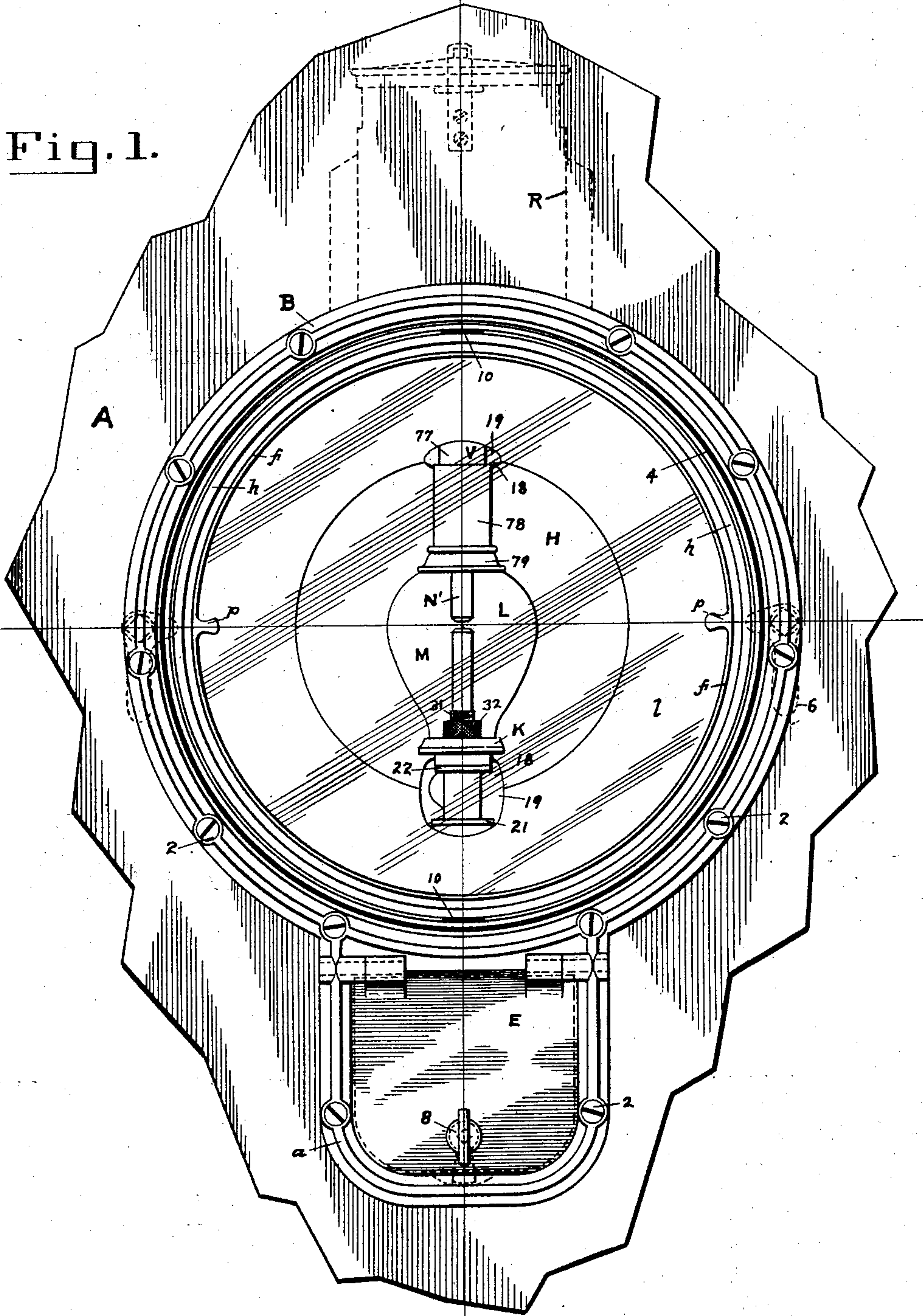


J. KIRBY, JR.  
ELECTRIC HEADLIGHT.  
APPLICATION FILED DEC. 26, 1901.

NO MODEL.

7 SHEETS—SHEET 1.

Fig. 1.



Attest:

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Fred. E. Keeley

Inventor.

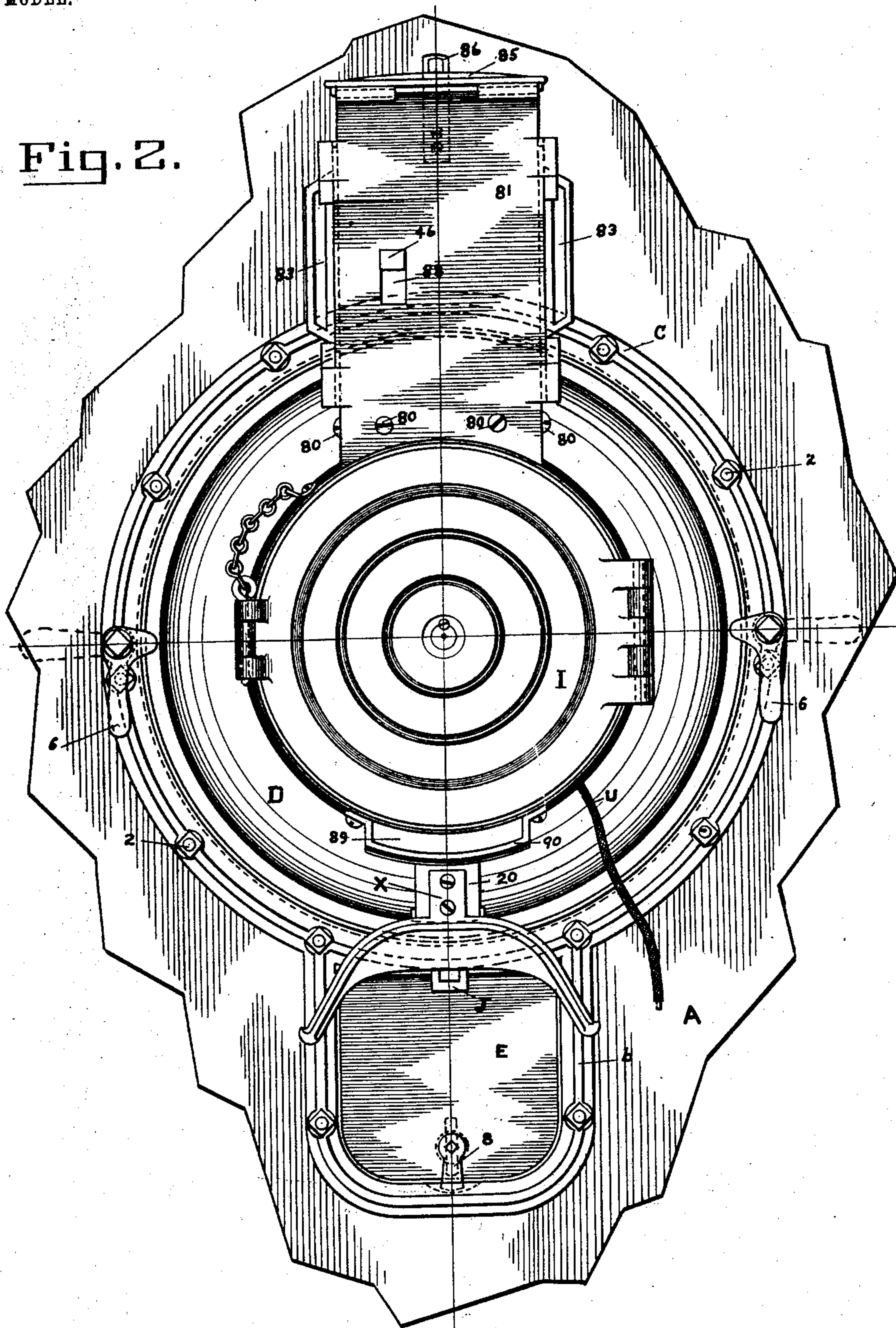
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7 SHEETS—SHEET 2.

Fig. 2.



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7 SHEETS—SHEET 3.

Fig. 6.

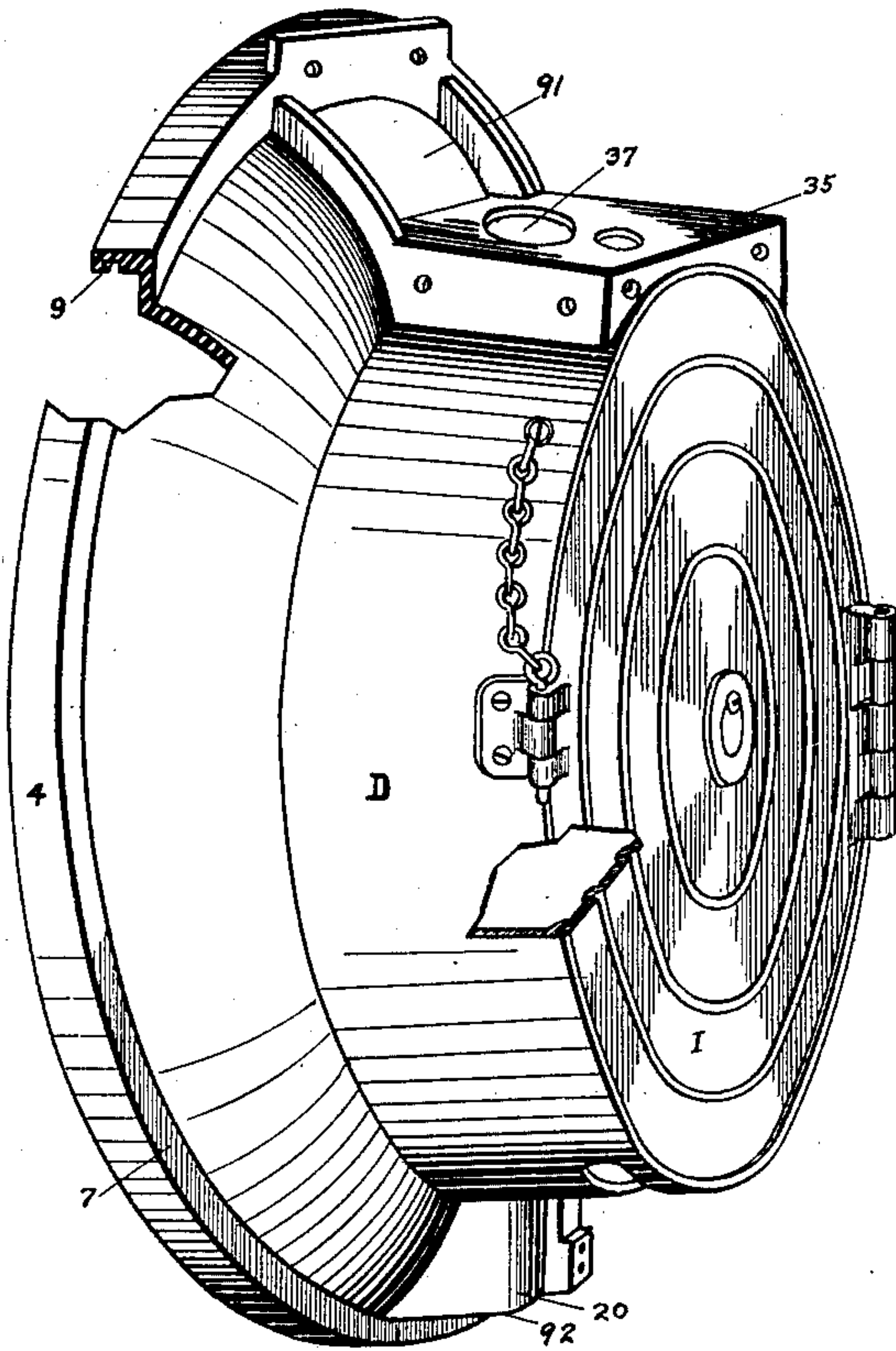


Fig. 12.

