

Feb. 12, 1952

C. F. SPAHN, JR  
ANTENNA MECHANISM

2,585,866

Filed July 28, 1948

6 Sheets-Sheet 1

FIG. 1

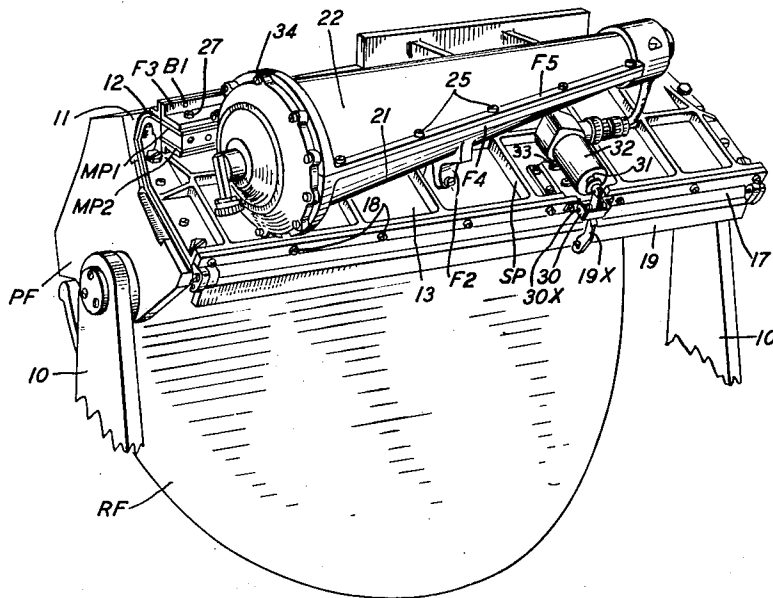


FIG. 6

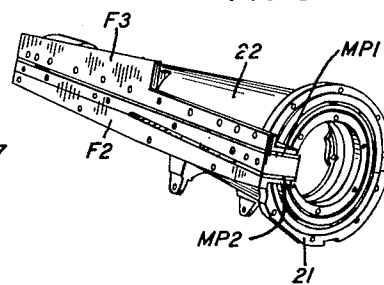
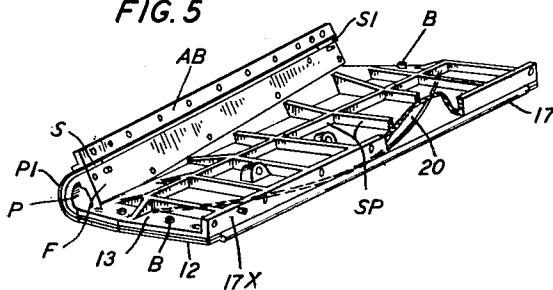


