

Aug. 11, 1925.

1,548,958

E. A. SPERRY

AVIATION BEACON

Filed May 4, 1921

3 Sheets-Sheet 1

Fig. 1.

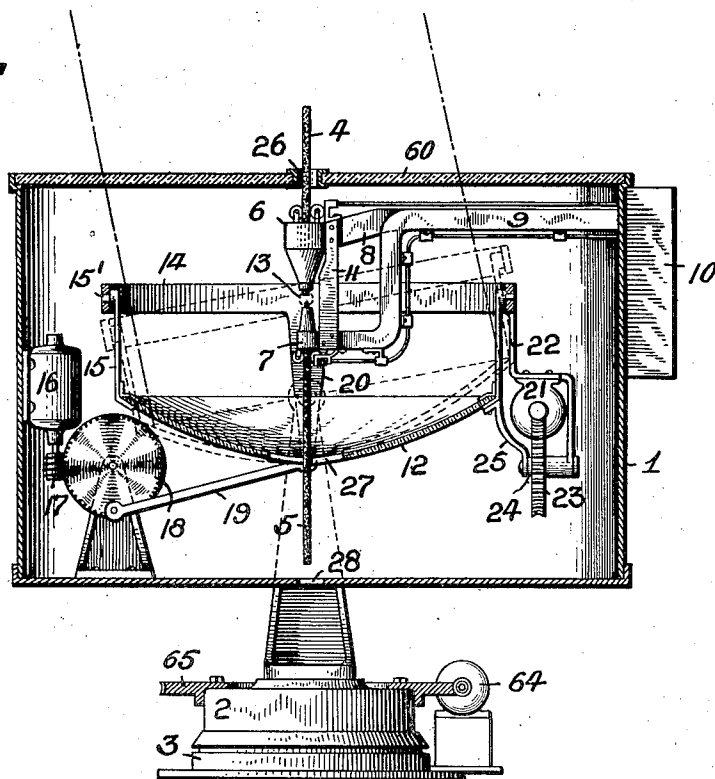


Fig. 2.

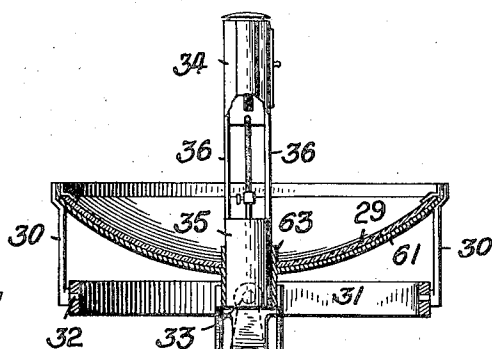
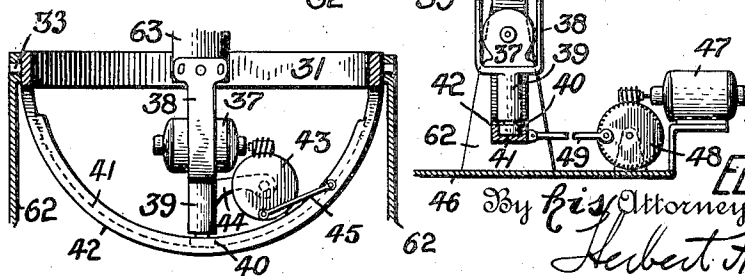


Fig. 3.



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3 Sheets-Sheet 2

Fig. 4.