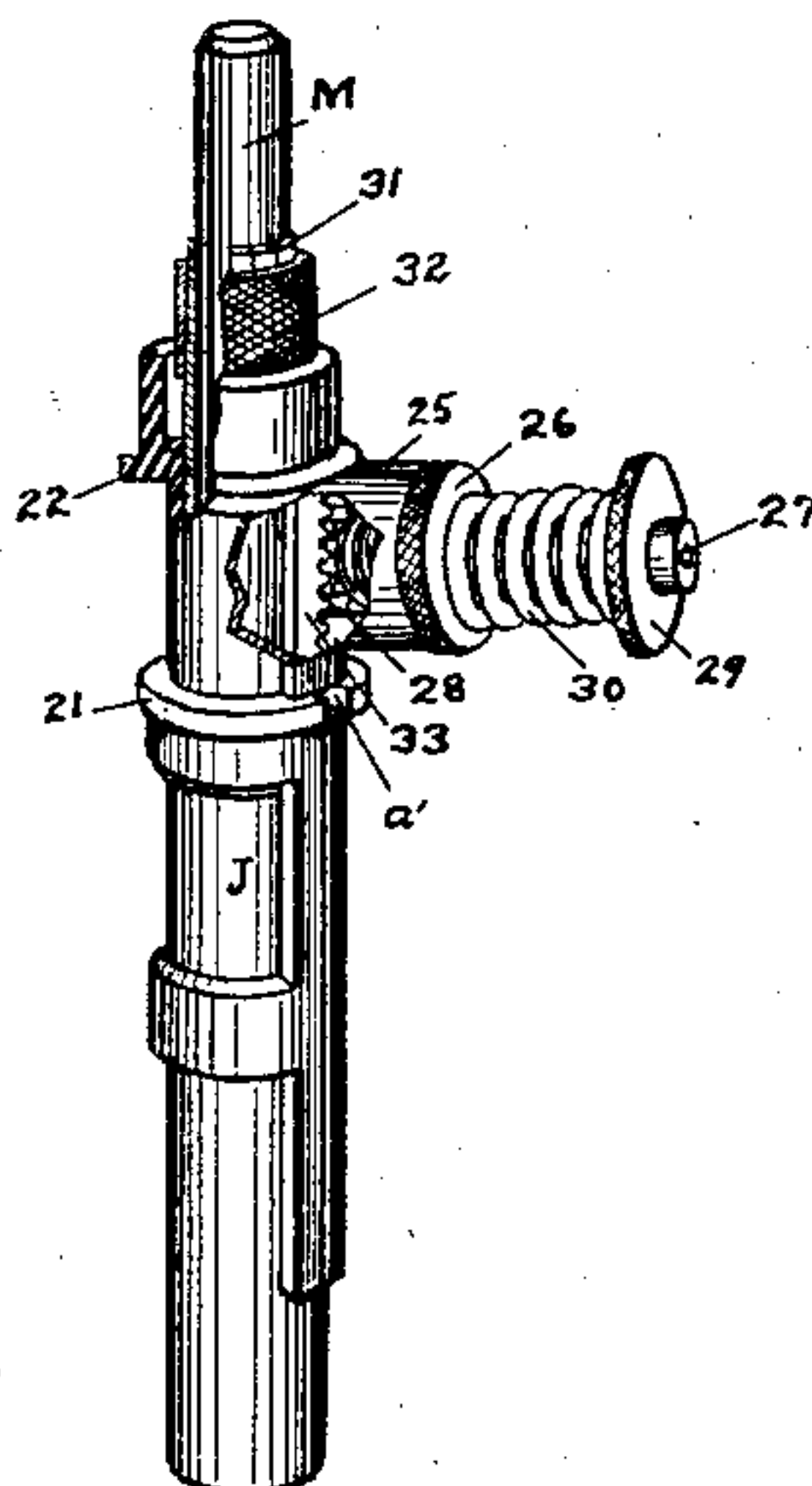
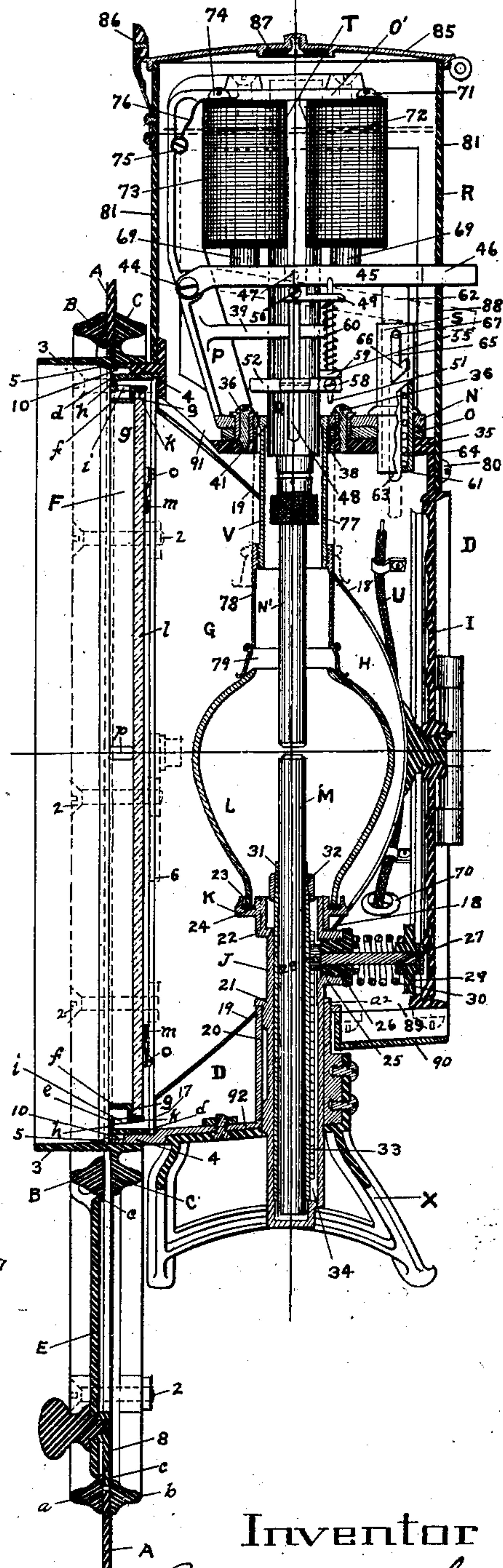


Fig. 11.



Fig. 3.



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No. 721,646.

PATENTED FEB. 24, 1903.

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ELECTRIC HEADLIGHT.  
APPLICATION FILED DEC. 26, 1901.

NO MODEL.

7 SHEETS—SHEET 4.

Fig. 4.

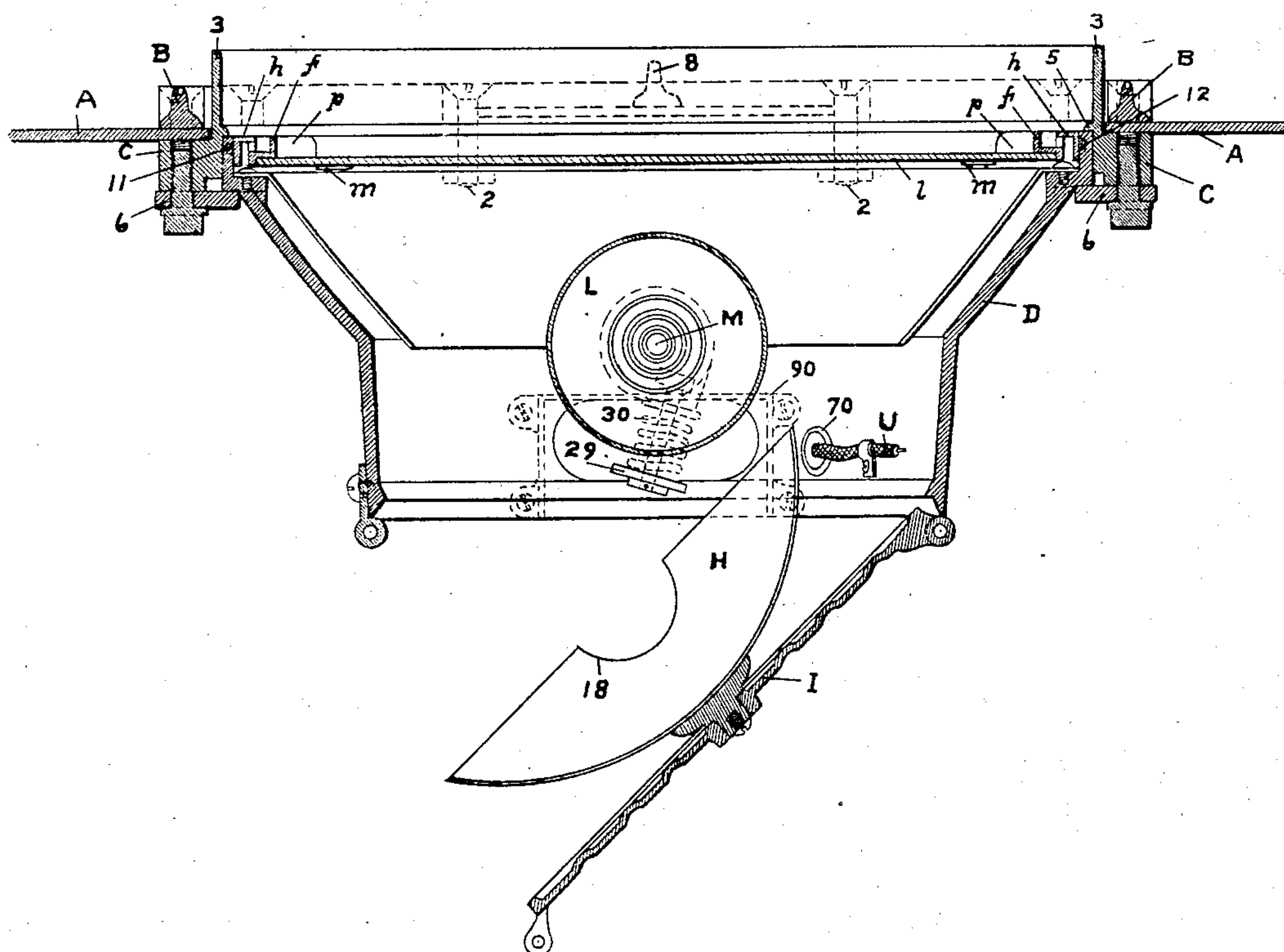
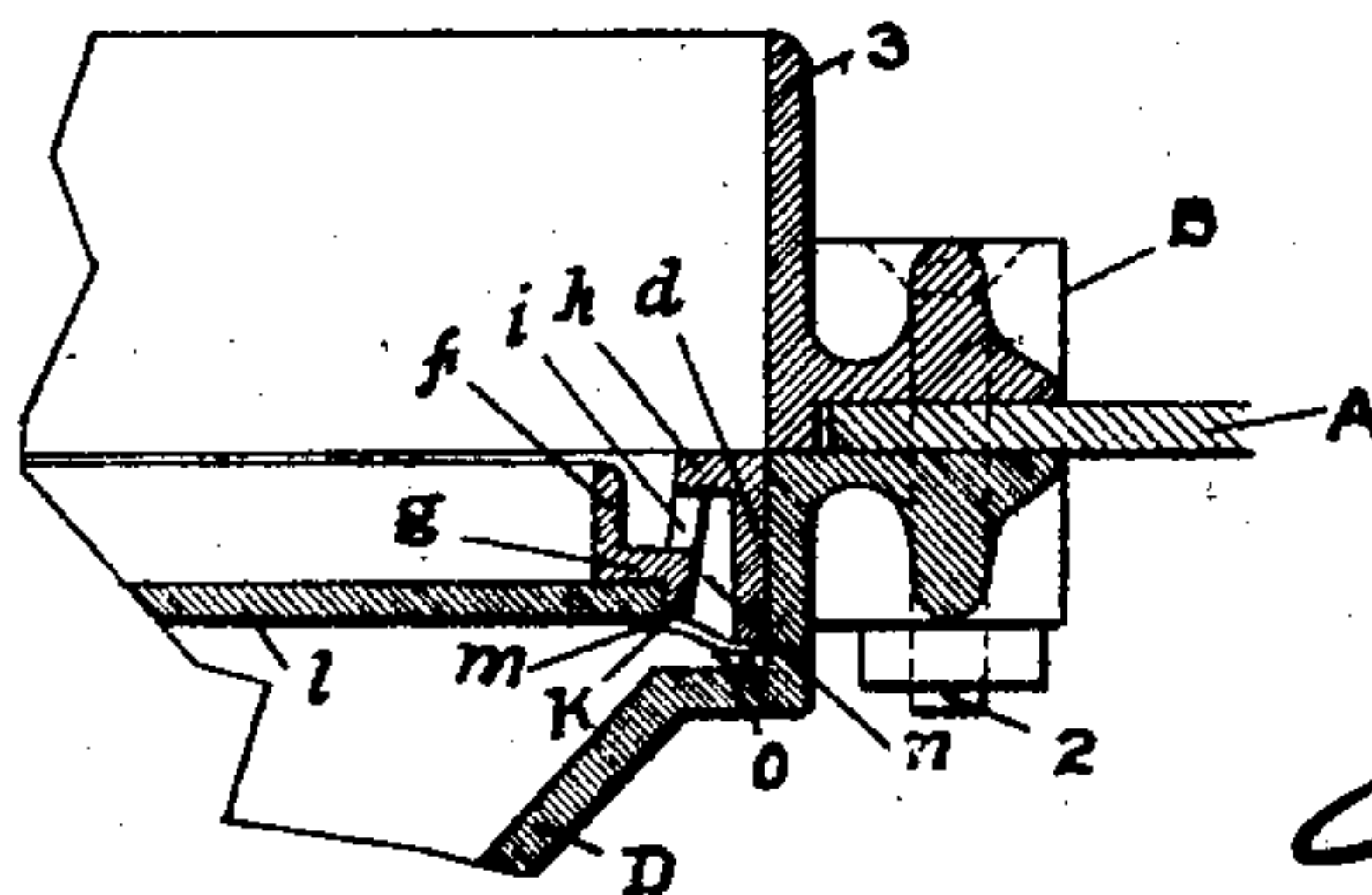


