LAMP CHANGER CONSTRUCTION

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1. My present invention relates to lamp changer construction and more particularly to certain apparatus for supporting and providing for the interchange of electric lamps, particularly of large size, which are arranged to be associated with a lighting system such as an aviation or marine beacon. Such apparatus is disclosed in substantial detail in my prior Patent No. 2,269,915, granted July 7, 1942, which discloses not only a lamp changer construction generally but also the operating means therefor.

The present invention is particularly adapted for use with apparatus as generally disclosed in my prior patent aforesaid and to use operating means such as are particularly disclosed in that patent. For this reason the operating means per se have not been disclosed hereinafter, but reference may be made to my prior patent for a full and complete disclosure of practical means by which the apparatus of the present invention may be actuated.

Reference is also made to my copending application, Serial No. 701,429, filed October 5, 1946, and entitled "Lampchanging Apparatus," wherein is disclosed a construction for this same general purpose, but with a somewhat different type of operating means. In this copending application the lampchanging arm, instead of being rotatable intermittently but in a unidirectional manner, is moved automatically through a predetermined arc and then may be manually re-set by a reverse movement to its initial position.

In general, devices of this kind are so arranged that when one lamp, in an operating position, burns out or fails for some reason, the lampchanging apparatus is moved so as to position the other or a second lamp in an operating position at which the apparatus is illuminated at a predetermined point, which point is usually the focal point of a lens or lens system. The present apparatus is intended for this general purpose.

In my prior Patent No. 2,269,915 aforesaid, a lampchanger construction is disclosed adapted for relatively small sized lamps, at least in proportion to the size of the apparatus therein disclosed. However, when substantially larger sized lamps are employed such, for example, as those known as PS-40 or PS-50 envelope lamps, it is necessary either to use a much larger sized mechanical apparatus in order to employ a structure as shown in the prior patent aforesaid, or to make other special provisions not disclosed in that patent to prevent interference of the parts and consequent inevitable breakage of lamps and/or other parts of the apparatus.

2. A primary object of the present invention therefore is to provide means by which a standard sized apparatus of a type as generally set forth in my prior patent aforesaid may be adapted for use with substantially larger sized lamps than those for which that apparatus was originally designed.

A further and more specific object of the present invention is to provide for the movement of lamps carried by a lampchanging apparatus as aforesaid in directions generally laterally of the principal plane of movement of the lamps; or more particularly, when the lamp carrier is rotated about a horizontal axis, for movement of the lamps laterally in respect to a vertical plane including the position of the center of illumination of the lamps at their operative position, which plane would be perpendicular to the axis of rotation of the lamp carrier.

A further object of the present invention is to provide for this lateral movement particularly by tilting the lamps in respect to the vertical and in a direction perpendicular to the plane aforesaid, preferably in response to the movement of the lamp carrier.

Further and detailed objects of the present invention include the provision of specific tilting means; for example, cam operated means responsive to the rotation of the carrier and cooperating with each lamp individually to tilt it a desired amount during the rotation of the carrier, so as to insure that it will move in a path out of contact with any other part of the apparatus.

A further object is to provide another and modified construction by which the tilting may be effected positively by a direct mechanical linkage in response to the carrier rotation.

Other and more detailed objects of the present invention will appear from the following description and appended claims, when considered in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary view principally in front elevation illustrating a form of lampchanging device wherein the lamps are tilted by a positive mechanical linkage;

Fig. 2 is a view of the apparatus of Fig. 1 principally in central vertical section, but with some parts shown in side elevation as seen from the right of Fig. 1;

Fig. 3 is a view similar to Fig. 2 showing a modified form of the invention wherein the tilting is effected by a cam associated with each lamp;

Fig. 4 is a fragmentary detail view as seen from
the left in Fig. 3 showing the mounting of one of
the lamps; and

Fig. 5 is a view similar to that of Fig. 4, but with
the lamp in a tilted position in respect to that
shown in Fig. 4, corresponding substantially to
the position of the lower lamp as shown in Fig. 3
as seen from the left in that figure.