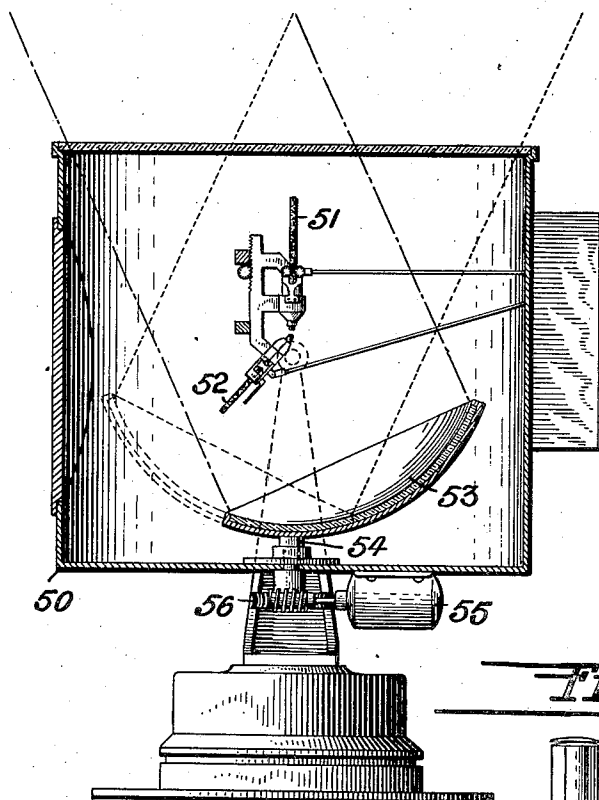
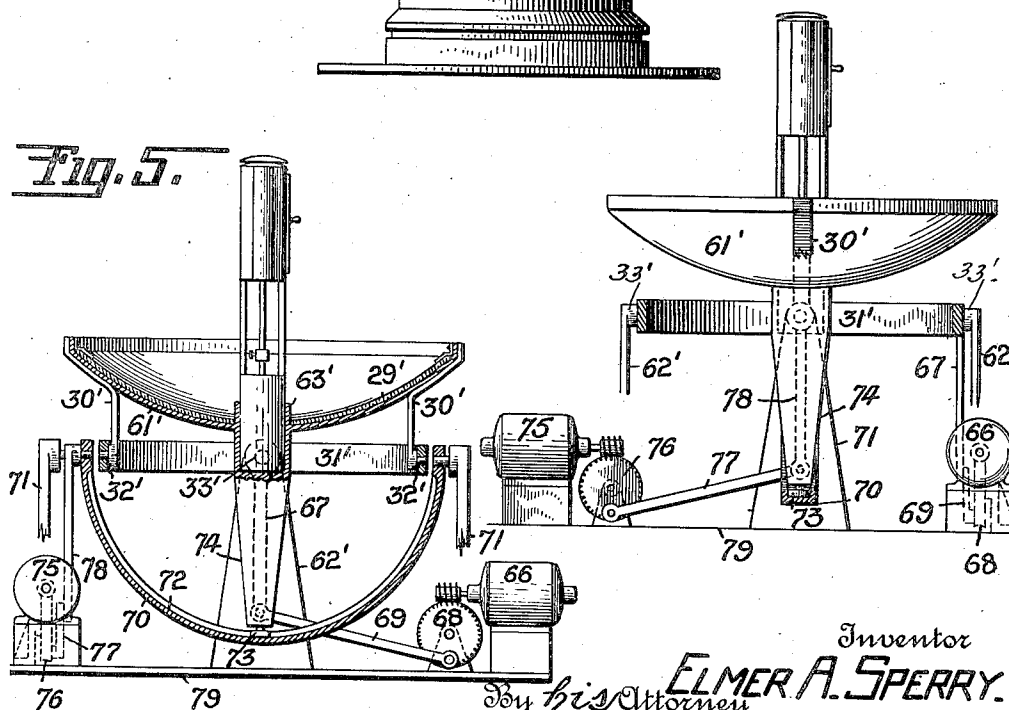


Fig. 6.

Fig. 5.



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3 Sheets-Sheet 3

Fig. 7.

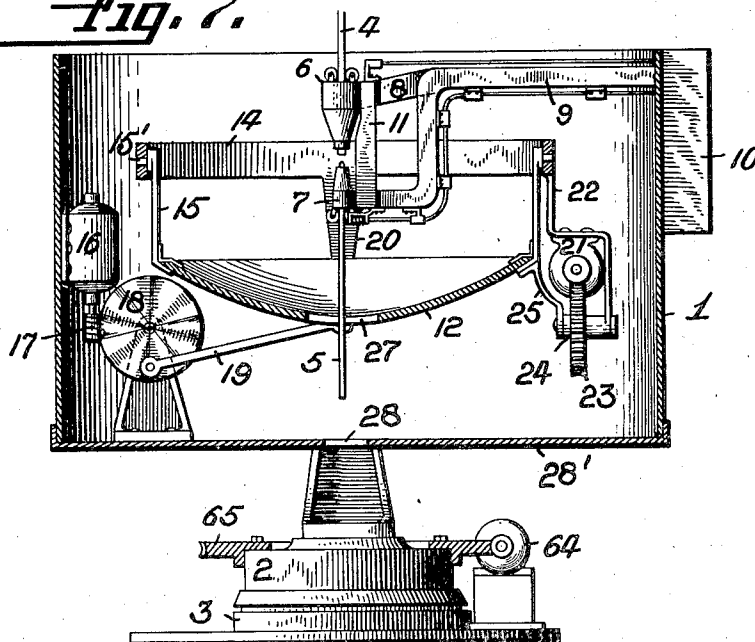
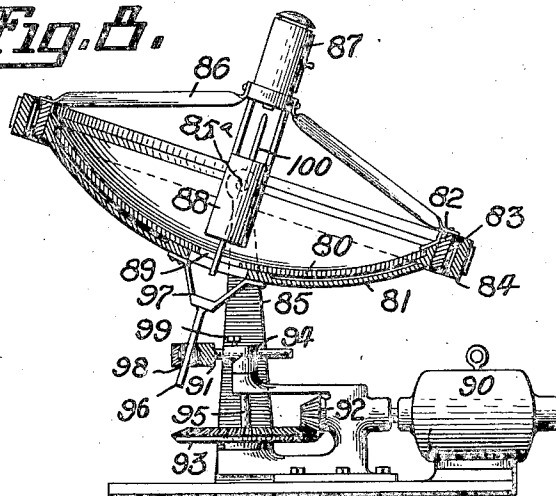


