Oct. 14, 1947. H. J. W. FAY 2,428,793

ANTENNA SYSTEM

Filed June 10, 1943 2 Sheets-Sheet 1

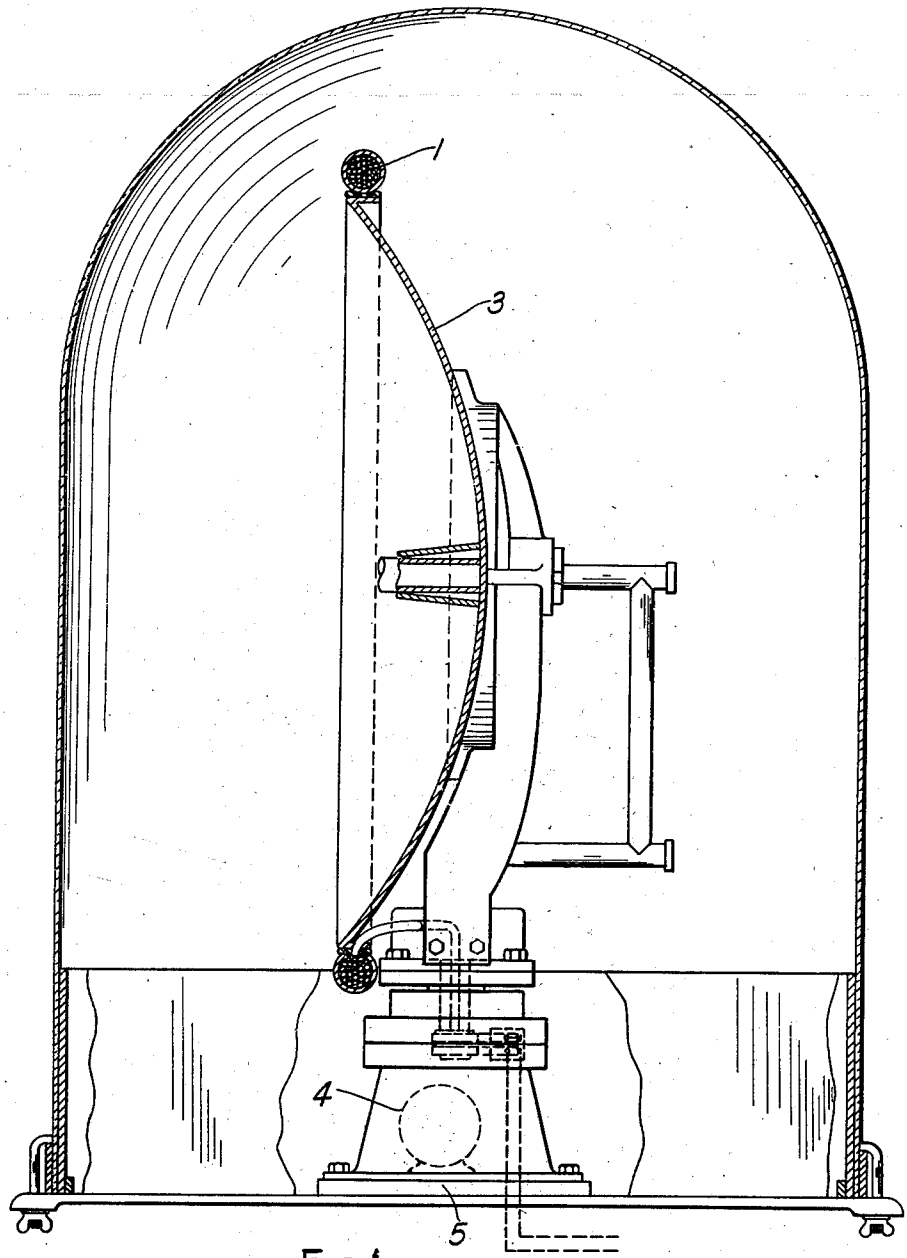


FIG. 1

INVENTOR.
HAROLD J.W. FAY
BY
His Attorney

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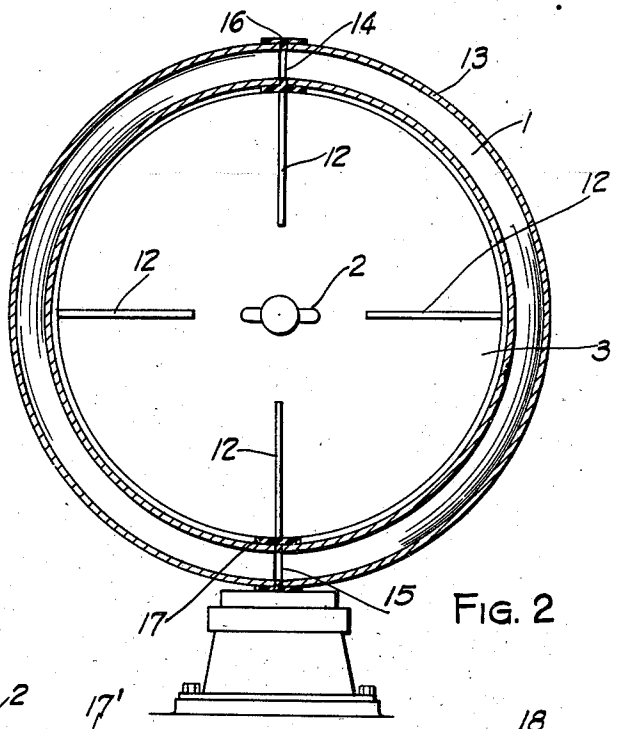


FIG. 2

