No. 710,243. Patented Sept. 30, 1902.

A. BREBNER.

ECLIPSING SCREEN FOR REVOLVING GROUP FLASHING LIGHTHOUSE LIGHTS, &c.

(Application filed Dec. 26, 1899.)

(No Model.)

5 Sheets—Sheet 1.

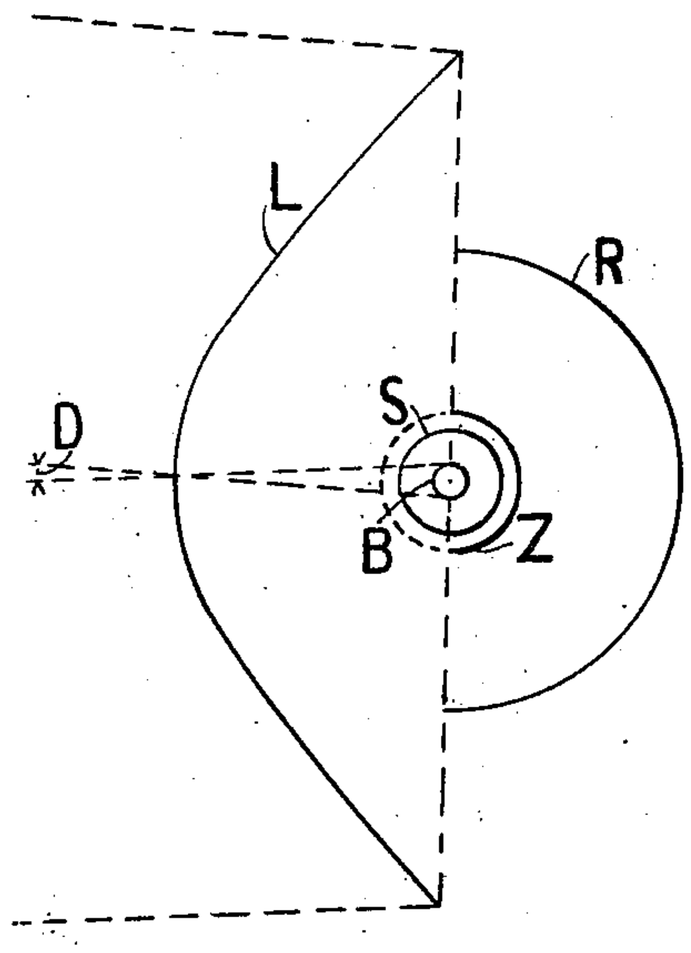

FIG. 1_A

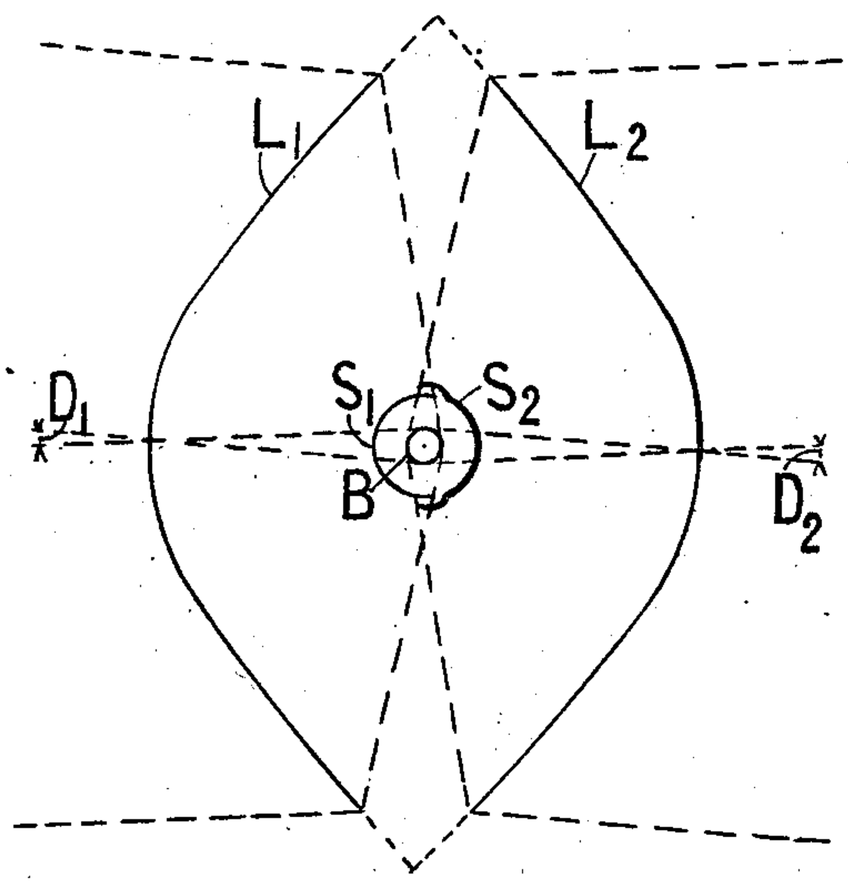

FIG. 2_A

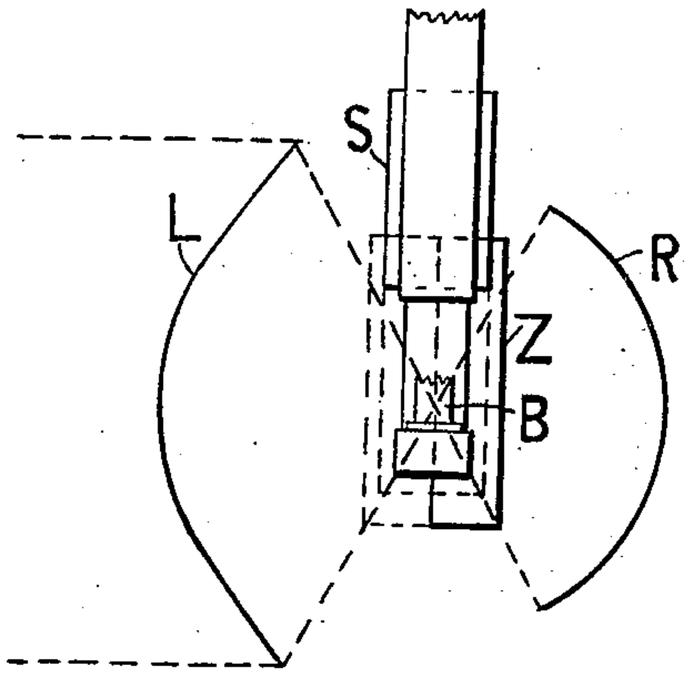

FIG. 1_B

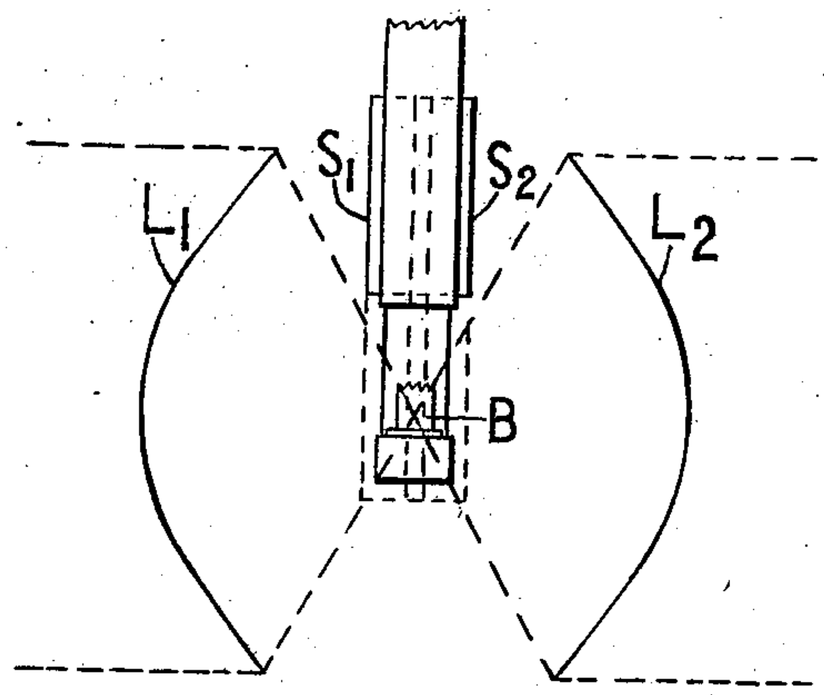

FIG. 2_B

Witnesses.

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By R. S. C. Caldwell