Fig. 8.



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UNITED STATES PATENT OFFICE.

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AVIATION BEACON.

Application filed May 4, 1921. Serial No. 466,774.

To all whom it may concern:

Be it known that ELMER A. SPERRY, a citizen of the United States of America, residing at #1505 Albemarle Road, Brooklyn, in the county of Kings and State of New York, has invented certain new and useful Improvements in Aviation Beacons, of which the following is a specification.

This invention relates to light projecting means and has for its chief object the provision of an efficient beacon especially adapted for aviation purposes, such as informing an aviator of his whereabouts or indicating the presence of a landing field. Another object is to provide a beacon whereby a powerful beam of light may be directed substantially vertically and kept in a state of motion. It is found that a beam which is moving is visible for greater distances than a beam which is at rest, even though the latter be of the same intensity as the moving beam. I thus increase the visibility of a beam of given intensity by moving it. When the beam is derived from a searchlight of the modern high intensity type and is kept continuously moving, an exceptionally effective aviation beacon results. A further object is the provision of simple and reliable means for continuously moving the beam. Other objects and advantages will become apparent as the description of the invention is hereinafter developed.

Referring to the drawings wherein I have shown what I now consider to be the preferred forms of my invention,

Fig. 1 is a vertical sectional view showing one form of my invention.

Fig. 2 is a vertical section showing a modification.

Fig. 3 is a view in elevation of a detail.

Fig. 4 is a sectional view of a third form of my invention.

Fig. 5 is a vertical sectional view of still another modification.

Fig. 6 is a view taken at right angles to Fig. 5.

Fig. 7 is a view of another form of my invention.

Fig. 8 is a vertical sectional view of another modification.

For projecting a beam I have shown in Fig. 1 a searchlight mechanism enclosed within a suitable drum 1. The latter may be mounted in the usual manner for turning about a horizontal axis upon the base 2, the latter being rotatable about a vertical

axis on lower base member 3. For conveniently rotating the searchlight drum about a vertical axis a motor 64 may be provided, which motor drives a worm wheel 65 attached to the rotatable member 2. Within the drum are the positive and negative electrodes 4 and 5 supported in the usual electrode holders 6 and 7 respectively, which in turn are carried by standards 8 and 9 supported by the drum. Electrode rotating and feeding mechanism of any conventional type may be employed, such for example as shown in my prior Patent No. 1,282,133, granted October 22, 1918. A box 10 attached to the drum may serve to enclose certain parts of said mechanism as is well understood in the art. I prefer to utilize the modern high intensity arc in order to obtain a beam of maximum brilliancy. The production of the high intensity effect requires either that one electrode be inclined with respect to the other or that the arc be deflected. I have shown the electrodes substantially in alignment, and for the purpose of deflecting the arc a bus bar 11 may be supported adjacent the arc on standards 8 and 9. This bus bar is in circuit with the arc and electrodes. In the arrangement shown in Fig. 1 said bus bar is electrically connected to the negative electrode and is insulated from the standard 8 which conducts current to the positive electrode. The crater of the positive electrode 4 is preferably located at the focal point of the light condenser or parabolic reflector 12, which reflector projects the beam of light thru the transparent front 60 of the searchlight. I prefer that the searchlight be turned upon its horizontal axis into the position shown to direct the beam vertically upward, since a vertical beam can be seen for long distances.