Fig. 16



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7 SHEETS—SHEET 5.

Fig 5.

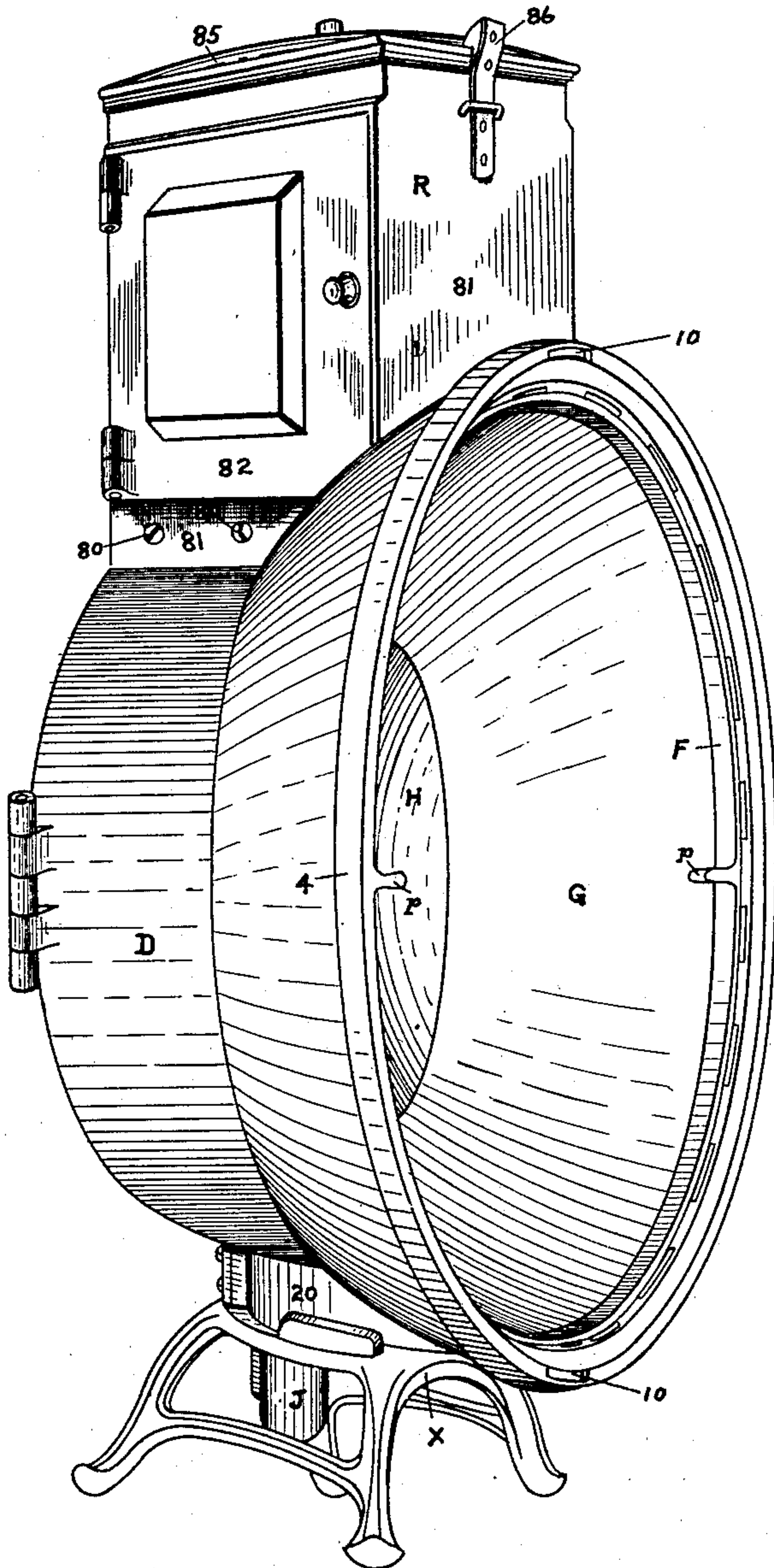
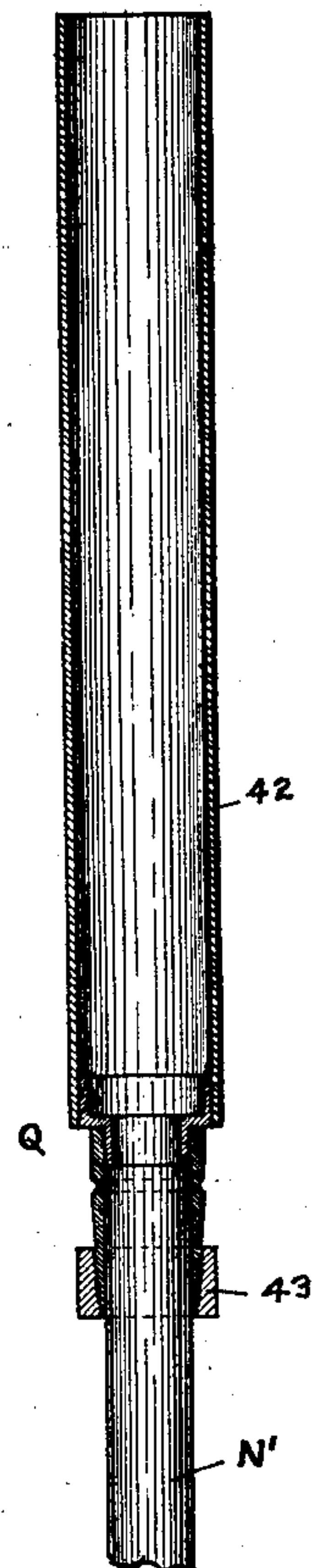


Fig 9.



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ELECTRIC HEADLIGHT.  
APPLICATION FILED DEC. 26, 1901.

NO MODEL.

7 SHEETS—SHEET 6.

Fig 7.

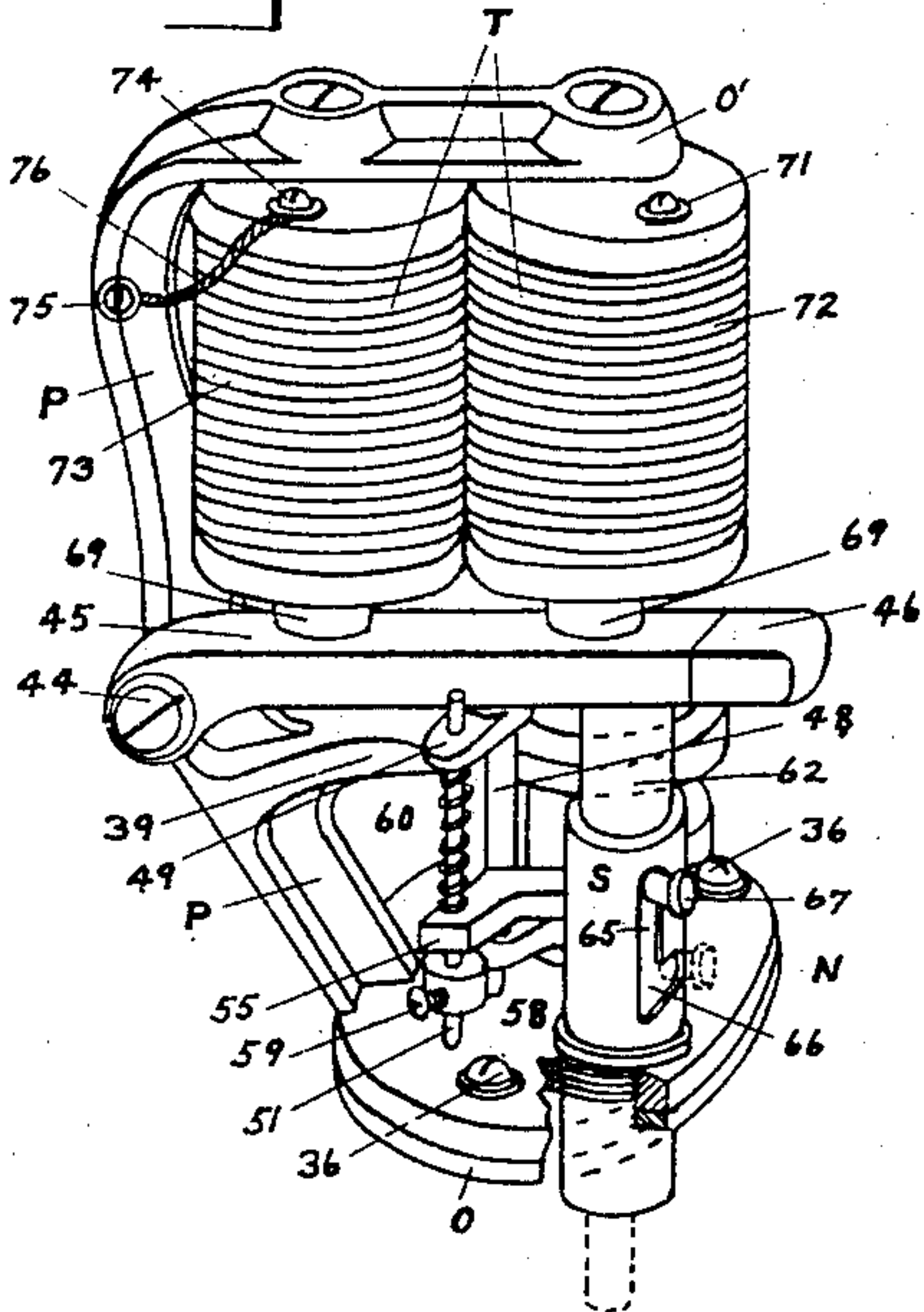


Fig 17.