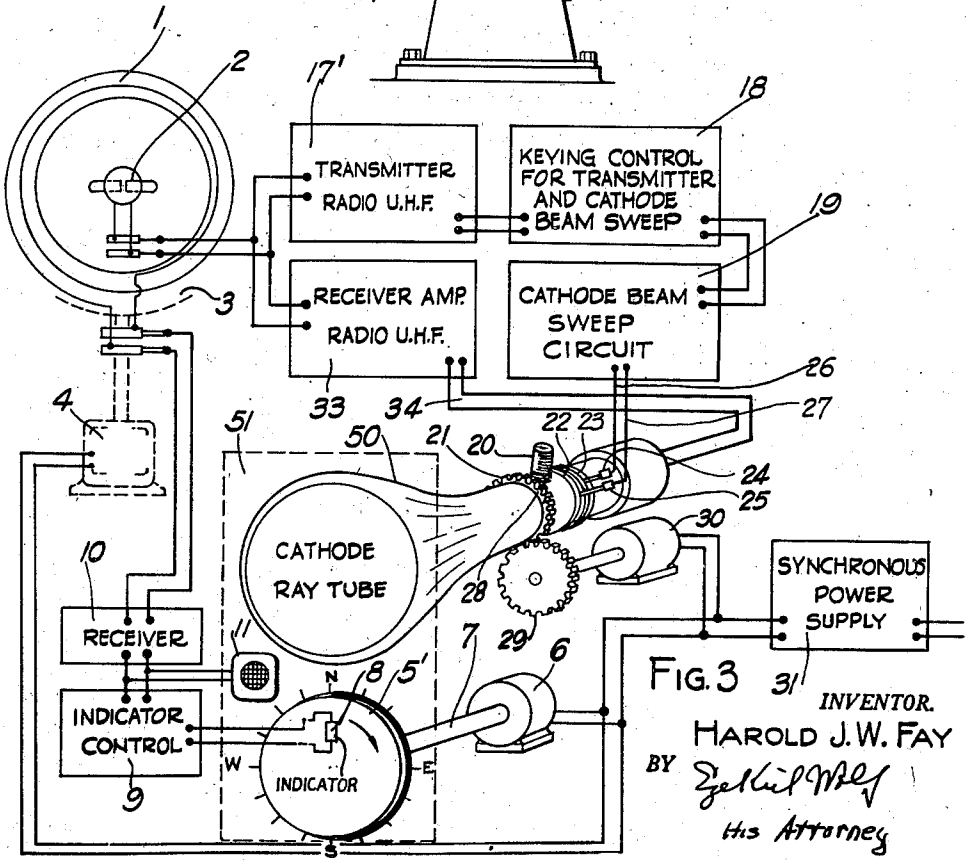


FIG. 3

INVENTOR.
HAROLD J. W. FAY
BY
His Attorney

Patented Oct. 14, 1947

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ANTENNA SYSTEM

Harold J. W. Fay, Westboro, Mass., assignor, by mesne assignments, to Submarine Signal Company, Boston, Mass., a corporation of Delaware