As I have previously pointed out, the visibility of a beam of light of given intensity can be increased by moving the same. Accordingly I have provided means for keeping the beam in a constant state of motion. By the means which I have provided the beam may be caused to rotate in such manner as to describe any of various paths. In Fig. 1 I have shown one form of means for attaining this end by moving the reflector independently of the electrodes. This means may be constructed and arranged substantially as follows:

Pivotaly mounted in any suitable manner

within the searchlight drum for movement about an axis 13 is a ring 14, from which ring the reflector 12 is suspended by arms 15. The latter are pivotally connected to ring 14 by trunnions 15' for movement about an axis at right angles to said axis 13. Preferably the crater of the positive electrode, which constitutes the principal source of light, is positioned not only at the focal point of reflector 12 but also at the intersection of axis 13 and the axis about which mirror 12 is movable with respect to ring 14. In other words the focal point of mirror 12 preferably coincides with the center of the Cardan mounting, and the positive crater should be positioned at this point. In this manner the said crater will remain continually at the focal point of the mirror or reflector regardless of the turning movements of the latter. For turning the ring 14 and mirror 12 about axis 13 I have shown a motor 16 supported by the searchlight drum and driving through the worm 17 a crank 18 to which is eccentrically connected a link 19. The latter is also connected to an arm 20 depending from ring 14. By this means the ring 14 and reflector 12 may be oscillated continuously about axis 13. Similar mechanism may be employed for oscillating reflector 12 with respect to ring 14. Thus, a motor 21 may be suspended by a bracket 22 from said ring and may drive a crank 23 connected by an eccentric link 24 with an arm 25 depending from the reflector.

From the above arrangement it will readily be seen that the searchlight beam can be oscillated simultaneously about axis 13 and the axis of trunnions 15'. The motors 16 and 21 may be electric motors of any conventional type. The beam can be made to traverse various paths by varying the relative speeds of rotation of the motors 16 and 21 or by varying the interval between the arrival of ring 14 at one of its limits of oscillation and the arrival of the mirror 12 at one of the limits of its oscillatory movement about the axis of trunnions 15'. By properly adjusting said motors it will be evident that the beam can be caused to describe a cone the axis of which is the axis of the searchlight.

The positive electrode may be replaced through an aperture 26 in the glass front of the searchlight. The condenser or reflector 12 may be provided with an aperture 27 through which a long negative electrode may protrude, as shown, the aperture being of sufficient size to permit limited swinging of the reflector with respect to the electrode. The negative electrode can be replaced through aperture 27 and an opening 28 in the rear of the searchlight drum. The aperture 27, in addition to permitting the use of a relatively long negative electrode, performs another valuable function, in that the

molten particles which fall from the electrodes can drop through said aperture without damaging the reflector.

In Figs. 2 and 3 is shown a modified form of my invention, wherein the electrodes are movable with the condenser or reflector 29. The latter is mounted on a suitable support 61 carried by arms 30 which project upwardly from ring 31 and are pivoted to said ring by trunnions 32. The ring 31 is pivotally supported in standards 62 on base 46 for movement about an axis 33, at right angles to the axis of trunnions 32. The lamp mechanism which is carried by the support 61 may comprise upper and lower housings 34, 35, the lower housing being secured within a cylindrical sleeve 63 which passes through a central opening in said reflector and is secured to or formed integral with the support 61. The upper housing 34 is supported from said lower housing by suitable bars or standards 36. The positive and negative electrodes are carried by the upper and lower housings respectively. One of the standards 36 may be employed as a bus bar to lead current to the positive electrode and thus reflect the arc. As the details of the lamp mechanism are not essential and form no part of my invention they will not be herein described.

For moving the mirror 29 about the axis of trunnion 32 I may employ a motor 37 carried by a bracket 38 depending from sleeve 63. Projecting downwardly from said bracket is an arm 39 carrying a roller 40 which is received within the trackway 41 of a curved bail 42 depending from ring 31. A crank 43, mounted to rotate on a bracket 44 carried by arm 39, is driven by motor 37. Connected at one end eccentrically to said crank is a link 45, the other end of said link being connected to said bail. From this construction it will be evident that as long as motor 37 is energized the mirror 29 will be oscillated about the axis of the trunnions 32, during which time roller 40 will travel back and forth in trackway 41. For oscillating ring 31 and mirror 29 about the axis 33 I have shown a motor 47 on base 46, which motor drives a crank 48. A link 49 is connected at one end to bail 42 and is connected eccentrically at its other end to crank 48.