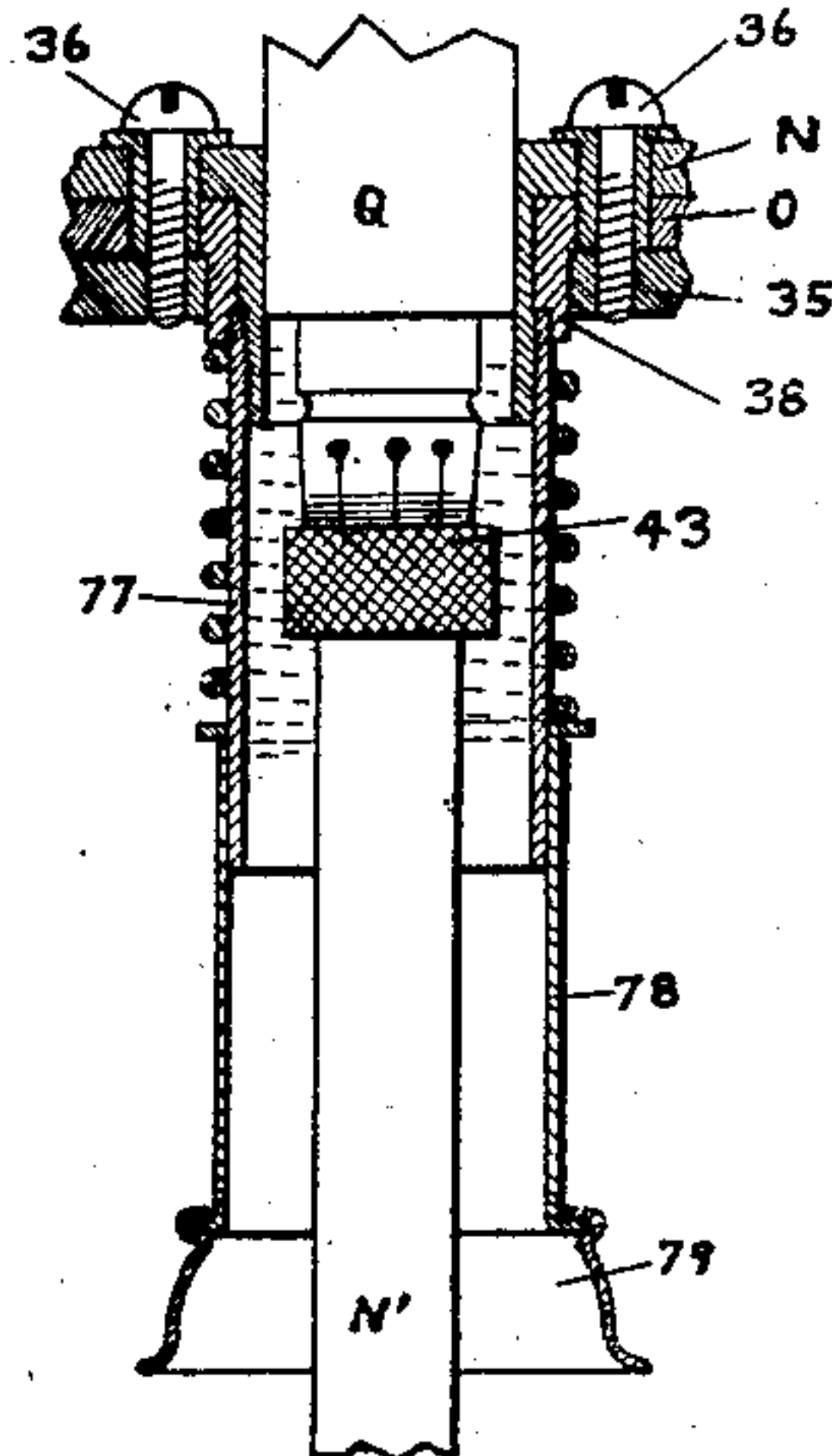


Fig 13.

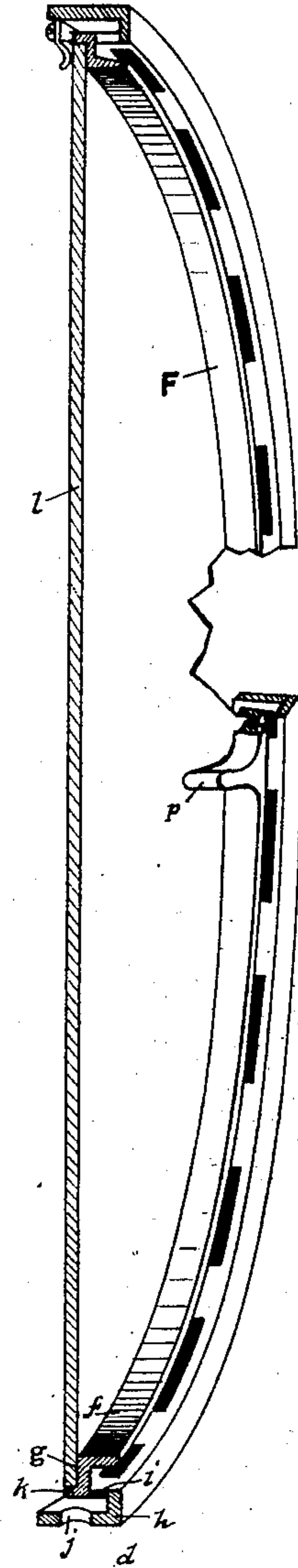


Fig 14.

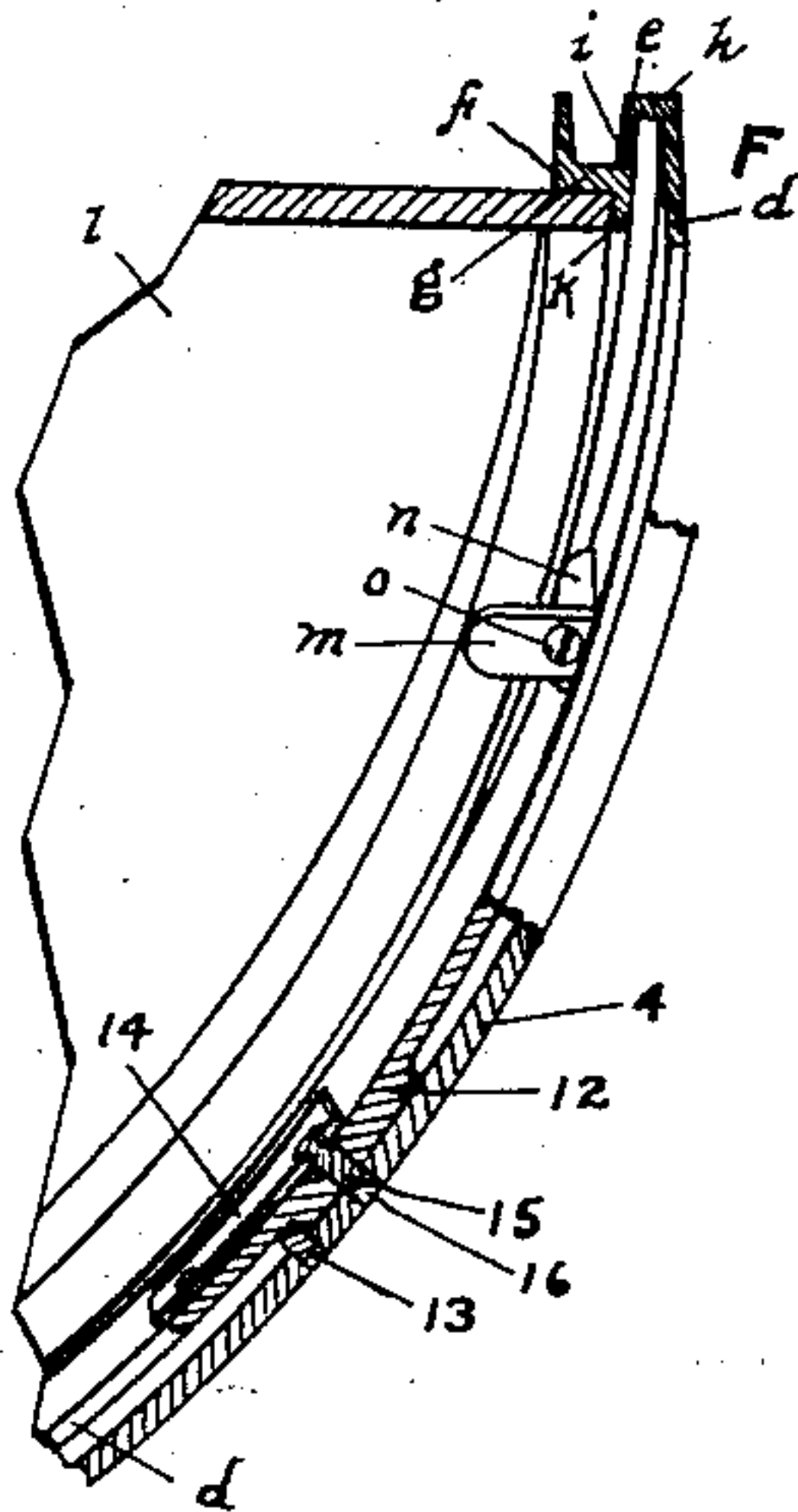
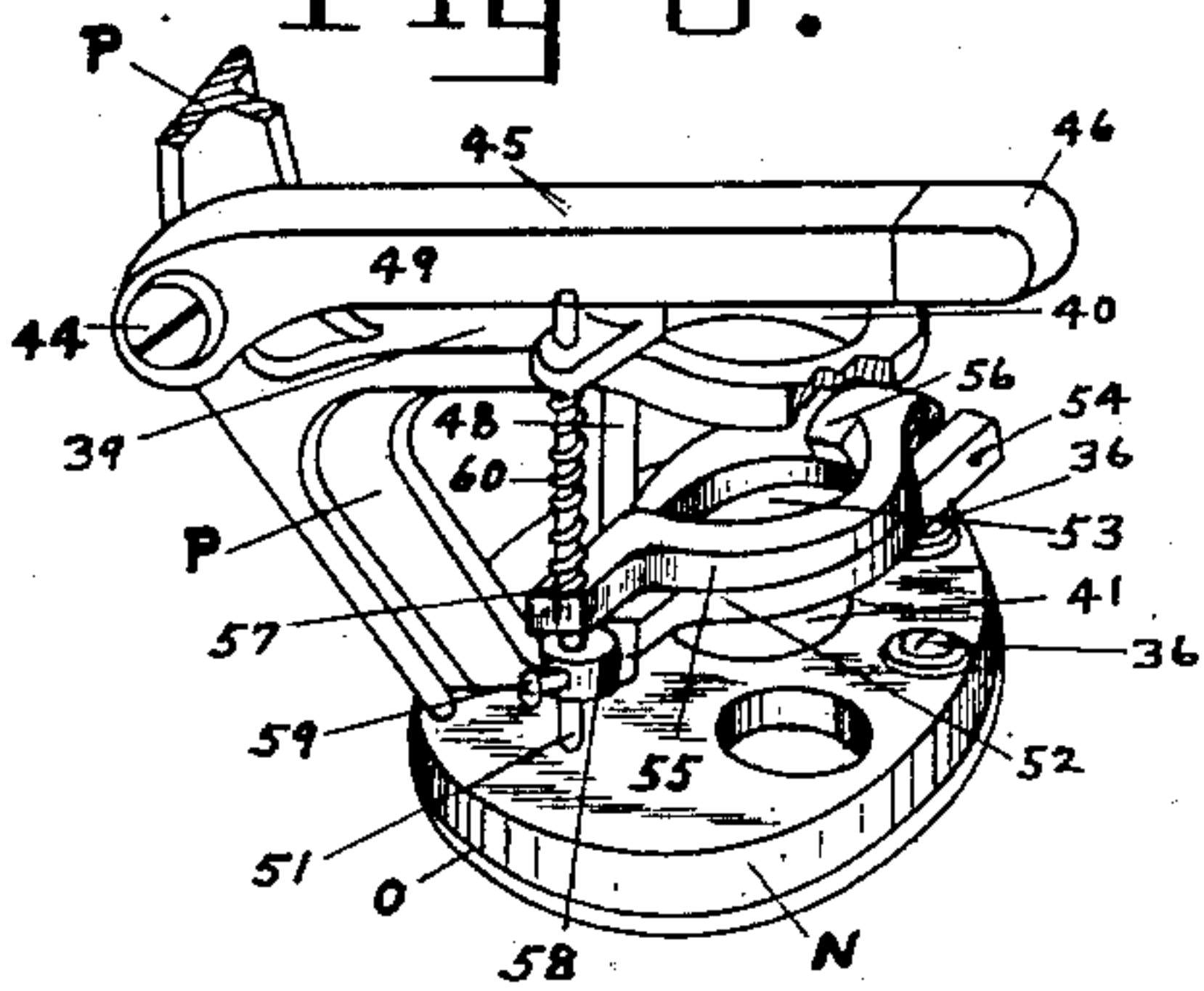