Considering first the form of the invention
shown in Figs. 1 and 2, there is illustrated in part
a lamp-changing apparatus arranged to be applied
to a type of structure as particularly shown in my
prior Patent No. 2,289,015 aforesaid. The pri-
mary difference, however, between the present
arrangement and the patented structure is that
in the present arrangement the lamps are not
maintained vertical throughout the movement of
the carrier as in the patented structure, but
are progressively tilted from the vertical in a
direction laterally of a plane perpendicular to
the axis of rotation of the lamp carrier and contain-
ing the focal point of the lens or lens system,
which point is preferably and usually the same
as the point at which the center of illumination
of each lamp occupies at the operative position
thereof.

There is shown in Figs. 1 and 2 a Fresnel lens
1 having a focal point at 2. A lamp 3 is shown at
its operative position with its center of illumi-
nation at the point 2. A second lamp is shown at 4
at its operative position when the lamp 3 is at
its operative position. There are but two lamps
mounted on the structure as shown in the ac-
companying drawings, although it is contemplated
that a structure similar to that herein shown
could be provided for the accommodation of more
than two lamps, using the same principles of con-
struction and operation. Various intermediate
positions of the lamps 3 and 4 are indicated in
dotted lines in Figs. 1 and 2.

As particularly shown in Fig. 2, the main move-
ment of each lamp is in a vertical plane perpen-
dicular to the plane of the paper and passing
through the point 2. However, the lamps are
tilted in moving between the operative position
thereof shown for the lamp 3 in Fig. 2 and the
operative position shown for the lamp 4 by a
progressive amount, so that the longitudinal axes
of the lamps are progressively further from the
vertical as the lamps are progressively moved
from their operative position to a position 180°
distant therefrom in the movement of rotation of
the lamp carrier, and vice versa. This tilting
movement enables the large lamps shown to avoid
contact not only with each other, but also with
other parts of the structure as particularly illu-
strated in Fig. 2, while permitting these large
lamps to be used with a relatively small lamp-
changer structure adapted for and usable with
lamps of much smaller size. In this way it is
possible to make many of the parts of a single
size and shape for each part irrespective of the
size lamps to be used therewith, which results in
economy in manufacturing operations.

Referring now more particularly to the draw-
ings, the stationary support for the lampchang-
ing device is shown at 5, this structure corre-
sponding to the structure 10 of my prior patent
aforesaid. Rigidly mounted in this support is a
stationary stud 8 about which a lamp carrier gen-
erally indicated at 7 may rotate, the axis of the
stud 8 preferably being horizontal as shown.

The carrier 7 may be rotated by any suitable
means (not shown), for example, means such as
are shown in my prior patent, but not here shown
in detail, such means being in general indicated
by a ring gear 8 secured to the carrier 7 and
meshing with a pinion 9, which may be suitably
connected to a driving mechanism, for example,
of the type shown in detail in my prior patent.
If it be desired to provide for the oscilla-
tion rather than unidirectional rotation of
the carrier 6, some well known type of "free-
wheeling" device may be arranged in conjunc-
tion with driving mechanism of the type of my prior
patent in order to permit unidirectional rotation
of the carrier 7 after it has moved through an angle
as 180°, such as a friction clutch or a pawl and
ratchet device as shown at 11—12, Fig. 7, of my
copending application Serial No. 701,429 aforesaid.
On the other hand, any suitable spring ac-
tuated device such as that particularly described
in my copending application Serial No. 701,429
aforesaid, and including a torsion spring as shown
at 51 in Fig. 5 of that application, located at any
convenient part of the device may be used. Al-
ternatively, a weight-actuated mechanism may
also be used as will be obvious to those skilled in
the art. It will be understood that as to the
present invention, the specific type of actuating
means for the carrier is relatively immaterial and
per se forms no part of the present invention.

While in the event that oscillatory movement
were used for the carrier, as through 180°, there
would usually be required a stop means for pre-
determining accurately the terminal positions
of the carrier movement, the present invention is
arranged and intended for unidirectional rota-
tion. Such stop means are, therefore, not in-
cluded in the present disclosure. Reference may
be had, however, for a disclosure of such means
to Figs. 10 and 11 of my copending application,
Ser. No. 701,429 aforesaid, and the associated de-
scription. With a unidirectional driving means
for the lamp carrier, means are preferably pro-
vided for insuring the accurate registry of each
lamp in succession at an operative position as
shown in the drawings, Figs. 1 and 2, for the
lamp 3. Such means are disclosed in detail in
my prior patent aforesaid and will not here be
repeated.