FIG. 5



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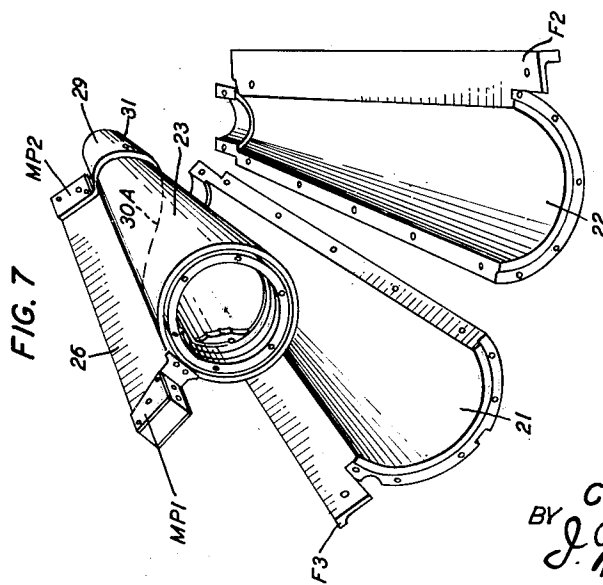
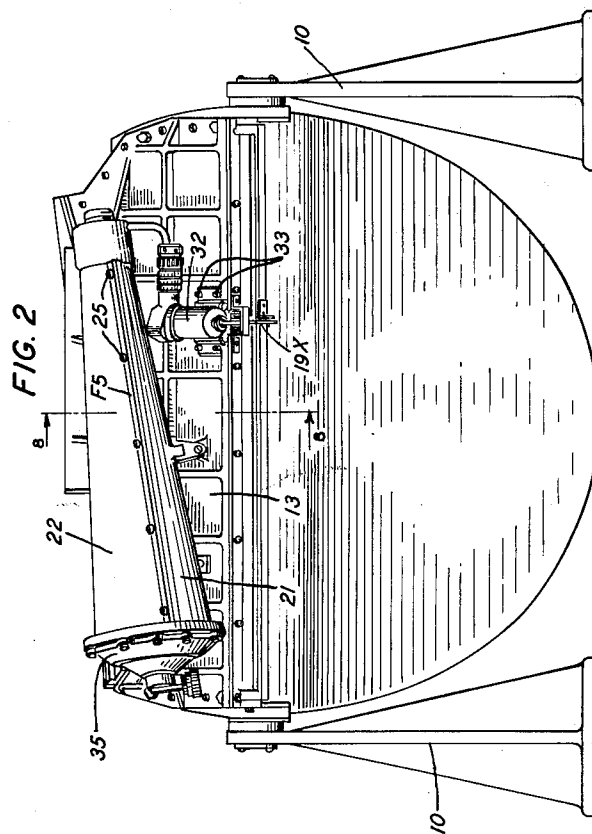
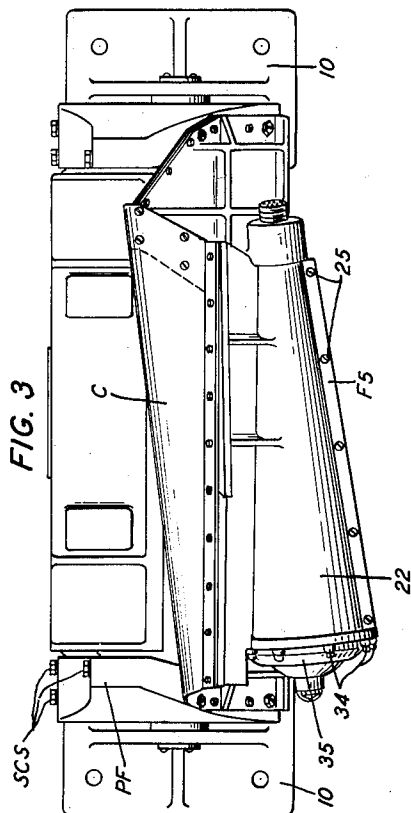