Fig 8.



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ELECTRIC HEADLIGHT.  
APPLICATION FILED DEC. 26, 1901.

NO MODEL.

7 SHEETS—SHEET 7.

Fig 15.

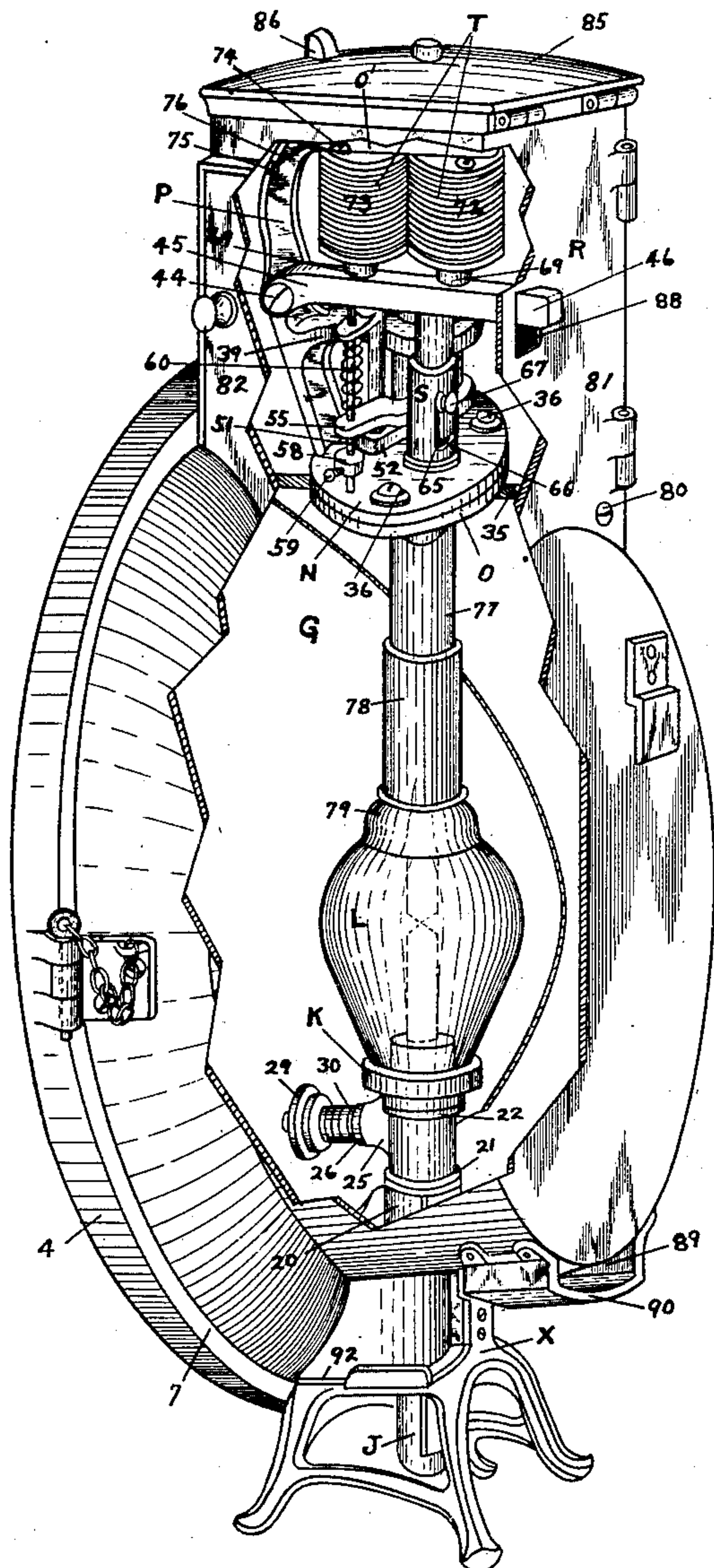


Fig 10.

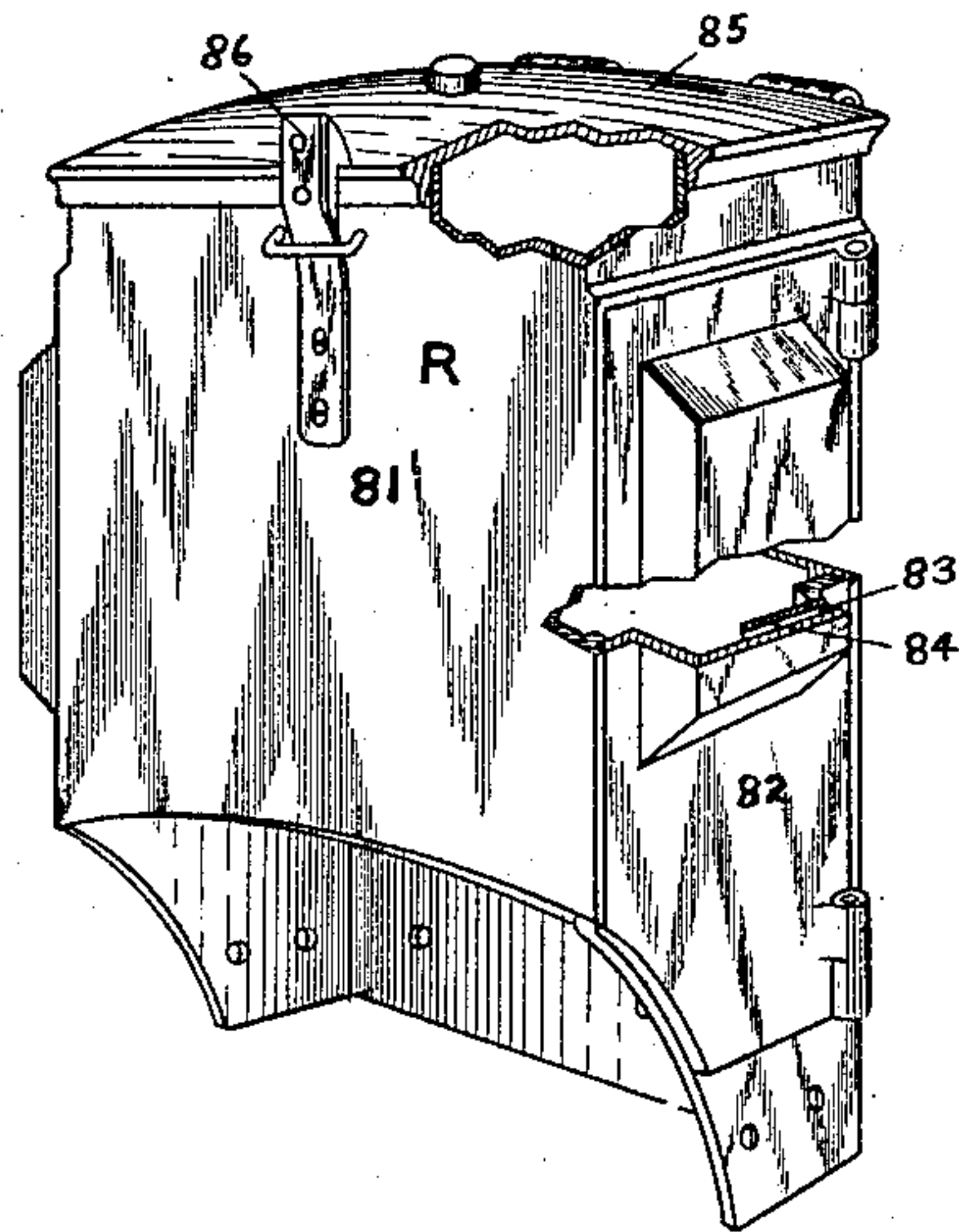
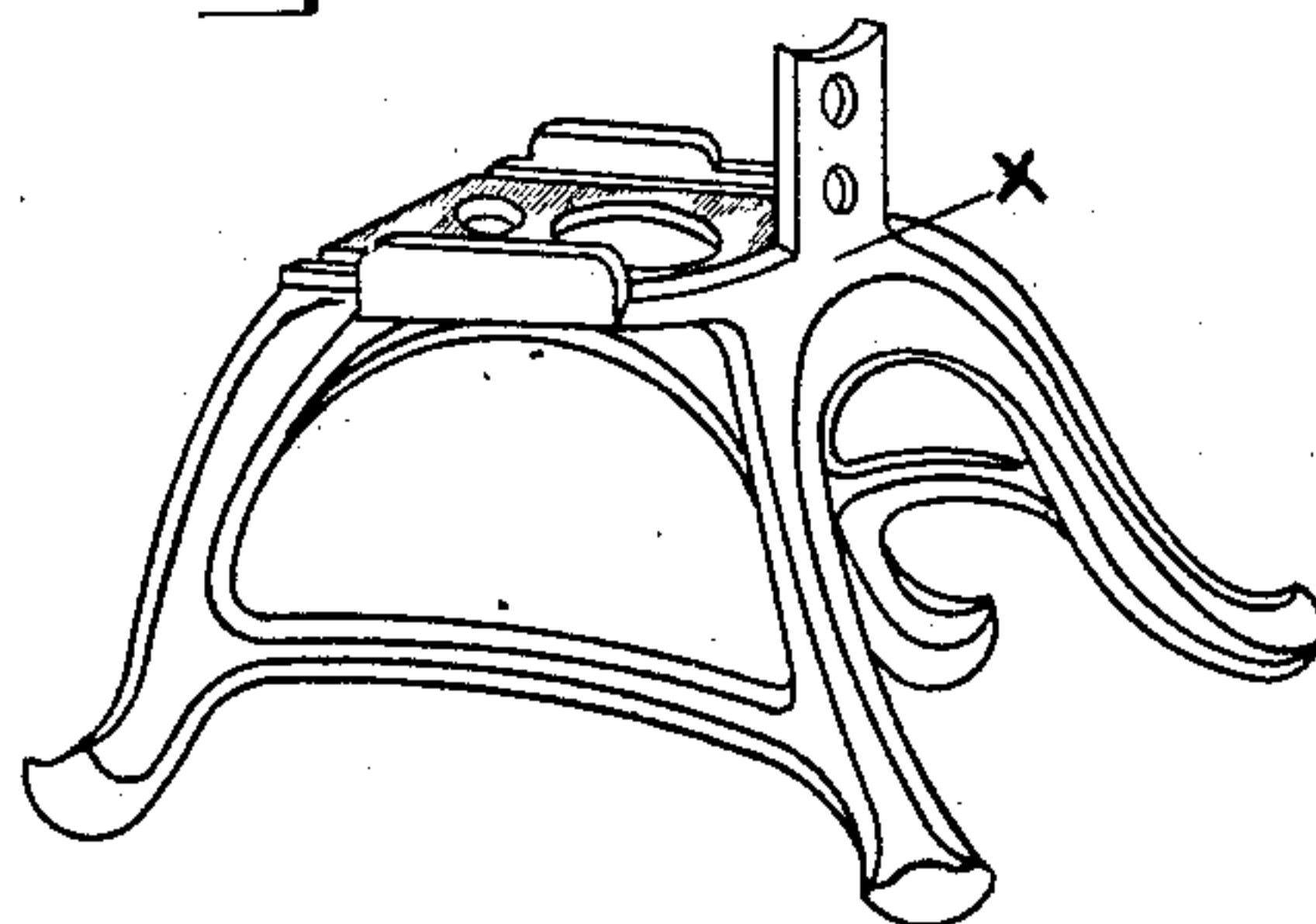