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No. 710,243. Patented Sept. 30, 1902.

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ECLIPSING SCREEN FOR REVOLVING GROUP FLASHING LIGHTHOUSE LIGHTS, &c.

(Application filed Dec. 26, 1899.)

(No Model.)

5 Sheets—Sheet 2.

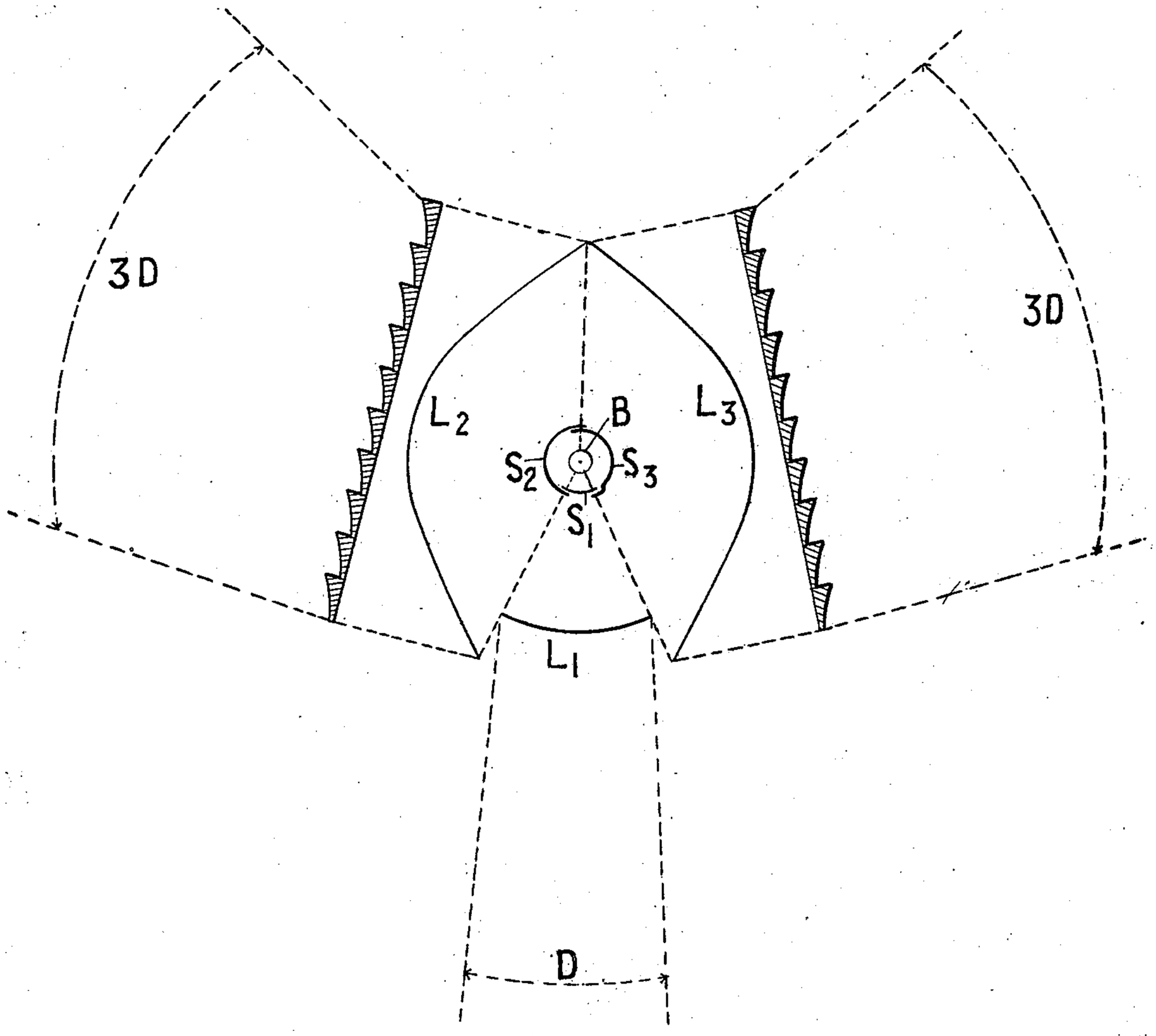

FIG. 2c

Witnesses.
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ECLIPSING SCREEN FOR REVOLVING GROUP FLASHING LIGHTHOUSE LIGHTS, &c.