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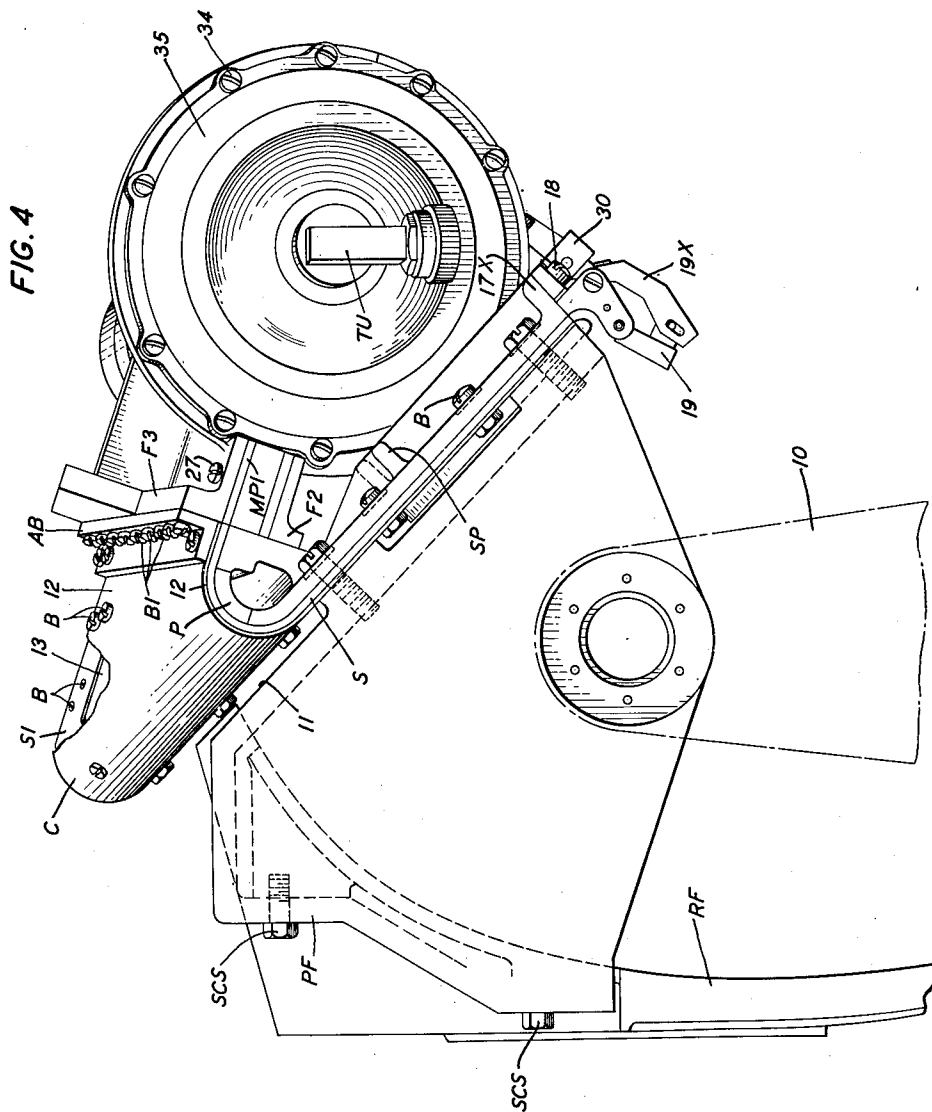
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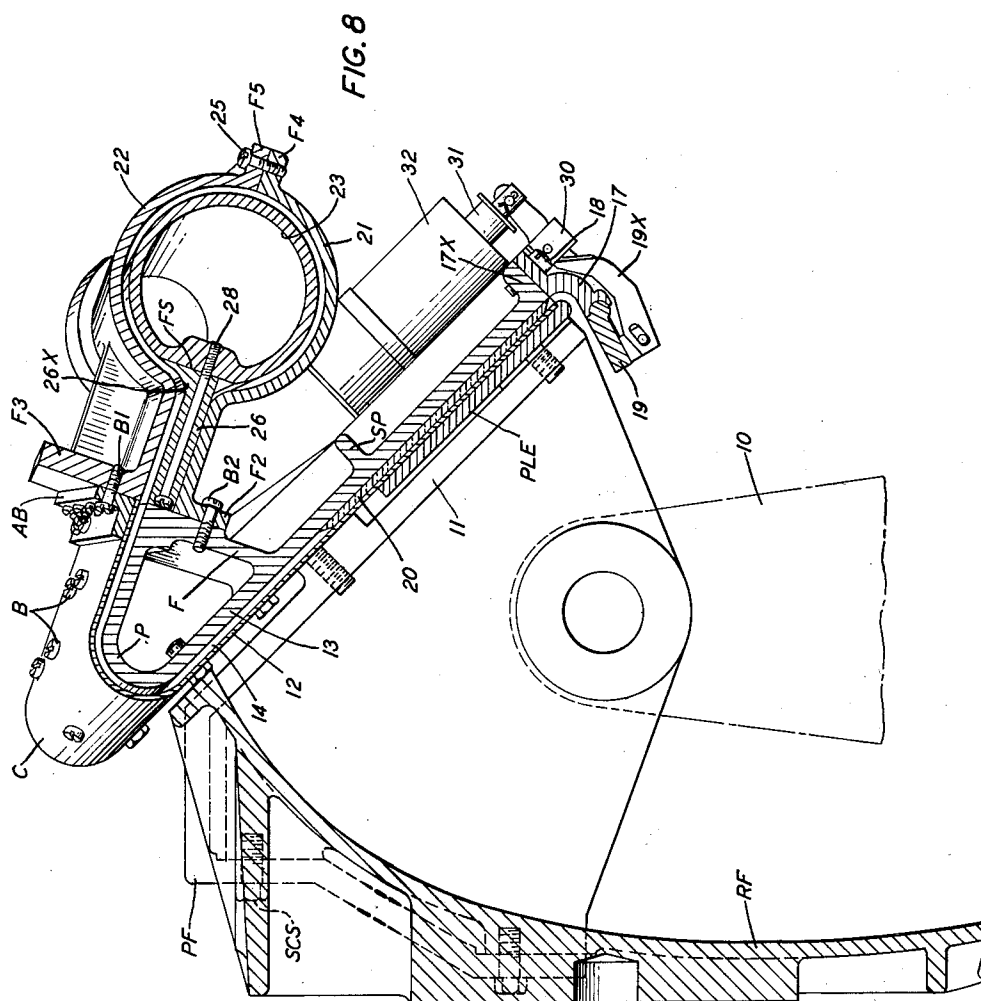
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