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3 Claims. (Cl. 250—11)

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The present invention relates to signalling by means of radio waves and in particular to means for measuring distance and determining direction of an object adapted to reflect ultra high frequency radio waves in combination with an identifying means where the reflecting body also acts as a signal transmitting source.

Range and distance measurement by means of electromagnetic waves have been usefully employed for detecting the presence of objects but these means as a whole have not been applied for the purpose of distinguishing the reflecting objects and identifying means.

One of the objects in the present invention is a combination of means whereby a signaling station may be both identified by means of its code signal and its distance and direction determined by the use of ultra high frequency reflected impulses, for instance, by the time-of-travel method in which distance is measured as a function of the time interval required for an electromagnetic impulse to travel to the wave reflecting object and return to the position of the measuring source. In the present invention, the receiving unit of the system combined a semi-directive loop circuit with a suitable ultra high frequency directive antenna which preferably employs a reflector and a doublet antenna pickup unit. By this means the code signal picked up from a transmitting station and the reflected beam picked up from it also may be made to operate associated indicated device.

Transmitting station may be identified on the ultra high frequency indicator in relation to the direction determination by a semi-directive loop and also by means of an audible signal. An advantage of the system in accordance with the present application is that it may be used for navigational purposes as a vessel is approaching a lightship or directive radio station, and serve as a means for clearly making known what might otherwise be unknown objects as picked up by the ultra high frequency directional range indicator.

Further advantages and merits of the present invention will be more fully understood from a description of the invention set forth in the specification below describing an embodiment of the same when taken in connection with the drawings in which

Fig. 1 shows an elevation partially in section through the antenna unit;

Fig. 2 shows a central section of the device shown in Fig. 1; and

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Fig. 3 shows diagrammatically a circuit arrangement and elements of the system.

A system as set forth in Fig. 3 comprises, in combination, a radio receiving loop 1, and a high frequency doublet antenna 2 which may be used with a reflector 3 (see Fig. 1). The ultra high frequency antenna and the loop are rotated by a proper motor 4 which may be of the synchronous type and which is positioned in the base 5 of the antenna unit.

Rotating in synchronism with the antenna unit as driven by the motor 4 is an indicator disc 5' which is rotated by motor 6 turning the shaft 7 on which the indicator disc 5' is mounted. A neon tube indicator 8 or other equivalent device may be mounted on the disc and energized by the indicator control 9 in accordance with the intensity of the signal in the receiver 10. The indicator control 9 may be so biassed that it will not produce a flash on the neon tube 8 when the signal received is at its lowest intensity. In accordance with this arrangement, therefore, as the loop approaches a null position, the indicator 8 will go out so that this will determine the direction of the bearing of the transmitted signal picked up by the loop 1. If desired, a loud speaker 11 may also be connected to the output of the receiver so that the code signal of the transmitting station may be picked up. The ultra high frequency system has as its pickup unit the doublet antenna 2 which is centered in a reflector 3 made of conductive material. This reflector may be cut radially in sectors with slots 12 extending part way to the center of the reflector, in order to increase the reflector impedance to the circulatory current induced in the loop antenna 1. The loop antenna may be mounted at the edge of the reflector as indicated in Figs. 1 and 2. This mounting may be made by placing the antenna loop or coil 1 within a conductive or non-conductive annular tube or torus 13. If the torus 13 is made of conductive material, it should be slotted as indicated at 14 and 15, and the ring should also preferably be insulatedly supported and spaced slightly away from the outer edge or rim of the reflector 3. This may be accomplished by using a pair of insulating sleeves 16 and 17.