(Application filed Dec. 26, 1899.)

(No Model.)

5 Sheets—Sheet 3.

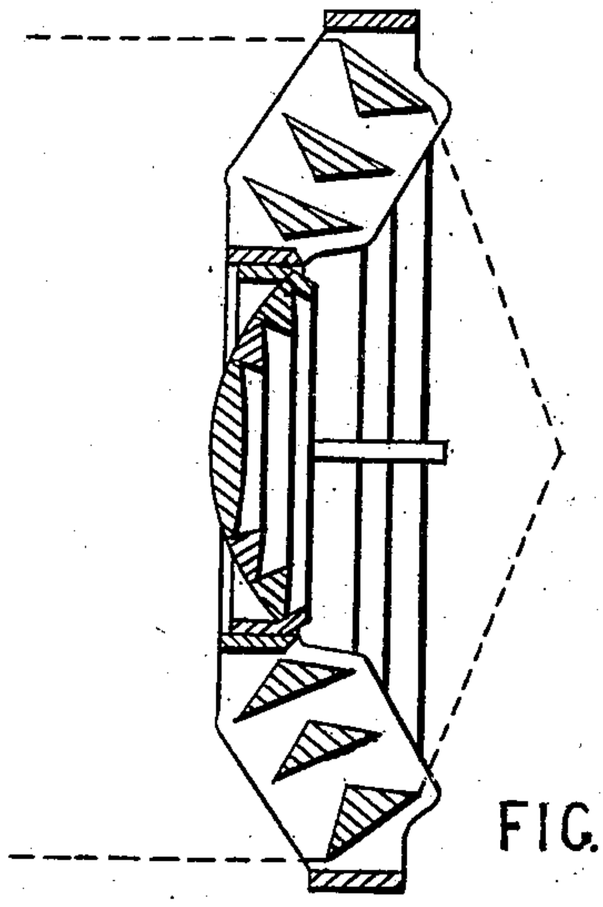

FIG. 2D

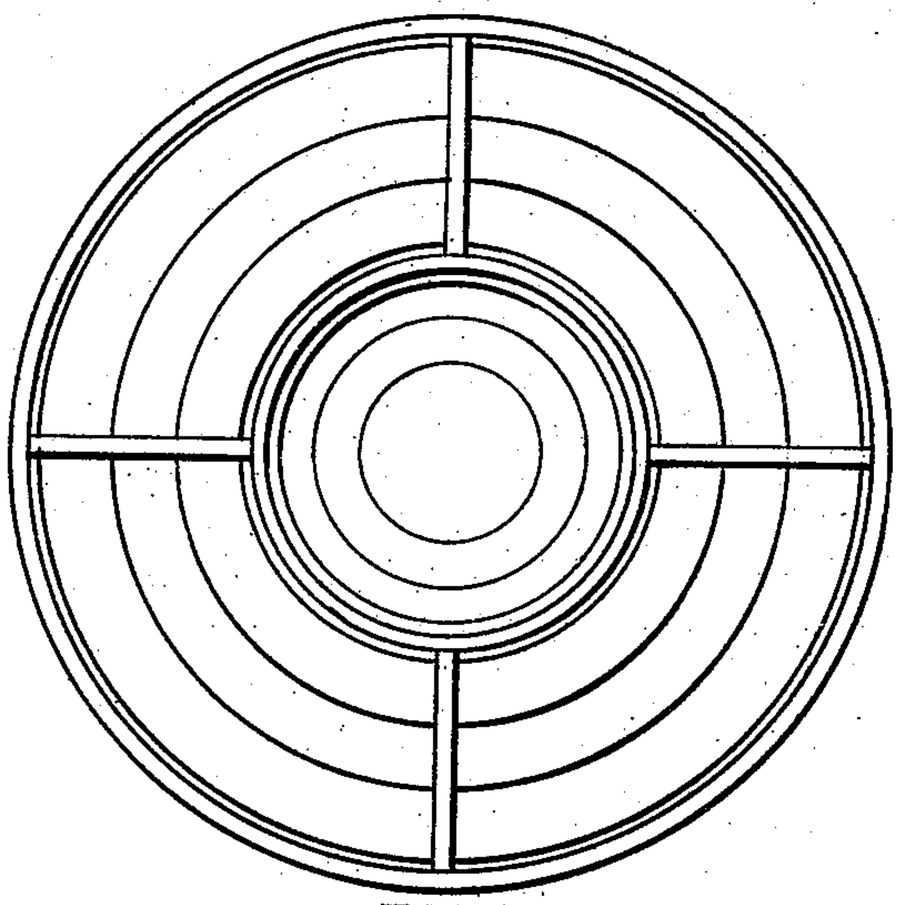

FIG. 2E

Witnesses.

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Inventor:

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By R. S. C. Caldwell.

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No. 710,243. Patented Sept. 30, 1902.

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ECLIPSING SCREEN FOR REVOLVING GROUP FLASHING LIGHTHOUSE LIGHTS, &c.

(Application filed Dec. 26, 1899.)

(No Model.) 5 Sheets—Sheet 4.