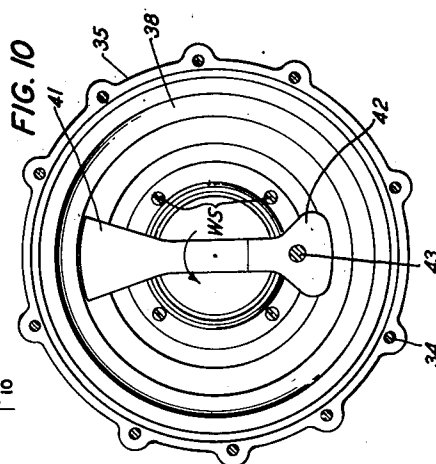
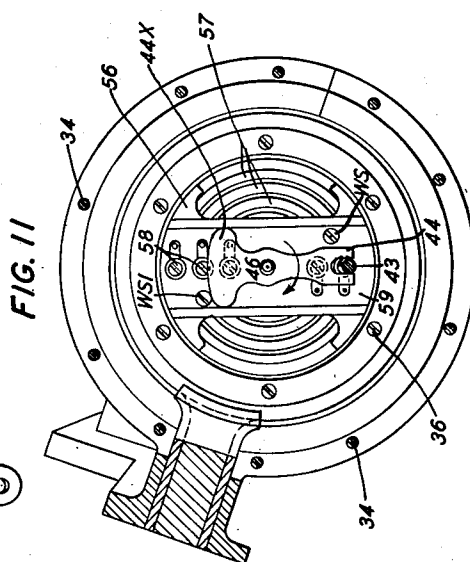
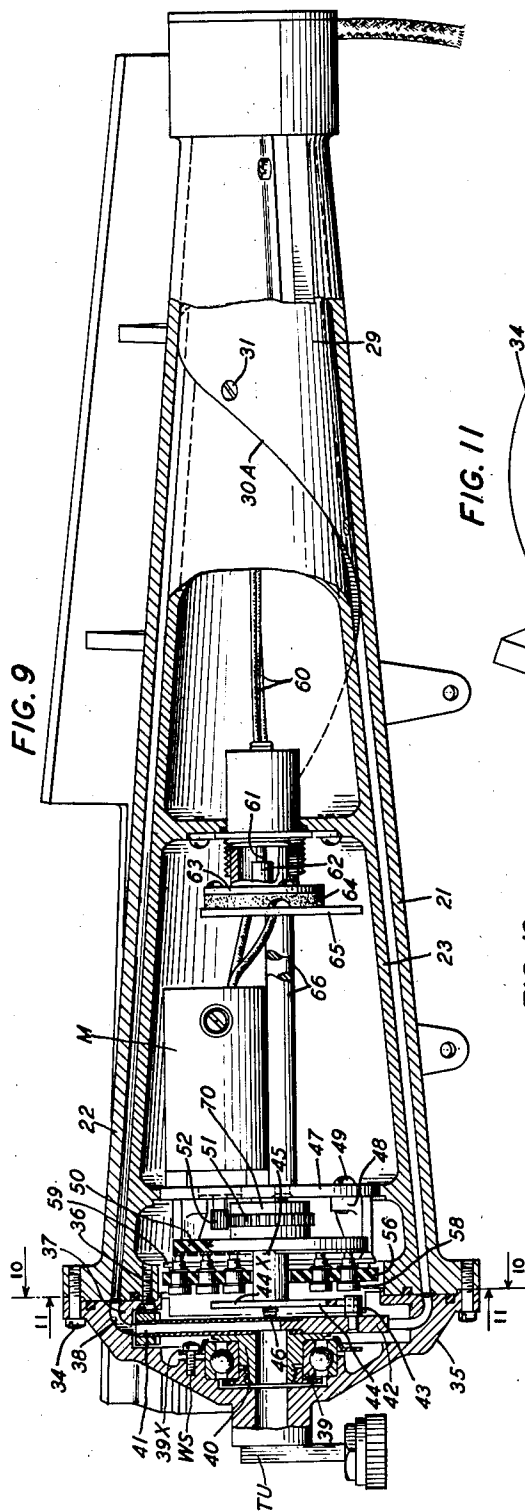
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FIG. 12

