardly into the recess of the flange through means of the expanding spring 63, and, when in this position, normally associates the compass shaft with the rockable member 64.

To disengage the shaft from the rockable mem-

ber, the rod handle 65, is drawn downwardly against the spring until the pin is free of the two recesses, at which time the pin is turned aside and held against the underpart of the hub. This movement disassociates the compass shaft from the rockable member.

The outwardly disposed arm 66, appearing below the upper end of the rod, supports the two insulated brushes 67 and 68, and are properly spaced apart so that when the rod is left free to be drawn upward by the spring an electrical engagement takes place with the strips 54 and 55, as a bridging effect for the motor circuit, shown more clearly in Figs. 2 and 4.

69, fixed to the lower end of the compass shaft shows the present method of sighting the ship's magnetic compass card for taking bearings.

Fig. 4 shows a more detailed view of the motor circuit 56, and the insulated terminals 54 and 55. The circuit 56 is composed essentially of the source 87, wires 88, connecting terminal 55. The wire 89 leads to the motor through brush 90, through brush 91, wire 92, to terminal 54.

Referring to Fig. 5, a modified form of pole changing means for the meter is shown. In this arrangement the half rings surround the compass shaft. There are four brushes 70, 71, 72 and 73, supported by the insulation piece 74. The brushes contact with the half-rings 75 and 76, 77 and 78, 79 and 80, and the two remaining half-rings 81 and 82, which are disposed concentrically about the compass shaft in the same manner as described and shown in the arrangement in Fig. 2, the link wires 83, 84, 85 and 86 functioning in the same manner.

The half rings 75, 77, 79 and 82 and their opposite rings 76, 78, 80 and 81 form circles around the shaft and are mounted separately on an insulation piece which is fast to the shaft. These rings are electrically paired together on one side by wires 83 and 84, and on the other side by wires 85 and 86. The brushes 70, 71, 72 and 73 make contact with the rings forming the two halves indicated by the numerals 75, 77, 79 and 82, and numerals 76, 78, 80 and 81.

It will be seen that as the two segments or half-rings carried on the shaft of the coil antenna and electrically dividing the antenna loop as at maximum or minimum are energized at different polarities the side of the coil antenna advanced toward a radio beacon will influence the throw of the needle according to that particular polarity which may indicate say, left of the course. When the coil antenna is reversed, an opposite effect is gained. In this manner a moving body may electrically balance its course when approaching a radio beacon.

It is, of course understood that I do not confine the invention to the operation of a meter as the same effect may be indicated by vibrating reeds or the like, each sign or polarity controlling a reed or other instrument.

As shown in Fig. 6, the segments 29—30—31—32 and 44—46—45 and 41 are connected beneath the insulated supporting plate for reversing the connections of the direct current circuit 17 with respect to the meter 28 to insure the meter reading in opposite positions synchronously with the change in angular position of the coil antenna 8.

In practice, on entering a port, especially during time of fog or storm, when visibility is low and uncertain the operator explores the electromagnetic field for the radio beacon course the ship will assume. Finding the bearing to be say, twenty degrees starboard, he reports same to the officer and then turns the antenna coil to zero, that is, directly at right angles to a true line along the length of the vessel, dividing the bow and stern.

The antenna coil is now in a position to be interlocked with the rocking member, as will be apparent by turning the handle of the rod around before the recess in the wheel hub, at which time the stay pin on the rod becomes released and allows the spring to force the rod upward into the recess of the flange, when so fixed the compass shaft becomes an integral part of the rocking member and is so forced to rock forward and backward, preferably at equi-distance, according to the speed of the motor, which, as shown, becomes energized through the contacting brushes on the rod closing the terminals of the motor on the flange. The power transmission of the rocking member is gained through the small spiral gear on the motor shaft meshing with the driving gear, which carries one end of the link, the other end being mounted on the flange.

As the vessel rounds ahead and gains the center of the radio beam the pointer of the meter, before the pilot, sways from ten degrees right of zero to ten degrees left of zero; he is then electrically balanced in the center of the radio beam and any slight deviation from the center of the beam will cause the pointer to sway farther away from zero on one side than on the other side.

It then becomes apparent for the officer to turn the bow of the vessel from the stronger side until the meter is restored to its true balance; ten degrees, right: ten degrees left. As he approaches the beacon, the pointer, influenced by the slowly rising signal strength, performs a gradual larger arc toward the right and left position of the scale of the meter; in this way, the officer may determine his linear distance from the beacon.

The double coil effect of the single coil is brought about by an automatic double pole switching means, either as a rotatable device, shown in Figs. 1, 2 and 6, or as associated with the compass shaft, shown in the modified form in Fig. 5.