Fig 18.



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Inventor.

*John Kirby, Jr.*



# UNITED STATES PATENT OFFICE.

JOHN KIRBY, JR., OF DAYTON, OHIO, ASSIGNOR TO UNITED STATES HEADLIGHT COMPANY, OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

## ELECTRIC HEADLIGHT.

SPECIFICATION forming part of Letters Patent No. 721,646, dated February 24, 1903.

Application filed December 26, 1901. Serial No. 87,238. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN KIRBY, Jr., a citizen of the United States, residing in the city of Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Electric-Arc Headlights; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention contemplates certain new and useful improvements in electric-arc headlights for use on electric-railway cars and other vehicles.

The objects of the invention are, first, to provide a more desirable, efficient, and compact form of such headlight, whereby the space required for its occupancy is reduced, and its construction, commensurate with its advantages, simplified and reduced in cost; second, to combine with the carbon-operating mechanism of such headlights means for automatically establishing the circuit by the electric current which operates the lamp and auxiliary means for establishing the circuit in event of failure of the current to perform such function; third, to provide such headlights with an improved form of case inclosing the reflector and having provision for mounting the carbon-operating mechanism upon the exterior thereof; fourth, to provide means for inclosing the arc whereby the waste of carbon is reduced to a minimum, and, fifth, to combine with the objects aforesaid other improved features, all of which are accomplished by new and novel combinations, which will hereinafter be fully described and claimed.

I have shown and will describe herein certain features which are also applicable to types of headlights other than electric arc and which features will be made the subject of another application for United States Letters Patent, which I intend to file with the Commissioner of Patents, and in which application such features will be illustrated, de-

scribed, and claimed. I will therefore confine the claims of my present invention to headlights of the electric-arc type.

My invention is clearly illustrated in the accompanying drawings, which form a part hereof, and in which—

Figure 1 represents a front view of a portion of the dashboard of a railway-car with the headlight mounted thereon; Fig. 2, a rear view of the same; Fig. 3, a vertical section through the center of the headlight and dashboard, except the positive-carbon-operating mechanism, part of which is shown in section and part in full; Fig. 4, a horizontal section through the center line of the headlight and dashboard, the back door of the case being shown partly open; Fig. 5, a front perspective view of the headlight removed from the dashboard; Fig. 6, a rear perspective broken view of the case with all appurtenances removed therefrom; Fig. 7, a detached perspective view of the positive-carbon-operating mechanism and base therefor; Fig. 8, a similar view to Fig. 7 with the carbon-holder, electromagnet, and auxiliary spring device removed; Fig. 9, a detached vertical section of the positive-carbon holder and carbon; Fig. 10, a broken perspective view of the supplemental case; Fig. 11, a broken perspective view of the negative-carbon holder detached; Fig. 12, a broken perspective view of the globe-carrier detached; Fig. 13, a broken perspective view of the glass-holder detached; Fig. 14, a rear perspective view of a portion of the glass-holder, showing the clips and fastening device; Fig. 15, a rear perspective broken view of a headlight adapted to be attached to the outside of the dashboard; Fig. 16, a sectional view showing a modification in the manner of attaching the headlight to the dashboard; Fig. 17, a modification of the upper globe-holder, and Fig. 18 a detached perspective view of the stand for the headlight.

Similar letters and figures of reference indicate corresponding parts throughout the drawings.

A represents a portion of the dashboard, in which there is formed an opening.

B represents a collar surrounding the opening on the outside of the dashboard, and C a



dash-ring surrounding the opening on the inside thereof.

The collar B and dash-ring C are each provided with holes 1, which register with corresponding holes in the dashboard to receive bolts 2, by which they are clamped to the dashboard, as clearly shown in Figs. 2 and 3. The dash-ring C is provided with a forwardly-projecting flange or rim 3, which extends through the dashboard and out beyond the collar B and which in addition to stiffening the ring forms a finish around the opening.

D represents the headlight-case, which is formed with an open front and an opening in the back thereof and preferably cast in a single piece of any suitable material and to the form shown, there being formed thereon a front projecting ring 4, adapted to engage the dash-ring C and stop against a shoulder 5, formed thereon, preferably, in line with the inside of the dashboard, the case being secured in such position by rotatable fasteners 6, attached to the dash-ring C and adapted to engage behind a shoulder 7 on the body of the case. Thus when it is desired to remove the headlight the said fasteners are swung to the positions shown by dotted lines in Fig. 2, when it will be free to be removed for placement in another car or for any other desirable purpose without the necessity of removal of bolts 2, collar B, and dash-ring C. It will be apparent, however, that the dash-ring C may be formed upon and integral with the body of the case, in which event it would be necessary to remove the bolts in order to free the headlight from its mountings, such construction being shown in Fig. 16.

When an electric-arc headlight is mounted upon the dashboard of a railway-car in substantially the manner already described, it is desirable, as matters of convenience and saving in breakage of glass, that the interior thereof shall be accessible from both the front and rear of the dashboard without disturbing the glass-holder or removing the headlight, and in order to obtain access to the back of the headlight from in front of the dashboard I provide an armhole through the latter below the headlight, through which the lower or negative carbon can be manipulated, and in performing such act the operator can see into the open front of the headlight to adjust the carbon to its proper position with relation to the reflector. Provision for obtaining access to the same from behind the dashboard will hereinafter be explained. To form a finish to the said armhole, as well as to stiffen the structure, the collar B and dash-ring C are provided with continuations thereof which extend therefrom around the armhole, as shown at *a* and *b*, and on the outside, preferably, is hinged a door E for closing the opening, which is a trifle smaller than the door, thus forming a jamb *c* for the door to close against, the latter being fastened by a latch 8.

The inside of the front ring 4 of the case is provided with a circumferential groove 9, into

which lateral channels 10 lead from its outer edge. A glass-holder F is contained within the said ring 4, being secured therein by means of lugs 11 and 12, projecting from its outer horizontal surface and adapted to enter the channels 10, whereupon by turning the glass-holder they will engage the groove 9 and retain the holder within the said projecting ring of the case, from whence it can then be withdrawn only upon turning it back to position, where the said lugs register with the said channels. It is obvious, however, that instead of the groove 9 extending around the ring, as shown and as above described, a single short groove may extend from each of the channels in either direction; but as a convenience of manufacture I prefer the construction shown and in which at a suitable distance from the said channels is provided a stop 13, against which one of the lugs will strike, and further forward movement of the holder will be thereby arrested, the holder being prevented from undue reverse movement and possible displacement by a spring 14, one end of which is secured to and on the inside of the outer horizontal member *d* of the glass-holder, the opposite end having a projecting pin 15, with beveled end and operative through the lug 12, the beveled end of the pin engaging an aperture 16 in the ring 4 of the case, as more clearly shown in Fig. 14. Thus the pressure of the spring must be overcome before the holder can be released, and while this is easily accomplished by the hand of an operator the pressure of the spring is such as to prevent any jarring motion to which the headlight may be subjected in service from displacing the glass-holder, which will hereinafter be more fully described.

Within the case there is located a parabolically-formed reflector G, provided with an outwardly-turned flange 17, by which it may be secured to the case near its front or open end in the usual manner. This reflector is cut away, preferably, on a line drawn through the focal point and is therefore open at both ends, the parabola being completed by an auxiliary reflector H, secured to a door I, hinged to the body of the case and forming the back thereof in the manner shown, or it may be secured in any other manner which will effectually accomplish its purpose, although in practice I have found the simplest and most efficient plan of mounting this auxiliary reflector to be to attach it to the door, as shown, whereby when the latter is opened the former will be carried with it, and the opening in the back of the main reflector will then be exposed for the purpose of cleaning the reflector, adjusting the carbons, or otherwise manipulating the lamp from the back of the headlight, the normal relative positions of the two reflectors being established by closing the door I. The walls of the two reflectors are cut away at 18 and 19 to form openings opposite each other, through which the mechanism of the lamp can operate.



In the wall of the case and by preference integrally therewith opposite the focal point of the reflector there is formed a hollow sleeve 20, which loosely supports the lower or negative carbon mechanism and which in the present instance consists of a removable receiver J, having a collar 21, which rests upon the top of the wall of said hollow sleeve and governs the elevation of the receiver within the case, the outer diameter of the upper end of this receiver being reduced to form a shoulder 22, upon which rests a removable globe-carrier K, provided with a circular recess or groove 23, in the bottom of which is a washer 24, of asbestos or other suitable material, for the lower end of the globe L to rest upon. The receiver is also provided with a lateral interiorly-screw-threaded boss 25, with which registers a nut 26, having a central bore, in which is journaled a pinion-shaft 27, carrying on its end within the receiver a pinion-wheel 28 and at its outer end an operating-wheel 29. A coiled spring 30, with its end bearing against the outer surface of the nut 26 and the inner surface of the wheel 29, respectively, holds the side of the pinion-wheel against the inner end of the nut 26 under constant pressure, and thus prevents undue movement of the former and imparts a steady movement to the mechanism while being operated. The receiver contains a carbon-holder 31, the upper end of which is slotted and tapered, the tapered portion being exteriorly screw-threaded and provided with a corresponding interiorly-threaded nut 32, the function of which is to press the slotted end of the holder against the carbon M and hold it securely therein. A rack 33 is secured to the exterior of the carbon-holder 31 and engages the pinion-wheel 28, whereby upon turning the latter the carbon-holder is elevated or lowered, according to the direction in which the wheel is turned, and the carbon is thereby fed to and from the focal point of the reflector through the lower open end of the globe. A vertical channel or recess 34 is formed in the receiver to accommodate the rack, the former being closed at the bottom to exclude air and its position rotatively being governed by a notch  $a'$ , adapted to engage a projecting stud  $a^2$  on the hollow sleeve 20. It is not essential that the negative-carbon mechanism just described should be employed in order to carry out all the objects of this invention, as it is obvious that other forms may be used in connection with the other features thereof; but I prefer this mechanism, because in addition to its especial efficiency and convenience of operation it can be instantly lifted out of the way to place the upper or positive carbon in position from within the case or for the purpose of cleaning out the receiver, which should be done frequently, or for making repairs, and for the further reason of convenience in manufacture, and as the detachable globe-carrier above described can be made

on an automatic machine its cost is thereby materially reduced.