In accordance with the present invention the
lamp carrier 7 carries rigidly secured therein ad-
dant to its outer end a pair of horizontally
disposed studs 10, which are secured to the car-
rier as by nuts 11. Pivot ed about each of these
studs is a lamp carrying means 12. These means
12 carry the lamps 3 and 4 in a manner more par-
ticularly hereinafter described.

Means are provided for rotating the means
12 about the horizontal axes of the studs 10 in
response to and proportional with the rotation of
the carrier 7 about its axis stud 6. In gen-
eral means similar to either of the arrange-
ments shown in my prior patent aforesaid can be
used for this purpose; that is, either a train of
gears as particularly shown in the accompany-
ing drawings, or sprocket and chain means as
shown, for example, in Figs. 1, 2 and 4 of my
prior patent. The essential characteristic is
that a parallel motion drive be provided for
the lamp carrying means 12 so that their upper
surfaces will always be maintained horizontally or
at some definite angle to the horizontal in ac-
cordance with the requirements of the present
invention.

For this purpose as shown in the accompa-
yning drawings there is provided a gear means here
shown as a pair of gears 13 concentric with the
stud 6 and preferably splined to this stud, so as
to be non-rotateable in respect to the stationary
support 5. While two such gears are shown in the accompanying drawings, it will be understood that only one such gear need necessarily be provided. Each of the lamp carrying means 12 is provided with a gear 14 secured thereto as by one or more screws 15. The gears 14 are arranged concentric with the studs 10. Intermediate the gear of gears 13 and the gears 14, there are one or more idlers, as may be necessary, an uneven number being required so that the movement of the means 12 and the lamps carried thereby will be a parallel motion linkage or drive. In this case but one intermediate idle gear 14 is shown at 16 associated with each gear 14, this idle being loosely pivoted upon a pinle carried by the carrier 7 and meshing with a gear 13 on the one hand and with an associated gear 14 on the other. As the gears 13 and 14 have the same number of teeth, it will be seen that the lamp carrying means 12 will always be maintained in a constant position in respect to the horizontal by the parallel motion linkage or drive described.

The particular description thus far given is essentially the same as the disclosure of my prior patent aforesaid and is common to both forms of the invention, the details being suitably undisclosed, so that the parts thus far particularly described have been given the same reference numbers.

Means are provided in accordance with the present invention for mounting each of the lamps for movement about a horizontal axis in respect to their associated lamp carrying means 12. For this purpose each means 12 is provided with a pair of upstanding ears 17 between which is pivoted a lamp supporting means 18, which in turn carries a conventional socket 19 in which the lamp is held in the usual manner. The pivotal connection between the ears 17 of the means 12 and the supporting means 18 is about a horizontal axis lying in a plane parallel to the vertical plane of rotation of the carrier, so that by tilting the lamps from the position of the lamps 3 and 4 as shown in Fig. 2 to that of the lamp 4 in Fig. 3 the figure of the lamps will be moved outwards or laterally of that vertical plane so as to avoid mechanical interference of parts as shown.

Means are provided for controlling the tilting of the lamps. For this purpose as shown in Figs. 1 and 2 a direct connection mechanical linkage is provided. This linkage comprises a crank 20 rigidly carried by the outer end of the stud 10 and having at its outer end a swivel member 21 rotatable in respect to the crank 20 about a horizontal axis parallel to the axis of the stud 10. This swivel member is connected by a link 22 to an extension 23 rigid with the lamp supporting means 18. The link 22 may be provided at its outer end with a ball end portion 25 received in a suitable substantially spherical seat in the extension 23 as shown.

Thus as the stud 10 is stationary in respect to the carrier 1, the crank 20 will always be maintained at the same angular position in respect to the lamp carrier 7 and thus will move in respect to the associated means 12 as shown by a comparison of the upper and lower portions of Fig. 2. This movement will be a tilting of the lamps between the positions for the lamps 3 and 4 as shown.