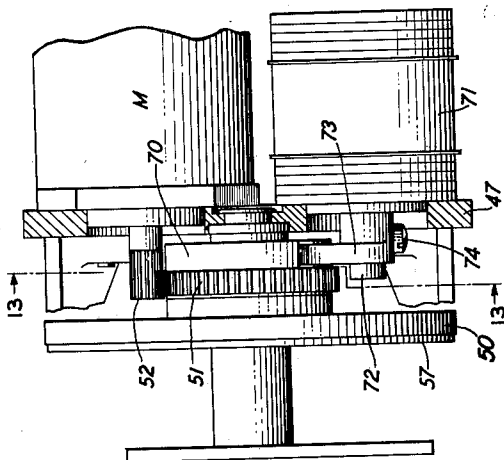


FIG. 13

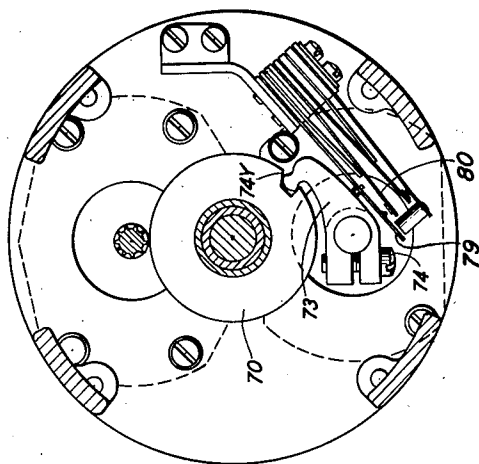
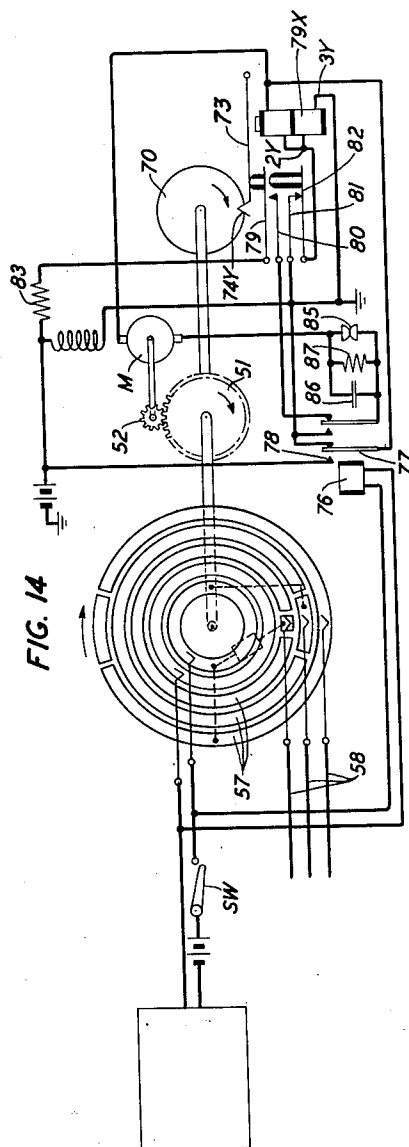


FIG. 14



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## UNITED STATES PATENT OFFICE

2,585,866

## ANTENNA MECHANISM

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Application July 28, 1948, Serial No. 41,047

3 Claims. (Cl. 250—33.63)

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This invention relates to radio signaling systems, and more particularly to a radio signaling apparatus of the type used for example in bomb directors and the like, on board airplanes.