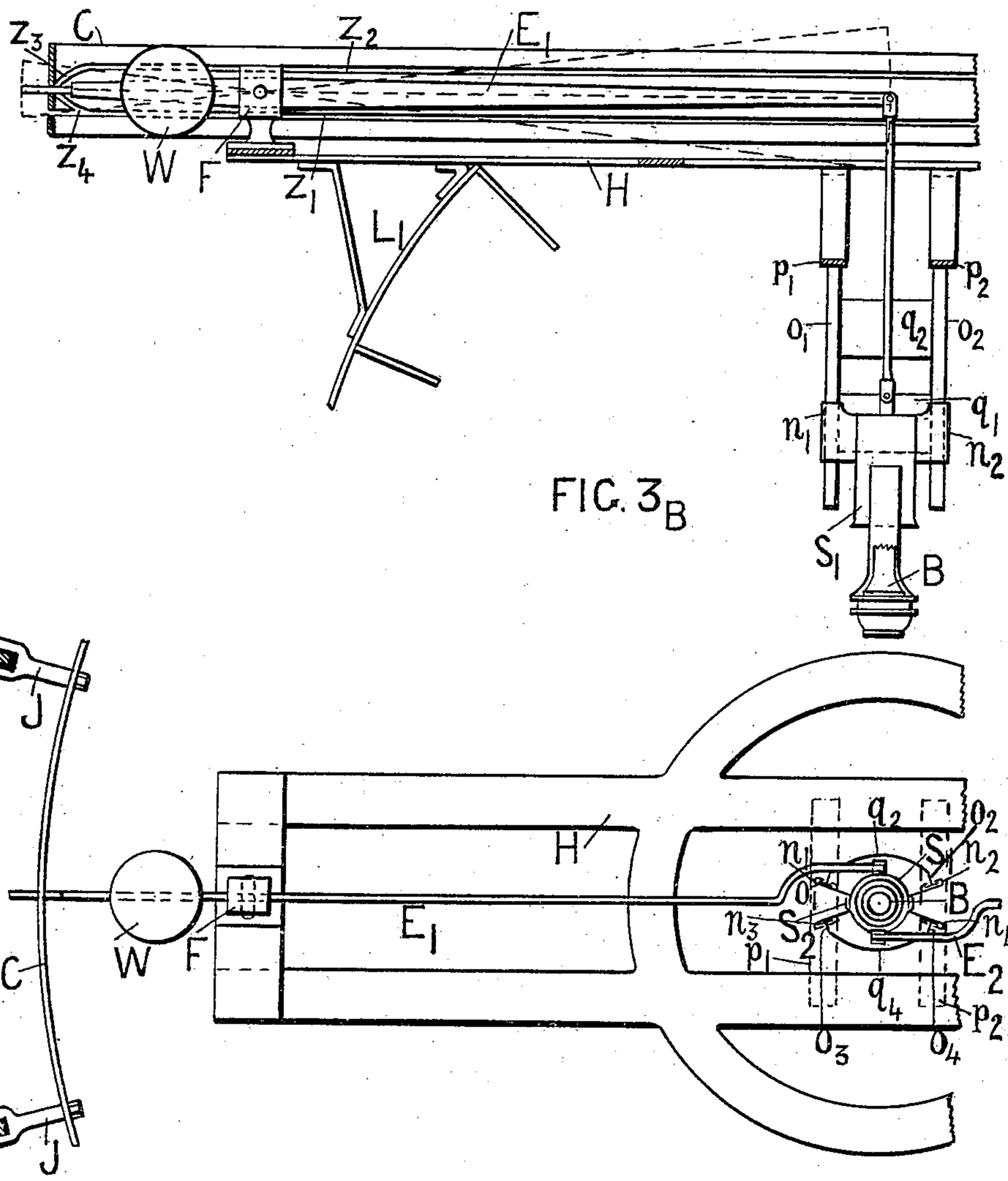

FIG. 3B

FIG. 3A

Witnesses.

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ECLIPSING SCREEN FOR REVOLVING GROUP FLASHING LIGHTHOUSE LIGHTS, &c.

(Application filed Dec. 26, 1899.)

(No Model.) 5 Sheets—Sheet 5.