The means shown in the accompanying drawings for conducting electric current to the several lamps may be identical with that fully disclosed in my prior Patent No. 2,288,315 above referred to, and is, therefore, not particularly described herein, such means being in general indicated by the reference number 25. The lamp carrying means 12 are provided with a suitable insulating block 26 for carrying the contacts moving with the lamps, which contacts are suitably connected by means, not shown, to the contact points or terminals of the socket 19. Flexible connectors are required in this case to permit of the tilting movement of the lamps.

Referring now to the form of the invention shown in Figs. 3 to 5, there is provided a modified mechanical arrangement for attaining the same or similar results to those attained in the Fig. 1 form of the invention. However, some further advantages may be obtained from this type of structure. As shown, the outer end of each of the studs 10 carries rigidly secured thereon a cam 27 arranged to contact a preferably hardened surface of a projection 28 serving as a cam follower, this projection being formed rigidly or integral with a part of a lamp supporting means 29 corresponding in general to the means 18 of Figs. 1 and 2. Each lamp supporting means 29 is pivoted on the horizontal axis to upstanding ears 30 of the lamp carrying means 12 corresponding structurally and functionally to the ears 17 previously described, the pivotal connection being essentially the same in both forms of the invention.

Means are provided for resiliently retaining the supporting means 29 in a position such that the cam follower surface of the projection 28 is always in engagement with the cam 27. For this purpose one or more tension springs as shown at 31 are provided, these springs being connected between suitable projections provided for the purpose, and secured in the lamp carrying means 12 and the supporting means 29 respectively as shown at 22 and 33.

Thus as the cam 27 are held rigid with the lamp carrier 7, they will be rotated in respect to the lamp supporting means 29 as the carrier rotates. If then the cams 27 are circular in configuration, as shown at 27, but eccentrically held on the studs 10 substantially the same type of movement of the lamps 3 and 4 will ensue as previously described in connection with Figs. 1 and 2. On the other hand it may be desired, for example, in order to accommodate the device to particular space requirements for a lens or lens system or for other associated parts or equipment to provide some non-circular contour for the cams 27. This may obviously be done, the space restrictions being taken into account in the design of the cams 27 so as to obtain the desired results. Furthermore, these cams may be removable and interchangeable, so that a set of cams may be employed peculiarly adapted to any size or shape of lamps to be used and further to the space restrictions or requirements of any particular installation. This is a special advantage for this form of the invention giving it more universal application than the other form as shown, for example, in Figs. 1 and 2.

While there is shown and described herein but two specific forms or embodiments of the present invention and some variants are further suggested, others will obviously occur to those skilled in the art. I do not wish to be limited, therefore, except by the scope of the appended claims, which are to be construed validly as broadly as the state of the prior art permits.

What is claimed is:

1. Lamp changing apparatus, comprising a sta-
tionary support, a rotary lamp carrier means mounted on said support for movement in respect thereto about a predetermined axis, a plurality of electric lamps mounted on said carrier means and movable in respect thereto in the plane of rotation of said carrier means about said axis and also laterally of said plane, each of said lamps being carried in a base means, an intermediate supporting member interconnected between said lamp carrier means and each said base means respectively and including a pivoted connection about an axis parallel to the first-mentioned axis as the connection between each said intermediate member and one of said means, permitting relative movements of said lamps in respect to said carrier in said plane, and a connection between said supporting member and the other of said means, permitting relative movement between said lamps respectively and said carrier in a direction normal to said plane, means operated by and in response to the rotation of said carrier for moving said lamps in respect thereto in said plane, and other means operated by and in response to the rotation of said carrier for moving said lamps in respect thereto and for controlling the position of said lamps in directions normal to said plane, so as to move said lamps successively to and from predetermined operative positions at which their centers of illumination are successively at a predetermined point and inoperative positions spaced therefrom both in and laterally of said plane.