The upper or positive carbon operating mechanism is mounted upon the exterior of the case, there being formed thereon a flat portion or surface 35 to receive the same, above and to which surface a base or plate N, carrying the same, is secured by screws or bolts 36, an insulating-block O being placed between to separate the positive and negative poles of the lamp. The flat portion 35 of the case is perforated at 37 to receive a depending collar 38 of the insulating-block O, as shown in Fig. 3. A bracket P extends upwardly from the base-plate N and is provided with a horizontally-disposed arm 39, perforated at 40, to receive and act as an upper guide for the positive-carbon holder Q, a lower guide for which is to be seen in a perforation 41 through the said base-plate. The said positive-carbon holder consists of a hollow rod 42, somewhat larger in diameter than the carbon, contracted at its lower end to an easy fit for the latter, as more clearly shown in Fig. 9, the lower end being also exteriorly tapered and slotted and provided with a screw-threaded nut 43, the outer diameter of which is slightly less than that of the rod 42, so as to permit the said nut to pass freely through the perforations 40 and 41, whereby the said carbon-holder can be removed from the outside of the case, as well as from the inside thereof, and which is a very desirable convenience in manipulating the lamp, the positive carbon N' being secured in the holder by tightening the nut 43. To the bracket P there is pivoted at 44 an operating-lever 45, preferably made of a good conducting material, such as soft iron or steel, and having its free end provided with an insulating-tip 46, extending through the wall of a supplemental case or covering R for the upper works of the lamp, for a purpose which will presently appear. Pivotaly connected with the lever 45 at 47 is one end of a vertical rod 48, to which is attached a lateral arm 49, secured in place on the rod by a set-screw 50, the free end of this arm being perforated to engage and slide upon another vertical rod 51. At the lower end of the rod 48 is secured thereto a clutch-arm 52, having a perforation 53, through which the carbon-rod 42 operates. To one end of this clutch-arm and opposite the rod 48 there is pivoted at 54 a cam-lever 55, provided with a cam 56. The opposite or free end of this cam-lever is provided with an aperture 57 to receive and through which the rod 51 operates, a movable collar 58 being secured on said rod below the cam-lever 55 and held in place by a set-screw 59. A spiral spring 60 surrounds the rod 51, its upper end bearing against the under side of the lateral arm 49 and its lower end bearing against the upper side of the cam-lever 55 to keep the same in contact with collar 58. Secured to the base-plate N, preferably by screwing thereto in



the manner shown in Fig. 3, and located under the operating-lever 45 at a suitable distance from its pivotal point is a vertically-disposed cylinder S, having a bottom 61 therein, provided with a central aperture, a portion of the same extending above and a portion below the said base-plate, this construction being desirable in order that the height of the whole structure may be reduced. Within this extension is an operating-bolt 62, provided with a reduced stem 63, adapted to slide through the said aperture, and around which stem is a spiral spring 64, whose upper end bears against the shoulder formed by the reduced stem of the bolt and whose lower end bears against the bottom 61. In the wall of this cylinder is formed a vertical slot 65 and a slightly-inclined lateral slot 66, communicating therewith at the bottom thereof, there being a projecting pin or knob 67 secured to the said bolt and adapted to operate in said slots, the purpose of which will soon appear. It will be observed from the foregoing that if the operating-lever is pressed downward carbon-rod 42, together with the vertical rods 48 and 51, lateral arm 49, clutch-arm 52, and cam-lever 55, will all be forced downward, and when the lower end of rod 51 strikes the base-plate the downward movement of the end of cam-lever 55 will be arrested, and a further downward movement of the clutch-arm 52 will carry with it the pivoted end of the cam-lever and thereupon shift the position of the cam 56 sufficient to release its grip on the carbon-rod, which will then drop until its carbon rests upon the end of the lower or negative carbon. The carbons now being together must be separated again before an arc can be produced, the distance of such separation being ordinarily about three-sixteenths of an inch, the length of the arc being governed, however, by the limit of movement of the cam-lever 55, and which is established by the location of collar 58 on the rod 51. The raising of the cam-lever, which is accomplished by the reverse or upward movement of the operating-lever 45, will cause the cam 56 to reengage or impinge the carbon-rod 42 and carry the same, together with the carbon N', back to the proper elevation to form the arc of the lamp, the upward movement of the operating-lever being limited by a suitable stop, hereinafter referred to.

The positive-carbon-operating mechanism as thus far described is substantially the same as shown and described in United States Letters Patent No. 615,927. I therefore disclaim the invention thereof and will now proceed to describe such part of my present invention as I believe to be new and useful combinations therewith.

It will be observed that this invention as a whole contemplates an entirely different structure from that of the said patent and in which the operating-lever N is lifted by the downward pull of a retracting-spring at the short end thereof, in contradistinction to

which I purpose the automatic lifting of the same through the instrumentality of the electric current which operates the lamp, in conjunction with auxiliary means, whereby in case of failure through decreased voltage or otherwise of the current to perform such function the said auxiliary means can be thrown into engagement with the operating-lever, and thereby furnish a substitute for the current in lifting the lever, while its downward movement may then be accomplished by hand until a convenient time can be had in which to put the current-operating device in working order again or until the voltage is increased sufficient to perform the work, it being understood that each time the circuit is broken, and which occurs whenever the arc distance becomes too great, caused by the burning away of the carbons, the latter must come together, or practically so, in order to reestablish the arc, and which is accomplished by their separation, as above explained; also, that when the headlight is on a car making a trip any failure of performance of such operation would make the headlight useless until proper conditions are again established. Therefore it is important that the headlight be provided with mechanism which will insure the performance of its every function, and as the same should require as little attention as possible, especially when in service, it is desirable that its feeding mechanism be automatic in operation, and to this end the bracket P is continued upwardly and terminates in a lateral projecting arm O', extending out over the operating-lever and from which depends an electromagnet T, the lower end 69 of the cores of which arrest the upward movement of and forms the stop for the operating-lever, which being made of good conducting material acts as an armature when the said magnet is energized, and is attracted to and held against the same so long as sufficient energy remains in the magnet; but instantly upon breaking the circuit the lever will be released and fall of its own weight, carrying with it the movable parts with which it is connected, thus causing the positive carbon to drop to contact with the lower one and establishing the circuit again, when the magnet will pick up the lever, in doing which the carbon will be returned to its normal position and the arc reestablished.

U represents an insulated conducting-wire leading from the source of supply through an insulation-bushing 70 in the wall of the case, thence upwardly through the top thereof, and it is connected at 71 with the coil 72 of the magnet, the coil 73 thereof being connected at 74 with the bracket P at 75 by a conductor 76, the negative pole of the lamp being grounded in the usual manner.

There is suspended from the top of the case a tubular extension V, formed in two sections 77 and 78, the upper section 77 being secured to the case and having at its lower end an exterior screw-thread adapted to register with



an interior screw-thread at the upper end of the lower section 78, at the lower end of which is a cap 79, adapted to engage the globe and to hold the same down upon its seat in the globe-carrier K. This arrangement, in conjunction with the perforation 41, forms a passage-way through which the upper or positive carbon and its holder operates and also practically excludes air from the inside of the globe, thus contributing to the life of the carbons. When the globe is to be removed or replaced, the lower section of the tubular extension is elevated, as shown by dotted lines in Fig. 3. The cap 79 is preferably made of thin metal, spun or stamped to shape, to allow of sufficient expansion when heated to prevent breaking the globe. A further and very important advantage in this construction, in connection with the positive and negative carbon holders already described, lies in the fact that as the positive-carbon holder is operative within the tubular extension and through the cap 79 and through the upper open end of the globe, the negative-carbon holder being operative through the lower open end of the same, both carbons can be consumed close to the ends of their respective holders or within about one-half or three-quarters of an inch of their entire original lengths, it being only necessary to waste the portion necessary to sustain them in the holders.

Above the headlight-case D and secured thereto by screws 80 or other suitable fastening is mounted a supplemental case R, hereinbefore referred to, within which the upper-carbon mechanism is inclosed. This case consists of a frame 81, preferably in a single piece open at top and bottom and having also openings in its sides, the side openings being closed by doors 82, paneled and hinged to the frame, as shown, the panels being provided with rear openings 83 for the escape of air, as hereinbefore mentioned, the said openings being provided with shields 84, the function of which is to protect the interior from the elements. The top of this case is provided with a hinged lid 85, held closed by a catch 86 and provided on the inside with an insulation-washer 87 to prevent contact between the metallic surfaces of the lid and upper-carbon holder when the latter is elevated. In the back of this case there is a slot 88, through which the operating-lever 45 projects, and whereby the said lever can be depressed by hand from the exterior of the headlight when it may be found necessary to do so, and in which case the operating-bolt 62, previously described, is first thrown into engagement with this lever by releasing the projecting pin or knob 67 from the inclined slot 66, when the spring 64 will force the said operating-bolt against the under side of the operating-lever, and whereby the same will be lifted and held in an elevated position when pressure is released therefrom.

The glass-holder F, the construction of which

has been hereinbefore partially described, is composed of the outer horizontal member *d*, previously referred to, intermediate and inner members *e* and *f*, and vertical members *g* and *h*, the horizontal member *e* being provided with air-openings *i*, arranged in alternation around the same, a drainage-opening *j* being provided through the outer horizontal member *d* at the bottom thereof. On the inside of the holder, opposite the intermediate member *e*, is an inwardly-projecting ring or collar *k*, which encircles a glass disk *l*, held therein by several clips *m*, one end of each of which is secured to a post *n* by screws *o*, the holder being also provided with finger-pieces *p* for convenience in handling.

Owing to the decreased size of the headlight and to the heat generated by the arc it is essential that ample provision be made for the free inlet and outlet of cold and hot air, respectively. Therefore in addition to the openings in the glass-holder already mentioned there is formed in the case an opening 89, protected by a shield 90, and through which opening cold air can enter the case from the back thereof, and another opening 91 is formed in the top of the case through which hot air can escape out into the supplemental case R, thence through the openings 83 into the outer atmosphere.

On the under side of the case and extending from the wall of the hollow sleeve 20 to the front projecting ring 4 is a flat portion 92, to which and to the back wall of the hollow sleeve is screwed or bolted a stand X, upon which the headlight may rest in an upright position when apart from its mountings.

It will be observed from the foregoing general description of this invention that the negative or lower carbon, which should be properly set with reference to the focal point of the reflector, can be adjusted from the front side of the dashboard and that to accomplish which the operator after opening the door in the back of the case can place his arm through the armhole in the dashboard and reach the operating-button of the negative-carbon holder to adjust the carbon, and in doing the same he can see through the front glass of the headlight to properly locate the carbon; that certain of its features are applicable to headlights other than the specific type herein described—as, for example, electric-arc headlights adapted to be supported upon the outside of the dashboard, as shown in Fig. 15; that the mode of attachment to the dashboard may be varied; that the portions of the case herein referred to as “flat” need not of necessity be flat; that the electromagnet need not necessarily be located over the operating-lever, and that by mere mechanical change it can be located in other positions adjacent to the carbon-operating mechanism and be made to perform the function hereinbefore ascribed to it; that the upper globe-holding device may be operated by a spring, as shown in Fig. 17, and that other



details of construction, as hereinbefore described, may be modified in various ways without departing from the spirit of my invention.