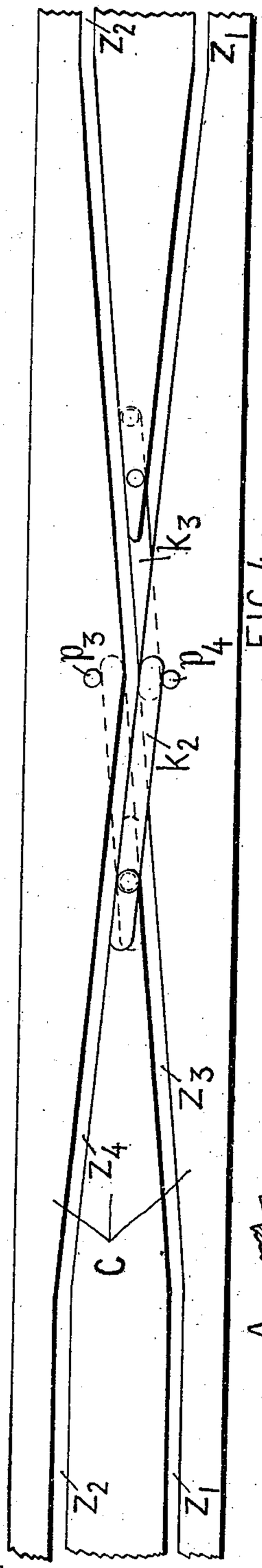

FIG. 4B

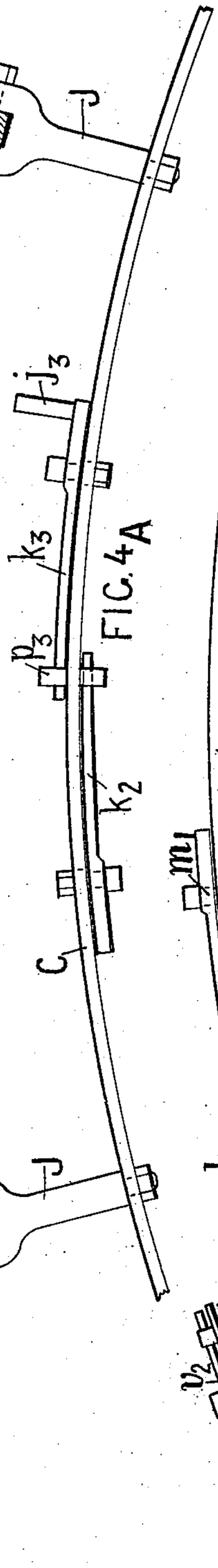

FIG. 4A

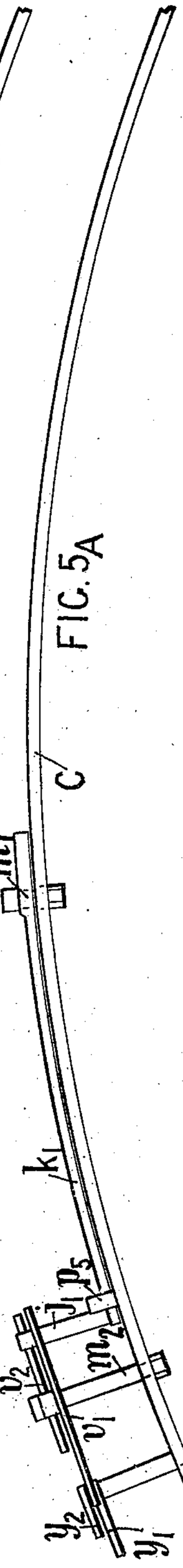

FIG. 5A

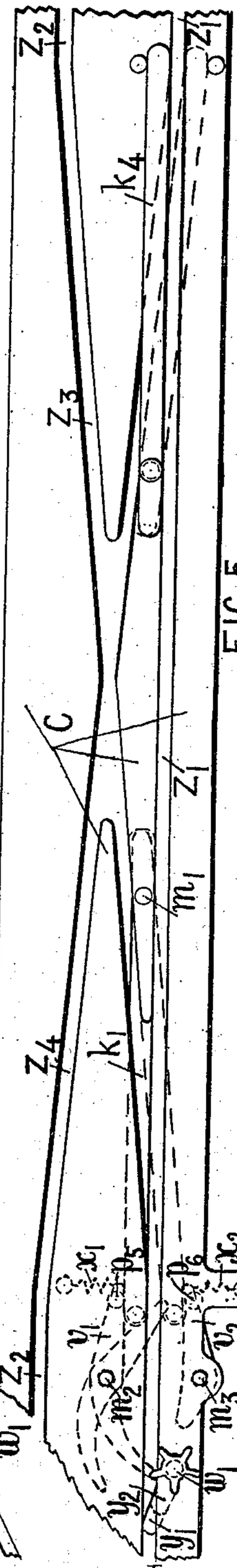

FIG. 5B

Witnesses.
Alexander Davidson
Emily Josephine Davidson

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Alan Brebner.
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Atty.

UNITED STATES PATENT OFFICE.

ALAN BREBNER, OF LONDON, ENGLAND.

ECLIPSING-SCREEN FOR REVOLVING GROUP-FLASHING LIGHTHOUSE-LIGHTS, &c.

SPECIFICATION forming part of Letters Patent No. 710,243, dated September 30, 1902.

Application filed December 26, 1899. Serial No. 741,641. (No model.)

To all whom it may concern:

Be it known that I, ALAN BREBNER, bachelor of science and member of the Institution of Civil Engineers, a citizen of Great Britain, residing at 4 Nemoure road, Acton, London, W., in the county of Middlesex, England, have invented new and useful Improvements in Screens and Revolving Lighthouse or Signaling Lights, of which the following is a specification.

The main feature of novelty in my invention lies in this that whereas eclipsing-screens for revolving group-flashing lighthouse-lights hitherto used or proposed have been so constructed as to eclipse the whole of the light source at once, whether by their sole action or by their action combined with that of reflectors, I propose a subdivided form of screen, whereby it becomes possible to cut off only a fraction—such as one-half, one-third, two-thirds, &c.—of the light source at one time and by means of which it becomes possible to obtain groups of flashes of a suitable duration in a more compact sequence or with shorter periods of eclipse than it is possible to obtain with eclipsing-screens which alone or in combination with a reflector cut out all the light simultaneously.

Figure 1^A is a horizontal diagrammatic view of a single-beam revolving light, and Fig. 1^B is a vertical diagrammatic view thereof. Fig. 2^A is a horizontal diagrammatic view of a double-beam revolving light, and Fig. 2^B is a vertical diagrammatic view thereof. Fig. 2^C is a horizontal diagrammatic view of a triple-beam revolving light. Fig. 2^D is a central section of one of the lenses employed in my invention, and Fig. 2^E is an elevation thereof. Fig. 3^A is a plan view of the burner and fragments of the adjoining parts, and Fig. 3^B is a side elevation thereof. Fig. 4^A is a plan view of a section of the guide-cylinder, and Fig. 4^B is an elevation thereof. Fig. 5^A is a plan view of a portion of a modified guide-cylinder, and Fig. 5^B is an elevation thereof.

In illustration of the advantage to be derived from a subdivided eclipsing-screen Figs. 1 and 2 may be consulted.

Fig. 1^A represents in horizontal focal section, and Fig. 1^B in vertical focal section, a single-beam revolving light, consisting of a lens L, reflector R, luminary B, and eclipsing-screen S. This combination is not included in my invention.

Fig. 2^A represents in horizontal focal section, and Fig. 2^B in vertical focal section, a double-beam revolving light, consisting of lenses L′ and L^2, luminary B, and a subdivided screen in two parts S′ and S^2. This combination is included in my invention.

In Fig. 1^A, D stands for the mean divergence of the beam from lens L, while in Fig. 2^A, D′ and D^2 stand for the mean divergences of the beams from lenses L′ and L^2. The luminaries B are similar and equal in size in both cases, and lenses L, L′, and L^2 are likewise similar and equal to one another.