As indicated by the diagram in Fig. 3, the antenna pickup element is rotated or spun synchronously with the indicating disc 5' by means of the motor 4. An ultra high frequency radio impulse or wave train is periodically emitted by means of the transmitter 17'. This emission is controlled by a keying control of any

known type set forth by the box 18, Fig. 3. The keying control for the transmitter in accordance with the usual practice commences the operation of the cathode beam sweep which is established through the cathode beam circuit shown in the block diagram by the element 19. The cathode beam sweep circuit is illustrated in diagram of Fig. 3 as electromagnetically controlling the bending of the cathode beam. This may be accomplished in any desired way. In the present arrangement, it is controlled by means of coil 20 mounted on a ring 21, surrounding the neck of the cathode ray tube 50. Proper brush connections are shown to conducting rings 22 and 23 on the ring 20 illustratively in Fig. 3 by the brushes 24 and 25 which are energized from the cathode beam circuit over the conducting lines 26 and 27, respectively.

For each transmitted impulse, the keying circuit 18 provides a variable energization of the coil 20 to bend the cathode beam from its center out to the edge of the tube. The coil 20 mounted on the ring 21 is rotated by means of a ring gear 28 meshing with the gear 29 which is driven by the motor 30 in synchronous operation with the motors 4 and 6 through the same supply source 31. Since in measuring distance by means of electromagnetic waves, the time intervals are of the order of microseconds, a comparatively slow continuous rotation of the coil 20 at, for instance, 20 R. P. S. will hardly affect the sweep of the cathode beam which must sweep from the center of the tube radially to the circumference in intervals of the order of microseconds.

The impulse, after it has been reflected and picked up by the antenna 2, is impressed upon the receiving amplifier 33 of the ultra high radio frequency, the output of which is impressed upon the control grid (not shown) of the cathode ray tube over the line 34. In accordance with the known practice, the circuit arrangement may be to suppress the beam except at the instant that a reflecting signal is received, in which case when a signal is received, a spot will appear on the luminescent face of the cathode ray tube. The distance of this spot from the center of the tube indicates the distance of the reflecting object from the observing station, and the radial direction of the spot from the center of the tube indicates the direction that the reflecting object appears to the observing station. In the event that the object producing the indication also is transmitting a signal of its own, the neon light 8 will produce the same relative indication that the spot on the cathode ray tube will produce. The spot may, therefore, be made to correspond to the point at which the neon light indicator goes out.

In the operation of the system, therefore, the ultra high frequency signal will be transmitted by the transmitter and received by the cathode ray tube in such a manner as to indicate the distance and direction of the reflecting object. If this reflecting object is also able to transmit a signal, this signal will give a directional indication by the indicator 8 and a code indication over the loud speaker 11 so that in this manner a spot corresponding to the transmitting station will be easily identified. For this purpose the cathode ray tube indicator, disc 5' and the indicator 8 together with the loud speaker may be incorporated in a single unitary structure 51.

Having now described my invention, I claim:

1. In a combination for distance ranging by the use of ultra-high frequency electromagnetic waves, means including a reflector having a doublet ultra-high frequency antenna and a loop antenna surrounding said reflector.

2. In a combination for distance ranging by the use of ultra-high frequency electromagnetic waves, means including a reflector having a symmetry about a point and having a doublet ultra-high frequency antenna and a loop antenna surrounding said reflector, said reflector being slotted radially towards the point of symmetry and said loop surrounding said reflector at its rim.

3. In a combination for distance ranging by the use of ultra-high frequency electromagnetic waves, means including a reflector having a symmetry about a point and having a doublet ultra-high frequency antenna and a loop antenna surrounding said reflector, said reflector being slotted radially towards the point of symmetry and said loop surrounding said reflector at its rim, said loop having a conductive case surrounding the same and means insulating sections of said conductive case from each other.

HAROLD J. W. FAY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,257,319	Williams	Sept. 30, 1941
2,327,641	Hooven	Aug. 24, 1943

FOREIGN PATENTS

Number	Country	Date
497,147	Great Britain	Dec. 9, 1938
542,634	Great Britain	Jan. 21, 1942