It is known that effective linear scanning at a high rate can be obtained through the use of a parallel plate type antenna in which a portion of the parallel plate structure is in effect rolled into a conical section. When thus rolled, the opening of that portion at its base assumes an annular shape and is substantially perpendicular to the plane of the other opening of the parallel plates. Energy fed into the annularly shaped end by an arm rotating along the annular path will then produce linear scanning at the other opening. The principles involved in this method of linear scanning and operation are set forth in the application of W. D. Lewis, Serial No. 789,602, filed December 4, 1947.

The object of the present invention is the provision of a radio signaling apparatus of the type above referred to which will be rugged in construction, accurate in operation while embodying a relatively small number of simple operating parts.

In the drawing,

Fig. 1 is an assembly view in perspective showing the support for the apparatus with portions broken away;

Fig. 2 is a front assembly view;

Fig. 3 is a top view of Fig. 2;

Fig. 4 is a left side view enlarged;

Fig. 5 is a detail view showing the assembly of two wall elements serving to form a portion of a wave guide, one of such elements being shown with portions broken away to show a lens clamped in position between the two wall elements;

Fig. 6 is a detail view showing the assembly of cylindrical cone elements serving to form a circular wave guide portion contiguous to the wall elements forming the wave guide portion shown in Fig. 5;

Fig. 7 is an exploded view of Fig. 6;

Fig. 8 is a vertical sectional view taken on line 8—8 of Fig. 2;

Fig. 9 is a view of the cone elements forming the circular wave guide portion shown in Fig. 6 partly in longitudinal vertical section showing at its larger end a rotary wave guide element and its actuating mechanism;

Fig. 10 is a view looking in the direction of the arrows on line 10—10 of Fig. 9; and

Fig. 11 is a view looking in the direction of the arrows on line 11—11 of Fig. 9;

Fig. 12 is a detail view showing a latch mecha-

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nism for stopping the rotatable wave guide element in starting position following each scanning operation;

Fig. 13 is a cross-sectional view taken on line 13—13 of Fig. 12 showing the latch in the form of a pawl in engagement with a notch at the periphery of a disc carried by the driven gear for the rotary wave guide element; and

Fig. 14 is a schematic view of a circuit for controlling the operation of the motor prior to the operation of the latch mechanism.

According to the construction of the radio signaling apparatus of this invention, a pair of upright supports 10 shown in Figs. 1, 2 and 3 is provided for pivotally supporting a base 11 formed with projections as PF serving for mounting a reflector RF secured thereon as by a plurality of screws SCS shown in Figs. 4 and 8.

On base 11 is secured a portion of a wave guide of rectangular cross-section best seen in Figs. 5 and 8 formed of two wall elements 12 and 13, while a bar 17 of curved cross-section is secured to the flange portion 17X of wall element 13 by a plurality of screws 18 and to the free edge of bar 17 is pivoted a flap member 19 forming a radio wave reflecting surface adjacent the curved edge of a lens 20 clamped between the wall elements 12 and 13, the flap 19 being movable in angular relation to the plane of wall elements 12 and 13 by a mechanism which will be hereinafter described in detail.

The wall element 13 is preferably in the form of a casting reinforced by a plurality of rib-like shaped portions SP and is provided with an upturned portion P terminating in the form of a flange portion F. An angle bar AB is secured to the upturned edge of wall element 12 to serve for securing this wave guide portion to a second wave guide portion as will be hereinafter described in detail. A pair of metallic strips S and S1 is disposed between the wall elements 12 and 13 to serve as spacer members at the longitudinal edges of these wall elements and clamped therebetween by a plurality of screws B best seen in Figs. 4 and 5.

The wave guide portion formed by wall elements 12 and 13 is secured to registering flange portions F2 and F3 formed at right angles relative to projections formed with two cylindrical conic-shaped casing sections 21 and 22 as by a plurality of bolts B1 and B2, best seen in Figs. 4 and 8.