The mounting of motor 37 below the ring 31, as shown is distinctly advantageous since the mirror 29 and its mounting may thus be made pendulous about both axes. The position of the center of gravity of the system with respect to the point of intersection of the axis of the trunnions 32 and axis 33 may be varied at will by varying the weight of the motor employed or by varying the distance between said point of intersection and said motor.

Fig. 4 shows a further modified form of

invention wherein the beam may be caused to describe a cone by rotating the reflector about only one axis. The searchlight drum 50 in this figure is mounted similarly to drum 1 and carries high intensity arc lamp mechanism of any conventional type including electrodes 51 and 52. The reflector 53, which may be of the ordinary parabolic type, is eccentrically mounted for rotation with a shaft 54, the central or optical axis of said reflector being inclined with respect to the axis of rotation of said shaft. Preferably the reflector is so mounted that its focal point lies on the axis of rotation of said shaft 54, or, in other words, the central or optical axis of the reflector intersects the axis of rotation of the reflector at the focal point. The crater of the positive electrode 51 is, of course, preferably positioned at said focal point. The reflector or condenser 53 may be rotated continuously by means of a motor 55, supported from casing 50, which motor drives a worm wheel 56 secured to shaft 54.

When the mirror is in its full line position the searchlight beam occupies the position shown in dot and dash lines while, when the mirror is turned through 180° into the position shown in dotted lines, the beam assumes its dotted line position. It will now readily be seen that the rotation of said mirror will cause the beam to describe a cone the axis of which is the axis of the searchlight. It will be seen also that the effect of rotating the eccentrically mounted mirror 53 is to cause rotation of the beam about two axes at right angles to the axis of rotation of said mirror.

A further modified form of my invention is shown in Figs. 5 and 6. In this modification the reflector is rotated about axes at right angles to each other by two motors neither of which is movable about either of said axes. While it will be apparent that this form of invention may be applied to rotating the reflector of Fig. 1 I have shown it in connection with the construction of Fig. 2, wherein the reflector and lamp mechanism are movable together. The ring 31' of Figs. 5 and 6 is pivotally supported by standards 62' for movement about an axis 33', and the reflector 29' is carried by a supporting member 61' which in turn is supported by arms 30' projecting upwardly from ring 31' and pivoted to said ring by trunnions 32'. The lamp mechanism is supported by the cylindrical sleeve 63' of member 61'. The means for moving ring 31' about axis 33' is shown as comprising a motor 66 which, through the medium of a crank 68 and link 69 causes oscillation of an arm 67 depending from said ring. For moving the reflector 29' about the axis of trunnions 32' I have shown a bail 70 pivotally supported by standards 71 for move-

ment about an axis coinciding with the axis of trunnions 32'. Said bail is provided with a trackway 72 in which is received a roller 73 carried by an arm 74, which arm is shown as depending from the sleeve portion 63' of member 61'. With this construction it will readily be seen that movement of bail 70 about its axis of oscillation will, through arm 74, cause a corresponding movement of mirror 29' about the axis of trunnions 32'. At the same time, movement of said reflector with ring 31' about axis 33' is permitted by roller 73 and trackway 72. The bail 70 may be oscillated by a motor 75 which drives a crank 76, to which crank is connected a link 77 in turn connected with an arm 78 depending from said bail. It will be seen that both motors 66 and 75 may be mounted on the base member 79 which supports standards 62' and 71, and that the necessity of supporting either of said motors for movement with ring 31' or reflector 29' is avoided.

It should be noted that in Fig. 1 the searchlight drum may be tilted about a horizontal axis on base 2 and that the beam of light may thereupon be caused to describe a cone by rotating the searchlight about a vertical axis by means of motor 64 and wormwheel 65. This may be done either simultaneously with or independently of the rotation of reflector 12 with respect to the light source.

As in Fig. 1, the beam of Figs. 2 and 5 may be caused to move with different periods about its horizontal axes of rotation and to traverse different paths by appropriately varying the speeds of the motors that cause said beam to turn about said axes. Thus by running said motors at different relative speeds the beam may be given one period of rotation about one axis and a different period about the other axis. Any of a wide variety of conventional means for varying the speeds of the motors may be utilized, and since such means are well known in the art no showing thereof in this application is thought to be necessary. Different paths of the beam may also be obtained, even though both motors run at the same speed by first commencing the rotation of the beam about one axis and then, at any desired subsequent time during the rotation of said beam about said axis, commencing the rotation of the beam about the other axis.