5 Having thus fully described my invention, I claim—

1. In an electric-arc headlight, the combination of a case having an open front and an opening in the back of the case provided with  
10 a door for closing the said opening, a hollow sleeve formed in the wall of the case, a carbon-holder supported in said sleeve, a reflector whose normal position is behind said carbon-holder, and means whereby the said re-  
15 flector can be shifted to permit of access to said carbon-holder from the back of the case.

2. In an electric-arc headlight, the combination of a case having an open front and an opening in the back of the case provided with  
20 a door for closing the said opening, a hollow sleeve formed in the wall of the case, a carbon-holder supported in said sleeve, a reflector whose normal position is behind said carbon-holder, and means whereby the said re-  
25 flector is shifted from and to its normal position by the opening and closing of the said door whereby access to the said carbon-holder can be had from the back of the case.

3. In an electric-arc headlight, the combination of a case having an open front and an opening in the back of the case, a hollow sleeve formed in the wall of the case, a carbon-holder supported in said sleeve, a main reflector open at both ends secured within  
30 the case, a door for closing the said opening in the back of the case, and an auxiliary reflector located behind said main reflector and arranged to be removed from and replaced in its normal position by the opening and  
40 closing of the said door.

4. In an electric-arc headlight, the combination of a case having an open front and an opening in the back of the case, a hollow sleeve formed in the wall of the case, a carbon-holder supported in said sleeve, a main reflector open at both ends secured within  
45 the case, a door for closing said opening in the back of the case, and an auxiliary reflector located behind said main reflector and arranged to be readily removed and replaced in position whereby access can be had to the main reflector through the opening in the rear thereof.

5. In an electric-arc headlight, the combination of a case having an open front and an opening in the back of the case, a hollow sleeve formed in the wall of the case, a receiver supported in said sleeve, a holder operative in said receiver, a carbon carried by  
50 said holder, a main reflector open at both ends secured within the case, a door for closing the said opening in the back of the case, and an auxiliary reflector located behind the said main reflector and adapted to substantially close the opening in the rear end thereof, the said auxiliary reflector being carried by  
65 and arranged to open and close with said door.

6. In an electric-arc headlight, the combination of a case, a reflector secured therein, a hollow sleeve formed in the wall of the case, 70 a receiver removably held in said sleeve, a carbon-holder operative within said receiver, a carbon carried by said holder, a removable globe-carrier at the upper end of the said receiver, and means for operating the carbon- 75 holder whereby the carbon held therein can be adjusted to bring its point of combustion into proper relation with the focal point of the reflector.

7. In an electric-arc headlight, the combination of a case, a reflector secured therein, positive-carbon-operating mechanism carried by the case, a carbon-holder operated by said mechanism, a hollow sleeve formed in the wall of the case, a receiver held in said sleeve, 80 a holder operative in said receiver, a carbon carried by said holder, a removable globe-carrier at the upper end of said receiver, and means for operating the said holder whereby the carbon held therein can be adjusted to 85 bring its point of combustion into proper relation with the focal point of the reflector.

8. In an electric-arc headlight, the combination of a case, a hollow sleeve formed in the wall of the case, a receiver removably held in 90 said hollow sleeve, a carbon-holder operative in said receiver, means whereby the proper position of said receiver in said hollow sleeve is established, and rack-and-pinion mechanism for operating said holder. 100

9. In an electric-arc headlight, the combination of a case, a hollow sleeve formed in the wall of the case, a receiver removably held in said hollow sleeve, a negative-carbon holder operative in said receiver, means whereby the 105 proper position of said receiver in said hollow sleeve is established, positive-carbon-operating mechanism carried by the case, and a supplemental case inclosing said operating mechanism. 110

10. In an electric-arc headlight, the combination of a case having an open front, a reflector secured within the case, a hollow sleeve formed in the wall of the case, a receiver removably held in said sleeve, means for pre- 115 venting the turning of said receiver therein, a negative-carbon holder operative in said receiver, positive-carbon-operating mechanism secured to the case on the outside thereof, and a supplemental case inclosing the said 120 mechanism.

11. In an electric-arc headlight, the combination of a case having an open front, a negative-carbon-holder, positive-carbon-operating mechanism, a carbon-holder operated by the 125 latter, carbons carried by said holders, a separate opening in the rear of the case whereby the carbons can be manipulated independently of said open front, means for closing the said opening, and a supplemental case 130 inclosing the said positive-carbon-operating mechanism.

12. In an electric-arc headlight, the combination of an integrally-formed case having an



annular front projecting rim and glass-holder carried thereby, a hollow sleeve formed in the wall of the case, a receiver and carbon-holder supported in said sleeve, carbon-operating mechanism mounted on the outside of the case opposite the said hollow sleeve, a carbon-holder operative through the case by said mechanism, a supplemental case inclosing the latter, and a door in said supplemental case to provide access to said mechanism.

13. In an electric-arc headlight, the combination of a case, carbon-operating mechanism carried by the case, a supplemental case inclosing the said mechanism, and a lever in direct connection with and forming a part of said mechanism extending through and operative independently of the wall of the said supplemental case whereby the said mechanism can be operated from without the case.

14. In an electric-arc headlight, the combination of a case, a base-plate attached to the case and having carbon-operating mechanism attached thereto, an aperture in said base-plate, a carbon-holder operative through said aperture, a supplemental case inclosing the said mechanism, and a lever in direct connection with and forming a part of said mechanism extending through and operative independently of the wall of the said supplemental case whereby the said mechanism can be operated from without the case.

15. In an electric-arc headlight, the combination of a case, a base-plate carried by the case, carbon-operating mechanism mounted upon said base-plate, an operating-lever forming a part of said mechanism, and a spring-actuated bolt mounted upon the base-plate and adapted to engage the said lever to return to and retain the same in a normal position.

16. In an electric-arc headlight, the combination of a case, a base-plate attached to the case and having carbon-operating mechanism attached thereto, an aperture in said base-plate, a carbon-holder operative through said aperture, an operating-lever in direct connection with and forming a part of said mechanism, an electromagnet energized by the current which operates the lamp and adapted to automatically operate the said mechanism and thereby establish the circuit when the same is broken, and auxiliary means for establishing the circuit by hand in case of failure of the said electromagnet to perform such function.

17. In an electric-arc headlight, the combination of a case, a base-plate attached to the case and having carbon-operating mechanism attached thereto, an aperture in said base-plate, a carbon-holder operative through said aperture, an operating-lever in direct connection with and forming a part of said mechanism, means whereby the electric current which operates the lamp will automatically operate the said mechanism to establish the circuit when the same is broken, and an auxiliary device whereby the circuit can be es-

tablished by hand in case of failure of the electric current to perform such function.

18. In an electric-arc headlight, the combination of a case, a base-plate secured to the case and having an aperture therethrough, carbon-operating mechanism mounted upon said base-plate, a carbon-holder operated through said aperture by said mechanism, a positive carbon held in said holder, an operating-lever in direct connection with and forming a part of said mechanism, a negative carbon opposite the said positive carbon, an electromagnet independent of said mechanism and energized by the current which operates the lamp, and means whereby the said magnet will automatically operate said mechanism and thereby close the circuit when the same has been broken.

19. In an electric-arc headlight, the combination of a base-plate having mounted thereon carbon-operating mechanism in which there is an operating-lever, a clutch-arm, a cam-lever in pivotal connection with said clutch-arm, a carbon rod operative through said base-plate and through said clutch-arm, a rod connecting said lever and said clutch-arm, an arm extending from said rod, a spring-actuated rod operative through said arm and through the free end of said cam-lever, and an electromagnet energized by the current which operates the lamp and adapted to establish the circuit when the same has been broken.

20. In an electric-arc headlight, the combination of a case, carbon-operating mechanism carried by the case, a carbon operated by said mechanism, an electromagnet energized by the current which operates the lamp and adapted to automatically operate the said mechanism and thereby establish the circuit when the same is broken, an auxiliary device for establishing the circuit by hand in case of failure of said electromagnet to perform such function, and means for throwing the said device in and out of engagement with said mechanism.

21. In an electric-arc headlight, the combination of a base-plate having mounted thereon carbon-operating mechanism in which there is an operating-lever, a clutch-arm, a cam-lever in pivotal connection with said clutch-arm, a carbon rod operative through said base-plate and through said clutch-arm, a rod connecting said lever and said clutch-arm, an arm extending from said rod, a spring-actuated rod operative through said arm and through the free end of said cam-lever, an electromagnet energized by the current which operates the lamp and adapted to establish the circuit when the same has been broken, and auxiliary means for establishing the circuit by hand in case of failure of the said electromagnet to perform such function.

22. In an electric-arc headlight, the combination of a case, a reflector secured within the case, a base-plate carrying carbon-operating mechanism, and a negative-carbon holder and



receiver therefor, a globe-carrier surrounding one end of said receiver, a globe open at opposite ends and having one end resting in said globe-carrier, a hollow extension-sleeve  
 5 extending below said base-plate and adapted to hold said globe in position, a positive-carbon holder operated by said carbon-operating mechanism and movable through the hollow of said sleeve, and carbons held in said carbon-holders and having their free ends with-  
 10 in said globe.

23. In an electric-arc headlight, the combination of a case, a reflector secured within the case, a base-plate carrying carbon-operating  
 15 mechanism, a negative-carbon holder and a receiver therefor, a globe-carrier surrounding one end of said receiver, a globe open at opposite ends and having one end resting in said globe-carrier, a hollow sleeve having a  
 20 fixed portion extending below said base-plate and a removable portion extending from below said fixed portion to and resting on the opposite end of said globe to hold the same in position, a positive-carbon holder operated  
 25 by said carbon-operating mechanism and movable through the hollow of said fixed and movable portions of said sleeve, and carbons held in said carbon-holders and having their free ends within said globe.

30 24. In an electric-arc headlight, the combination of a case, a base-plate carrying carbon-operating mechanism and having an aperture therethrough, a globe open at opposite ends, a support for the lower end of said  
 35 globe, a hollow sleeve forming a passage-way

between said plate and the open upper end of the globe, a carbon-holder operative through said aperture and said hollow sleeve, and a carbon held in said holder and operative within said globe. 40

25. In an electric-arc headlight, the combination of a case, a base-plate having an aperture therethrough and carrying carbon-operating mechanism consisting in part of a  
 45 clutch-arm, a carbon-holder operative through said aperture and through said clutch-arm and consisting of a rod having a reduced portion at one end to receive the carbon and a nut for fastening the same therein, the said  
 50 rod being of larger diameter than other parts of said holder whereby the same can be withdrawn from said aperture and said clutch-arm from above or below the same.

26. In an electric-arc headlight, a base-plate having an aperture therethrough, carbon-op-  
 55 erating mechanism carried by said base-plate, in combination with a carbon-holder operative through said aperture by said mechanism, and a carbon held in said holder, the said carbon-holder being so constructed as to  
 60 be removable from either end thereof upon releasing the said mechanism from its hold thereon.

In testimony whereof I hereunto subscribe my name this 21st day of December, 1901. 65

JOHN KIRBY, JR.

Witnesses:

E. R. KIRBY,

JNO. I. UNDERWOOD.