The casing sections 21 and 22 are formed with flange portions F4 and F5 serving for securing these sections in assembled relation along their registering edges by a plurality of bolts 25 and

into this wall assembly is fitted a hollow cylindrical conic-shaped casing 23 best seen in Figs. 7 and 8, held in spaced relation to the inner surface of casing sections 21 and 22 by a sleeve 29, this sleeve being secured to the casing 23 by a plurality of screws 31 and is formed with a helix-shaped edge 30A best seen in Fig. 9 serving to reflect the radio waves towards the larger end of the cone assembly thus formed. The conical casing 23, as best seen in Figs. 7 and 8, is formed at its outer periphery with a flat surface FS to which is secured, as by a plurality of bolts 28, to an oblong-shaped bar 26 having metallic plates as MP1 and MP2 best seen in Figs. 1, 4, 6 and 7 serving as spacer members between the radial projection of casing section 22 and the top disposed surface of bar 26, this bar having its top disposed edge curved as shown at 26X in Fig. 8 so as to direct the radio waves toward the circular path formed between the conical casing sections 21 and 22 and conical circular casing 23.

A segment-shaped lens 20 shown in Figs. 5 and 8 is clamped between the wall elements 12 and 13 with its curved edge disposed adjacent the so-called horn-shaped portion of the wave guide formed by a plate PLE and bar 17, to which, as above-mentioned, the flap 19 is pivoted for angular movement by the operation of a yoke member 19X itself pivoted at its middle length portion on a bracket 30 secured to bar 17 as by screws 30X, this yoke being operatively connected to the end of a plunger 31 mounted for longitudinal movement in a solenoid 32 secured to the wall element 13 as by a plurality of screws 33 shown in Figs. 1 and 2.

To the larger end portion of the conical casing formed by sections 21 and 22 is secured, as by a number of screws 34, a cover element 35, and to the larger end of the inner disposed conical casing 23 is secured, as by a number of screws 36, best seen in Fig. 9, a ring 37 which cooperates with the cover member 35 to form an annular wave guide portion 38 radial to the plane of rotation of a hollow arm 41 operated by a mechanism which will be hereinafter described in detail. Cover 35 is provided centrally thereof with a bore fitted with a ball bearing 39 held in place by a ring 39X and screw WS, while to the inner race of ball bearing 39 is fitted the hub portion 40 of hollow arm 41. Arm 41 is balanced by a counterweight 42 from which a stud 43 extends perpendicularly for engaging a clutch element in the form of a forked arm 44 formed with a hub portion 45 pivoted on a spindle 46 extending perpendicularly from the plane and at the center portion of a disc member 47 secured by a plurality of screws 49 to a plurality of lug members as 48 formed integrally with the inner disposed conical casing 23 and on the hub portion 45 of arm 44 is mounted a disc member 50 of insulating material, a gear 51 and a disc 70, the gear 51 meshing with a pinion 52 best seen in Fig. 9, keyed on the armature shaft of motor M securely supported at its front end portion by the disc member 47, arm 44 being counterbalanced by weight 44X.

On the disc member 47 as best seen in Fig. 12 is mounted an electromagnet 71 having a rotatable armature in the form of a shaft 72 serving for mounting a pawl 73 secured thereon by a screw 74, the pawl 73 normally engaging the notch 74y of disc 70 by the tension of a contact spring 75 which will be hereinafter described in detail.

To one side of insulating disc member 50 is mounted a plurality of concentrically disposed

slip rings 57 engaged by respective brushes 58 carried by a supporting plate 59 secured to the opposite end of projections 48 by screws WS and WS1 best seen in Fig. 11, brushes 58 being connected to electrical apparatus not shown and which forms no part of the present invention.

Electrical connections from motor M to lead-in wires 60 are effected by a pair of plugs 61 inter-engaging respective sleeves 62 carried by a disc 63 to the opposite side of which is vulcanized a circular pad 64 of resilient material, such as rubber compressed between the disc 63 and a plate 65 supported by a pair of rods 66 secured at their opposite ends to the disc 47 as by riveting, the resilient pad 64 serving to hold the sleeve 62 in firm engagement with the plugs 61 so as to absorb the vibrations generated by motor M while in operation.