2. Lampchanging apparatus, comprising a stationary support, a rotary lamp carrier mounted on said support for movement in respect thereto about a predetermined axis, a plurality of electric lamps mounted on said carrier and movable in respect thereto in the plane of rotation of said carrier about said axis and also laterally of said plane, a base means carrying each of said lamps, an intermediate supporting member interconnected between said lamp carrier and each said base means respectively and including a pivoted connection between each said intermediate supporting member and said lamp carrier providing for the movement of each said intermediate supporting member in respect to said lamp carrier about an axis parallel to the first-named axis of said lamp carrier, and a connection between each said supporting member and each said base means respectively providing for the movement of said base means and a lamp carried thereby in a direction normal to said plane, means operated by and in response to the rotation of said carrier for moving said lamps in respect thereto in said plane, and other means operated by and in response to the rotation of said carrier for moving said lamps in respect thereto and for controlling the position of said lamps in directions normal to said plane, so as to move said lamps successively to and from predetermined operative positions at which their centers of illumination are successively at a predetermined point and inoperative positions spaced therefrom both in and laterally of said plane.

3. Lampchanging apparatus, comprising a stationary support, a rotary lamp carrier mounted on said support for movement in respect thereto about a predetermined axis, a plurality of electric lamps mounted on said carrier and movable in respect thereto in the plane of rotation of said carrier about said axis and also laterally of said plane, an intermediate supporting member for each of said lamps respectively which is pivotable to said lamp carrier on an axis parallel with the axis of rotation of said carrier, a base means for each of said lamps respectively pivoted to the respective supporting members on an axis which is maintained horizontal and which is perpendicular to the axis between said carrier and said supporting means respectively, parallel motion means operated by and in response to the rotation of said carrier for moving said lamps in respect thereto in said plane, and other means operated by and in response to the rotation of said carrier for moving said lamps in respect thereto and for controlling the position of said lamps in directions normal to said plane, so as to move said lamps successively to and from predetermined operative positions at which their centers of illumination are successively at a predetermined point and inoperative positions spaced therefrom both in and laterally of said plane.

4. Lampchanging apparatus in accordance with claim 3, wherein the last-named means for tilting said lamps in response to the rotation of the carrier comprises a cam rotated in respect to each lamp engaged means in contact therewith, whereby each of said lamps and its associated carrying means are rotated in respect to their associated axes and cams, the lamps are tilted laterally of said carrier.

5. Lampchanging apparatus in accordance with claim 3, wherein the last-named means for tilting said lamps in respect to said carrier comprises a cam removably secured to an axle stationarily carried by said carrier and about which said lamp carrying means is rotatably mounted, means stationarily located in respect to each lamp for engaging the peripheral surface of said cam, and resilient means for retaining the cam engaging means in contact therewith, whereby each of said lamps and its associated carrying means are rotated in respect to their associated axes and cams, the lamps are tilted laterally of said carrier.

6. Lampchanging apparatus in accordance with claim 3, wherein the last-named means for tilting said lamps in respect to said carrier comprises a cam removably secured to an axle stationarily carried by said carrier and about which said lamp carrying means is rotatably mounted, means stationarily located in respect to each lamp for engaging the peripheral surface of said cam, and resilient means for retaining the cam engaging means in contact therewith, whereby each of said lamps and its associated carrying means are rotated in respect to their associated axes and cams, the lamps are tilted laterally of said carrier.

7. Lampchanging apparatus, comprising a stationary support, a rotary lamp carrier mounted on said support for movement in respect thereto about a substantially horizontal axis, at least two electric lamps mounted on said carrier on lamp carrying means which are pivoted to said carrier for movement in respect thereto about horizontal axis studs rigid with said lamp carrier and diametrically symmetrical disposed in respect to the axis of said carrier, means mounting each of said lamps for movement in respect to its associated carrying means about an axis lying in the direction perpendicular to the axis of each of said carrying means in respect to said lamp carrier, parallel motion means subject to the rotation of said lamp carrier for rotating each lamp and its associated carrying means in respect thereto about the horizontal axes of said studs incident to the rotation of the carrier; and means for deflecting said lamps in a direction lateral of said carrier comprising a crank rigidly carried by the outer end portion of each of said studs, and a link articulated to said crank and to a part rigid with said lamps, so that upon rotational movement...
of said lamp carrying means with respect to said carrier, there will be a relative rotation of each said crank and said lamps respectively such as to cause a tilting of the lamps, the entire construction being arranged so as to enable said lamp-changing apparatus to accommodate itself to the use of lamps of such large size that tilting thereof is necessary to permit carrier rotation and lamp interchange without interference of the parts in their movements incident thereto.

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