For the satisfactory working of these eclipsing-lights in a lighthouse it is necessary that there should be a dark horizontal arc or an arc throughout which it is unnecessary to maintain the character of the light, and in this arc the opening and closing of the screens must be effected. Now in Figs. 1 the apparatus is allowed to revolve twice with the screen S raised, and then the screen is dropped while the beam is in the dark arc, only to be raised again after two revolutions of the apparatus, and so on continuously. There results for the mariner a light showing a flash of one-tenth of a second, a short eclipse of four and nine-tenths seconds, a flash of one-tenth of a second, and a long eclipse of fourteen and nine-tenths seconds, the whole double-flashing characteristic being presented in each successive period of twenty seconds. In Figs. 2, on the other hand, the apparatus starts with S^2 closed in front of lens L^2 and screen S′ raised, while beam D′ is over the dark arc referred to above. Screen S′ continues raised during one revolution, then lowered during one revolution, and so on continuously. When lens L^2 and screen S^2 have come to the position in the dark arc from which lens L′ started screen S^2 is raised and remains raised during one revolution and then is lowered during one revolution, and so on. There results a light showing a flash of one-tenth of a second, a short eclipse of two and four-tenths seconds, a flash of one-tenth of a second, and a long eclipse of seven and four-tenths seconds, the whole double-flashing characteristic being presented in each successive period of ten seconds. Compari-

son of the alternative designs of Figs. 1 and Figs. 2 shows that that of Figs. 1, which is not included in my invention, gives flashes about thirty per cent. more powerful than that of Figs. 2, while the latter design, which is included in my invention, has the advantage of completing the double-flash signal in half the time or of giving this signal twice in the time required for one delivery of it by combination of Figs. 1, and consequently also design of Figs. 2 gives more light in a given time than design of Figs. 1. Similarly, if a triple-flash signal be required the combination of Figs. 2, included in my invention, delivers it in twelve and one-half seconds instead of twenty-five seconds, required for the delivery of it by the combination of Figs. 1, not included in my invention, and so on for other group-flashing characteristics. Another advantage combination of Figs. 2 has over combination of Figs. 1 is that by means of it the minimum of one flash per five seconds insisted on by the French state engineers in the lightning-light system and more than this minimum can be realized without using lamps of exceptional size producing excessive heat. If, again, the apparatus be of three panels, each subtending about one hundred and twenty degrees in azimuth, and a subdivided screen in three parts be used, a still more compact set of group-flashing signals can be obtained, albeit with reduced power of beam in each flash, and in this case there is a set-off against reduced power of light in the fact that the three-panel apparatus can be worked in a smaller and cheaper lantern, and, in general, where it is more important that the flashes be numerous in a given time than that they be very powerful the subdivided screen becomes invaluable. The subdivided screen may also be used with advantage in certain combinations of apparatus giving flashes of equal power, but of different duration or color.

One characteristic of my proposed subdivided eclipsing-screens is that they must necessarily resolve along with the optical panels from which they are adapted to intercept the light proceeding toward them from the luminary. The simplest direction of displacement of these screens in operation is a vertical one; but any less convenient mode of causing them to alternately intercept and liberate the rays proceeding toward the revolving optical panels is claimed as included in my invention. Other characteristics of my proposed subdivided screens are that when all the subdivisions are closed the light of the luminary is intercepted toward all points of the compass, that the minimum number of optical panels they are to be used with is two, and that each subdivision has a panel of optical apparatus corresponding to it, from which it intermittently intercepts the light and never intercepts the light from any other panel, so that these subdivided screens, the sum of which forms a complete screen, intercepting when all closed the light from the central luminary toward all points of the compass, cannot be confounded with a partial screen, intercepting only the light from the central luminary in a limited azimuth, such as might be used in Figs. 1, (shown as Z,) whether of cylindrical, spherical, or other form, placed between luminary and reflector at one time and brought around between luminary and lens at another time, for such latter partial screen could not at all be used so as to provide a more compact sequence of group flashes such as my subdivided screen is specially designed to produce. Another characteristic of my proposed subdivided screen is that in their best form the subdivisions must overlap at the borders, as shown in S and S^2 of Figs. 2, in order that the interception of the light from corresponding panels may be complete. Still the less efficient form of subdivided screen without overlapping borders falls within my claimed invention.

I shall now describe the method of working the subdivisions of the screen which I consider the simplest and of which I claim the invention, although it may be convenient sometimes to use any other suitable method not protected by Letters Patent. At the same time I shall describe the details of the subdivided screen. For these purposes Figs. 3^A to 5^B may be consulted.

Fig. 3^A illustrates in plan, and Fig. 3^B in vertical sectional elevation, the subdivided screen composed of two subdivisions, the essential details of these subdivisions, the mechanism for working them, their connection with the mechanism, and the connection of screens and mechanism with the optical apparatus. Figs. 4 and 5 show further details of the working mechanism and will be referred to farther on.

In Figs. 3^A and 3^B, B is the unique burner, placed at the focus of the optical apparatus; L', part of the frame of one of the two lenses, to each of which one semiscreen is adapted, as indicated in Figs. 2^A and 2^B. n' n^2 are guide-lugs attached to semiscreen S'; n^3 n^4, guide-lugs attached to semiscreen S^2. o' o^2 are vertical guide-rods to semiscreen S' as it rises or falls; o^3 o^4, the same for semiscreen S^2. q' q^2 are stiffening-stays to o' and o^2; q^3 q^4, the same to o^3 o^4. F is the support to lever E'. E' is a lever connected at one end to semiscreen S' by a species of piston-rod jointed at either end, (it may be with ball or roller bearings,) the other end of E' moving in a slit of cylinder C. E' moves in a vertical plane about a fulcrum in F with or without ball or roller bearings and is provided with a counterweight W, so adjusted as to balance the two parts of the lever with their adjuncts on opposite sides of the fulcrum. H is an addition to the frame of the lenses L' and L^2, adapted to carry F and the parts p' and p^2, to which guide-rods o', o^2, o^3, and o^4 are fixed, and probably also the smoke-tube and damper to burner B. The form of H will vary accord-