The half-rings, in either case, end when the coil is at minimum or at right angles to the long center line of the ship, that is, when the pointer indicates zero of the meter scale.

It is noted, however, if a maximum signal strength of the antenna coil is desired instead of the minimum, as described, the position of the coil and half-rings may be changed to that paralleling the long line of the ship.

It is also noted that the coil antenna may be used in the transmission of electrical energy as well as for receiving the same.

While I have described my invention in certain preferred embodiments I desire that it be understood that modifications may be made and that no limitations are intended other than are imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A directional receiving system comprising a coil antenna, a receiving apparatus connected with said coil antenna, an indicating meter, connecting means extending between said receiving apparatus and said indicating meter and a driving motor connected with said coil antenna for automatically shifting said coil antenna through an angular path on either side of a predetermined bearing, a reversing switch operated

by said motor, and connections leading from the connecting means to said switch for reversing the polarity of the connections of said indicating meter with respect to said receiving apparatus synchronously with the change in direction of angular movement of said coil antenna.

2. A directional receiving system comprising a coil antenna. a signal receiving circuit having its input connected with said coil antenna and its output circuit connectible with an audible responsive device or a visually indicating meter, means for connecting said visually indicating meter with said signal receiving apparatus, a rotatable shaft for manually imparting angular movement to said coil antenna while taking observations with said audible responsive device, a driving motor mechanism, a reversing gear, and a clutch mechanism for connecting or disconnecting said driving motor mechanism with said rotatable shaft through said reversing gear for imparting automatic orientation to said coil antenna in periodically changing directions while taking observations on said indicating meter.

3. A directional receiving system comprising a coil antenna, a signal receiving circuit having its input connected with said coil antenna, a visually indicating direct current operated meter, means for connecting said visually indicating meter with said signal receiving apparatus, a driving motor, a reversing switch driven by said motor, connections between said reversing switch with said indicating meter and with the direct current output of said signal receiving apparatus, and means for imparting angular movement to said coil antenna in timed relation to the reversal of the connections between said meter and the direct current output of said signal receiving circuit for visually indicating the amplitude of the signaling energy incident upon said coil antenna on either side of a particular line of direction.

4. A directional receiving system comprising a coil antenna, a signal receiving circuit having its input connected with said coil antenna, a visually indicating direct current operated meter, means for connecting said visually indicating meter with said signal receiving apparatus, a driving motor, a rocker arm driven by said motor, a reversing switch operated by said motor, connections between said reversing switch and said visual indicating meter with the direct current output of said signal receiving apparatus, and a clutch mechanism for selectively transmitting angular movement between said rocker arm and said coil antenna when said driving motor is initiated in movement for effecting angular displacement of said coil antenna on either side of a particular line of direction synchronously with the reversal of the connections of said visually indicating meter with respect to the output of said signal receiving apparatus.

5. In a directional receiving system, a coil antenna, a rotatable shaft for imparting angular movement to said coil antenna, a visual indicating direct current operated meter, said meter having a central zero position and having an indicator shiftable to either side of the zero position, a signal receiving apparatus having its input circuit connected with said coil antenna and its direct current output circuit connectible with said visual indicating direct current operated meter, means for mechanically rocking said coil antenna to a predetermined angular position on either side of a particular line of direction and means for automatically reversing the connection of said visual indicating meter with respect to the output of said signal receiving apparatus in timed relation to the change in the direction of angular movement of said coil antenna for producing a throw of said indicator to either side of the central zero position in proportion to the amplitude of the signal energy received by said coil antenna in either of the angular positions thereof.

6. In a directional receiving apparatus, a coil antenna, a rotatable shaft for imparting movement to said coil antenna, a signal receiving apparatus having its input circuit connected with said coil antenna, a visual indicating direct current operated meter, said meter having a central zero position and having an indicator shiftable to either side of the zero position, connections extending to said visual indicating meter from the direct current output of said signal receiving apparatus, a driving motor disposed adjacent said shaft, a rocker arm periodically actuated by said motor, a reversing switch actuated by said motor and interposed in the connection between said indicating meter and the output of said signal receiving apparatus, and clutch mechanism operative from a position exterior of said housing for connecting said rocker arm with said rotatable shaft for imparting angular movement to said shaft in timed relation to the reversal of the connections of said meter with respect to the output of said signal receiving apparatus for producing a throw of said indicator to either side of the central zero position in proportion to the amplitude of the signal energy received by said coil antenna in either of the angular positions thereof.

JOHN P. BUCKLEY.