In any of the forms of my invention any given beacon can be distinguished from any other by assigning to each beacon a distinctive rate of rotation of the beam, or, in the forms shown in Figs. 1, 2 and 5, by causing the beam of each beacon to traverse a path different from the beams of the other beacons. In this manner the aviator may be readily enable to distinguish one beacon

from another and to determine his location or obtain other information.

As shown in Fig. 7, the glass front of the searchlight casing of Fig. 1 may be omitted and the searchlight may be exposed directly to the weather. In this case the hole 27 in the reflector 12 serves the additional function of permitting the escape of any moisture which may collect on said reflector. The hole 28 in the bottom of the casing 1 serves similarly to permit moisture to escape from said casing. If desired, the rear wall or bottom 28' of the casing may be slightly inclined on all sides toward the aperture 28 to facilitate the escape of moisture from the casing.

Fig. 8 shows still another modified form of my invention. In this modification the mirror 80 is mounted in a suitable supporting frame 81 which in turn is secured to a ring 82. The latter is pivoted by trunnions 83 to an outer ring 84, which latter ring is pivoted to a suitable support 85 for movement about an axis 85^a at right angles to the axis of trunnions 83. The lamp mechanism may be supported by arms 86 extending from ring 82. As shown, said lamp mechanism may be similar to that shown in Fig. 2 and comprises housings 87 and 88 which carry the positive and negative electrodes respectively, and are in turn supported by the arms 86. An aperture 89 in the bottom of reflector 80 and frame 81 may be provided if desired, for permitting a long negative carbon to be inserted into housing 88. Said negative carbon is shown at 100 extending through the bottom of housing 88 and also through opening 89. For rotating the reflector a motor 90 drives a crank arm 91 through the medium of suitable gears 92, 93. Said crank arm is shown mounted adjustably in a housing 94 rotatable with the shaft 95 of gear 93, the axis of rotation of the latter preferably passing through the center of the gimbal mounting; i. e. through the intersection of the axes of rotation of the reflector. An arm 96 projecting from a spider 97 secured to the bottom of frame 81 is connected through a universal joint 98 with said crank 91. The arm 96 may be slidable in the ball of the universal joint. It will be seen that by the construction above described, the reflector can be rotated by motor 90 about the pivotal axes of both rings 83 and 84 continuously and simultaneously and that by adjusting crank arm 91 in housing 94 the throw imparted to the reflector may be varied as desired. A set screw or bolt 99 may be provided for locking said crank arm in adjusted position in said housing.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, to-

gether with the apparatus, which I now consider to represent the best embodiments thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others omitted without interfering with the more general results outlined, and the invention extends to such use.

Having described my invention, what I claim and desire to secure by Letters Patent is:

1. In combination, a reflector mounted for movement about axes at an angle to each other and to the vertical, a crank arm, means for rotating said crank arm about a vertical axis, and a connection between said reflector and said crank arm for causing rotation of the reflector simultaneously about said first mentioned axes.

2. An aviation beacon comprising in combination an arc searchlight arranged to normally project a beam of parallel rays vertically, means supporting said searchlight about a plurality of axes, and means located below said searchlight for continuously moving it about said axes simultaneously comprising a motor, and a crank arm driven thereby connected to the searchlight.

3. An aviation beacon comprising in combination a ring, a reflector, an arc lamp supported thereon arranged to normally project a beam vertically, a second ring pivotally supporting said ring, means pivotally supporting said second ring at right angles to the pivotal axis of said first ring, and means for continuously moving said rings about their axes simultaneously including a motor and a crank arm whereby the projected beam is caused to travel in the path of a cone.

4. An aviation beacon, comprising in combination an arc searchlight, a Cardan suspension for said searchlight, and means for continuously oscillating said searchlight about a plurality of axes of said suspension, said means including a source of power and a crank arm connecting said source of power to said searchlight.

5. An aviation beacon, comprising in combination an arc searchlight, a Cardan suspension for said searchlight, means for continuously oscillating said searchlight about a plurality of axes of said suspension, and means whereby said last-named means may be adjusted to vary the path of the reflected beams.

In testimony whereof I have affixed my signature.

ELMER A. SPERRY.