ing to the form of the optical apparatus to be dealt with. All the parts hitherto mentioned revolve along with the optical apparatus, excepting possibly in certain cases the burner B and its smoke-tube. C is a cylinder fixed relatively to the revolving apparatus, whether to the lantern-standards A through brackets J or by other suitable means. C has cut in it lower and upper horizontal slits z' and z^2, placed in communication with each other by diagonal slits z^3 and z^4, as shown clearly in Fig. 4^B and also in Fig. 5^B, in which latter case the lower slit z' extends all around the cylinder C. When the outer end of lever E′ is engaged in the lower slit z', the screen S′ is raised. When engaged in the upper slit z^2, the screen S′ is lowered and the flame behind it eclipsed from the lens L′. In passing from the lower to the upper slit the end of lever E′ passes along the diagonal slit z^3, the screen S′ being lowered and the light of B shut off from lens L′. When it moves back to the lower slit along z^4, the screen S′ is raised and the light liberated toward lens L′. As lever E′ and semiscreen S′, with their adjuncts, correspond to lens L′, so another lever E^2, (shown in part in Fig. 3^A,) with semiscreen S^2 and similar adjuncts, correspond to lens L^2. (Not shown except roughly in Figs. 2^A and 2^B.) As previously mentioned, the opening or closing of the subdivisions of the screen must be effected while the corresponding beam points over the dark arc of the lighthouse. Consequently the portion of cylinder C containing the diagonal slits z^3 and z^4 must be fixed to the lantern in such position as will cause the subdivisions of the screen to rise or fall while the beam points over the dark arc. In Figs. 4^B and 5^B the azimuthal angle occupied by slits z^3 and z^4 is thirty-six degrees, an angle generally suitable; but if necessary it may be made less or greater when the dark arc of the lighthouse is less or greater. Suppose now the characteristic required be a double-flashing light, Figs. 4^A and 4^B, show the arrangement of diagonal slits for this case, in which neither of the horizontal slits z' nor z^2 need be carried all around the cylinder C^2. At the intersection of the diagonal slits z^3 and z^4 in this as in all other cases are placed two locks k^2 and k^3, capable of pivoting up or down about one pin between two other pins p^3 and p^4 in C, so as to open or close the passages along slits z^3 and z^4. To prevent rattling, each lock is provided with a small spring (not shown) between its shorter end and cylinder C, so as to hold it where it is put. Suppose now the apparatus, consisting of the lenses L′ and L^2, starts its revolution, actuated by any of the usual clockwork-machines, with outer end of lever E′ at the foot of slit z^4 or the beginning of slit z' and outer end of lever E^2 consequently near the middle of slit z^2 on the opposite side of cylinder C, and continues revolving at the rate of one revolution in five seconds. As the end of E′ moves around z' the semiscreen S′ is raised, so that a beam of light from lens L′ passes around the horizon, and when outer end of E^2 comes around to the beginning of z' after passing down z^4 and raising semiscreen S^2 lens L^2 in turn moves a beam of light around the horizon. When outer end of lever E′ comes to slit z^3 and passes up it to the beginning of z^2, semiscreen S′ is thereby closed and remains so till outer end of lever E′ has once more revolved with the apparatus and descended z^4. Similarly in turn semiscreen S^2 makes one revolution closed before being reopened as outer end of lever E^2 descends z^4. The light shown to the mariner, the burner B having been chosen so as to produce a mean horizontal divergence of beam of seven and one-fifth degrees, is thus as follows: a flash lasting one-tenth of a second, a short eclipse lasting two and four-tenths seconds, a flash lasting one-tenth of a second, and a long eclipse lasting seven and four-tenths seconds, total period ten seconds, the characteristic double-flashing group repeating itself every ten seconds. With regard to locks k^2 and k^3 it is evident that k^2 is free to move out of the way of the lever end ascending z^3 or descending z^4 at any time. k^3, on the other hand, is displaced by projections on the end of lever E^2 acting on pin j^3 each time this lever end passes j^3, so that as soon as lever end E^2 has passed lock k^3 in one diagonal slit it closes this lock in this slit and opens the other slit. The projections on outer end of lever E^2 do not exist on that of lever E′, but their form is shown in dotted lines on lever E′ in Fig. 3^B. For the production of the other group-flashing characteristics slit z' must be carried all around cylinder C, as shown in Fig. 5^B, and two more locks k' and k^4 are required besides k^2 and k^3 of Figs. 4. Lock k^4 is moved freely at any time into the required position by the traveling lever ends without other aids, just as mentioned for k^2. k', however, requires a special device for opening or closing diagonal slit z^3. Further, lock k^3 must now be controlled by a special device, which need not be described, since it is analogous to that to be now described for k'. This device is illustrated in plan in Fig. 5^A and in developed vertical elevation in Fig. 5^B. Lock k' moves about pivot m', being checked in range by pins p^5 and p^6. Like the other locks, it has a small spring in its shorter end near m', which presses enough on cylinder C to hold the lock where it is put and prevent rattling. At the approach to the intersection of slit z^3 with slit z' is placed a small toothed wheel w' inside cylinder C on a turning pin which carries cams y' and y^2 at its other end outside C. To the right of w' are placed two pins m^2 and m^3, about which or along with which turn two levers v' and v^2, held up and down, respectively, by springs x' and x^2 when not pressed down and up, respectively, by cams y' and y^2. In Figs. 5 the pinion w' has five teeth and corresponds to a quintuple-flashing light, and the number of teeth in w' will be in each case the same as the number of flashes in the