In the operation of the radio signaling apparatus of this invention, the so-called feed horn or arm 41, Figs. 9 and 10, is held in the starting position by the pawl 73, Figs. 12, 13 and 14 in engagement with the notch 74y at the periphery of disc 70. When the arm 41 is to be rotated, a relay 76 is energized by the manual closure of a switching device SW. The closing of contacts 77—78 by the operation of relay 76 causes the energization of solenoid 79X which pulls the pawl 73 out of the notch 74y in the disc 70. The operation of pawl 73 is effective to cause the operation of motor M through the closure of contacts 79—80. The receiving radio waves, when the antenna is operated as a receiver and not a transmitter, impinge on the reflector RF and are reflected toward the horn-shaped portion of the wave guide formed by bar 17, the movable flap 19 and the rounded edge of plate PLE secured to the underside of wall element 12. The radio waves pass through the lens 20 and through the wave guide portion formed by the wall elements 12 and 13, the bar 26 and the radially formed portion of casing section 22 to be collimated by the helix surface 30A of sleeve 29 toward the circular path formed by cover member 35 and ring 37, and toward the free end of arm 41 actuated by the motor M. The radio waves from the hub portion 40 of arm 41 pass through a wave guide section formed by a tubing TU carried by the cover 35 and to electrical apparatus of the radio signaling system, not shown, and which forms no part of the present invention. When relay 76 is deenergized by the opening of switching device SW the current for the motor armature is reversed through the resistor 83 and the motor is rotated slowly in the opposite direction until the pawl riding on the disc 70 falls in the notch and turns the motor off. The solenoid contacts connected to the terminals 2y and 3y are opened when the pawl reaches the end of its engagement with the notch 74y, thus reducing the current required for holding the solenoid operated. Contact protection is provided for the motor governor contact 85 by a condenser 86 and a resistor 87 connected as shown in Fig. 14.

What is claimed is:

1. A radio signalling apparatus comprising a pair of supports, a mounting pivoted on said supports, a wall assembly secured to said mounting forming a portion of a wave guide for the apparatus, a reflector carried by said mounting for directing the radio waves towards one end of said wave guide, a plurality of conical casing elements forming a portion of the wave guide contiguous to the first-mentioned portion, a rotatable arm 75 forming a portion of the wave guide contiguous to



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the last-mentioned wave guide portion, a first disc mounted within said casing elements for rotation with said arm, said first disc having a notch on its periphery, a pawl engaging said notch when said arm is stationary, means for removing said pawl from said notch to allow rotation of said arm, a second disc mounted within said casings for rotation with said arm, a plurality of concentrically disposed slip-rings mounted on said second disc, a plurality of stationary contacts engaging said slip-rings, motor means within said casing elements for rotating said discs and said arm, and means operably connecting said motor to said discs and said arm.

2. A radio signaling apparatus comprising a plurality of wave guide sections disposed in contiguous registering relation to each other, a plurality of concentrically disposed conical casings forming one of said sections, a sleeve element serving as a spacer between said casings, said sleeve having a helix formed edge from which the energy is collimated toward the larger end of said conical casings, a cover member and a ring secured to said casings at the larger end thereof forming another of said wave guide sections contiguous to the wave guide section formed by said casing sections, a radially disposed hollow arm pivoted in said cover member having its free end disposed for rotation in juxtaposition to the wave guide section formed by said cover member and said ring, and actuating means defining a clutch and a gear mechanism for actuating said arm mounted in one of said conical casings.

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3. A radio signaling apparatus comprising a pair of conical casings disposed in concentric relation to each other, a helically-shaped reflector disposed in the annular space between said casings to form a section of a wave guide for the apparatus, a closure common to said conical casings cooperating with means secured to one end of one of said casings to form an annular wave guide section contiguous to the first-mentioned section, a pivoted hollow arm member having its free end disposed for movement in juxtaposition to the last-mentioned wave guide section, a motor, a gear mechanism actuated by said motor, a clutching device operatively connecting said arm to said gear mechanism, a disc of insulating material actuated by said gear mechanism, a plurality of slip rings mounted in concentric relation to each other on said disc and a plurality of stationary contact members engaging said slip rings.

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