group-flashing characteristic. (In some cases cams y' and y^2 may be one and the same.) Suppose, now, for example, one finds the optical apparatus revolving at the rate of one revolution in five seconds, driven by the usual weighted clockwork or other suitable means, and that w' is in the position shown in Fig. 5B, while levers E′ and E² have their outer ends engaged in lower slit z', and therefore are holding the screens S′ and S² open while the lenses are emitting beams of light at two and one-half seconds intervals. When end of E′ comes to w', it will move it around one tooth, cam y' acting on lever v' and causing its other end to move k' to its lower position, locking z' and opening z^3, so that end of E′ moves up the latter, lowering semiscreen S′ and interrupting flashes from lens L′. When end of lever E² arrives in turn at w', it moves it around one tooth farther and passes up z^3, closing semiscreen S² and interrupting flashes from lens L², while cam y^2 is left close up to left end of lever v^2. Shortly end of lever E′ arrives at and descends along z^4, entering in z', with semiscreen S′ raised and lens L′ causing flash No. 1 of a new group to move around the horizon. Two and one-half seconds later end of lever E² descends z^4 and enters z', with lens L² carrying flash No. 2 of the group around the horizon. After nearly two and one-half seconds more end of lever E′ arrives at pinion w' and moves it a third tooth around, causing cam y^2 to move v^2, and thus push k' back to its upper position, locking z^3 and opening z', so that end of lever E′ continues along z' to produce flash No. 3 of the group. Then comes end of lever E², moves pinion w', a fourth tooth around and continues along z' to produce flash No. 4 of the group. Lastly comes end of lever E′, moving pinion w' a fifth tooth around and continuing along z' to produce flash No. 5, the last of the group. w' again occupies its primitive position, and two and one-half seconds after the passage of end of lever E′ that of lever E² arrives and moving w' the first tooth around closes slit z and opens z^3 to the passage of lever E², which, ascending z^3, closes semiscreen S² and begins the second interruption of the flashes. As stated already, lock k^3 will in this case be used similar to k^3 of Figs. 4, but without the pin j^3, and will have its position regulated in a manner analogous to that described for k'. Thus it has been shown how a quintuple-flashing light is to be obtained showing a flash of one-tenth of a second, a short eclipse of two and four-tenths seconds, a flash of one-tenth of a second, a short eclipse of two and four-tenths seconds, a flash of one-tenth of a second, a short eclipse of two and four-tenths seconds, a flash of one-tenth of a second, a long eclipse of seven and four-tenths seconds, a total period of seventeen and one-half seconds, the characteristic quintuple-flashing group repeating itself every seventeen and one-half seconds. Similarly by the modification of pinion w' of the analogous pinion at the intersection of z^3 and z^4 and of the corresponding cams and levers only, while the entire optical apparatus, subdivided screen, levers E′ and E², and cylinder C remain unchanged, the other group-flashing characteristics can be obtained. By further subdivision of the screen into three or more parts adapted to optical apparatus containing three or more lenses and worked in a manner quite analogous to that described for the semiscreens with bi-valve lenses all the group-flashing characteristics can be obtained with shorter total periods, the quadruple-flash total period, for instance, being reduced from fifteen seconds for the screen of two subdivisions to ten seconds for the screen of three subdivisions for the same burners, lenses of the same focal length, and the same speed of rotation. By combining with a lens of, say, ninety degrees horizontal compass another of two hundred and seventy degrees horizontal compass specially arranged to give a colored flash or a flash of threefold duration produced artificially and adapting, respectively, to them one-fourth and three-fourths subdivisions of whole screen or by analogous combinations two other classes of distinctive characteristice can be obtained.

Revolving optical apparatus with the subdivided screen, as mentioned above, can be arranged for signaling by the Morse or similar codes.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A complete subdivided eclipsing-screen of a plurality of subdivisions, which can be opened or closed independently of one another in combination with a burner and with a revolving optical apparatus composed of two or more panels, each panel permitting to pass one beam of light and having one subdivision of the said eclipsing-screen adapted to affect it and it alone, and means for opening and closing the subdivisions of the eclipsing-screen, substantially as set forth and for the production of group-flashing lights.

2. In combination with a burner and with a revolving optical apparatus of two or more single-beam panels, a complete subdivided eclipsing-screen of two or more subdivisions, each subdivision of screen corresponding to one single-beam panel of the said optical apparatus and being provided with extended borders, and means for opening and closing the subdivisions of the eclipsing-screen, substantially as set forth and for the production of group-flashing lights.

3. A complete subdivided eclipsing-screen of two or more subdivisions combined with a burner and a revolving optical apparatus of two or more corresponding single-beam panels, a lever connected to each of the subdivisions of the screen, and carried by the re-

volving optical apparatus, and a stationary guide-cylinder having slits in which said levers travel.

4. A complete subdivided eclipsing-screen of two or more subdivisions of unequal horizontal angle in combination with a burner and with a revolving optical apparatus of two or more corresponding single-beam panels of unequal horizontal angle for the production of group-flashing lights containing flashes of different color.

5. A complete subdivided eclipsing-screen of two or more subdivisions of unequal horizontal angle in combination with a burner and with a revolving optical apparatus of two or more corresponding single-beam panels of unequal horizontal angle for the production of group-flashing lights containing flashes of different duration.

6. A revolving optical apparatus of a plurality of panels consisting in part of a complete subdivided eclipsing-screen, one subdivision of the said eclipsing-screen corresponding to each panel of the said optical apparatus, with the necessary operative means therefor and with a burner, for the production of group-flashing lights.

7. Sets of complete subdivided eclipsing-screens of a plurality of subdivisions combined with burners and with sets of revolving optical apparatus of two or more corresponding single-beam panels, for the production of light-signals of a code of signals in which each signal can be represented by a group of flashes.

8. In a device of the character described, a revolving optical apparatus comprising a burner, a number of single-beam panels, and a complete eclipsing-screen composed of subdivisions, one subdivision for each panel, a lever attached to each subdivision of the screen and carried by the revolving optical apparatus, and a stationary guide-cylinder having two horizontal slits in which the levers are adapted to ride, a pair of crossed slits connecting the horizontal slits, and a switch mechanism arranged to control said levers, substantially as described.

9. In a device of the character described, a revolving optical apparatus comprising a burner, a number of single-beam panels, and a complete eclipsing-screen composed of subdivisions, one subdivision for each panel, a lever attached to each subdivision of the screen and carried by the revolving optical apparatus, a stationary guide-cylinder having two horizontal slits in which the levers are adapted to ride and a pair of crossed slits connecting the horizontal slits, and locking means located at the junction of the slits, substantially as described.

10. In combination, a source of light, a plurality of groups of lenses or projectors arranged about said source, means for rotating said groups of lenses or projectors, and means for cutting off the light from said source to each of said groups of lenses or projectors in rotation whereby the light emanating from the said source is by successive stages in rotation entirely obscured from and in the same manner allowed to again fall upon the said lenses or projectors.

11. In combination, a source of light, a plurality of groups of lenses arranged about said source, means for rotating said groups of lenses, and means for cutting off the light from said source to each of said groups of lenses, consisting of adjustable tubular shields, each of said shields cutting off the light from one of said groups of lenses.

12. In combination, a source of light, a plurality of groups of lenses arranged about said source, means for rotating said groups of lenses, and means for vertically cutting off the light from said source to each of said groups of lenses, consisting of adjustable tubular shields, each of said shields cutting off the light from one of said groups of lenses.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ALAN BREBNER.

Witnesses:
ALFRED NUTTING,
H. D. JAMESON.