No. 719,149. PATENTED JAN. 27, 1903.

A. F. SHORE.

ELECTRIC ARC LAMP.

APPLICATION FILED JAN. 29, 1900. RENEWED JULY 19, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

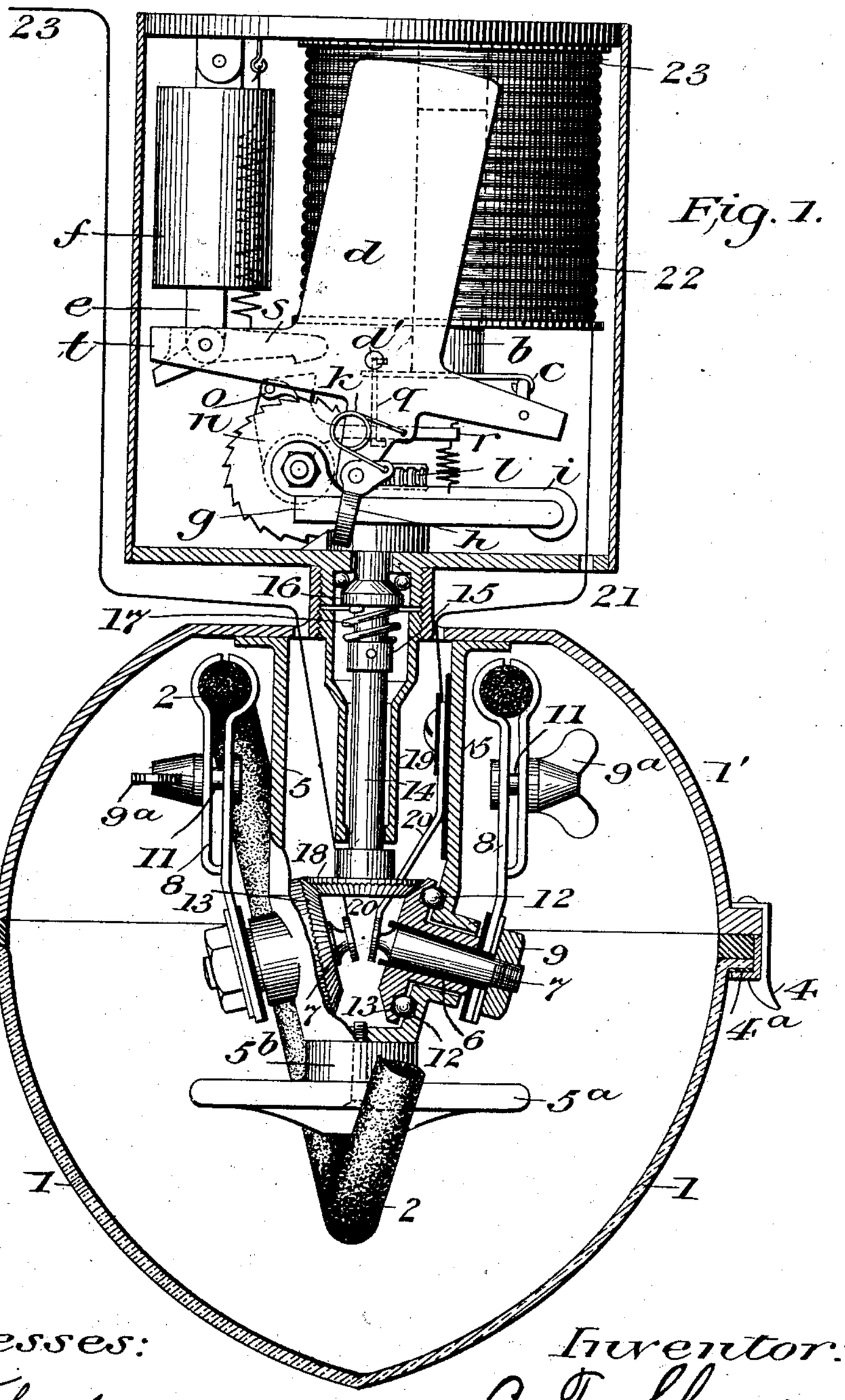

Fig. 1.

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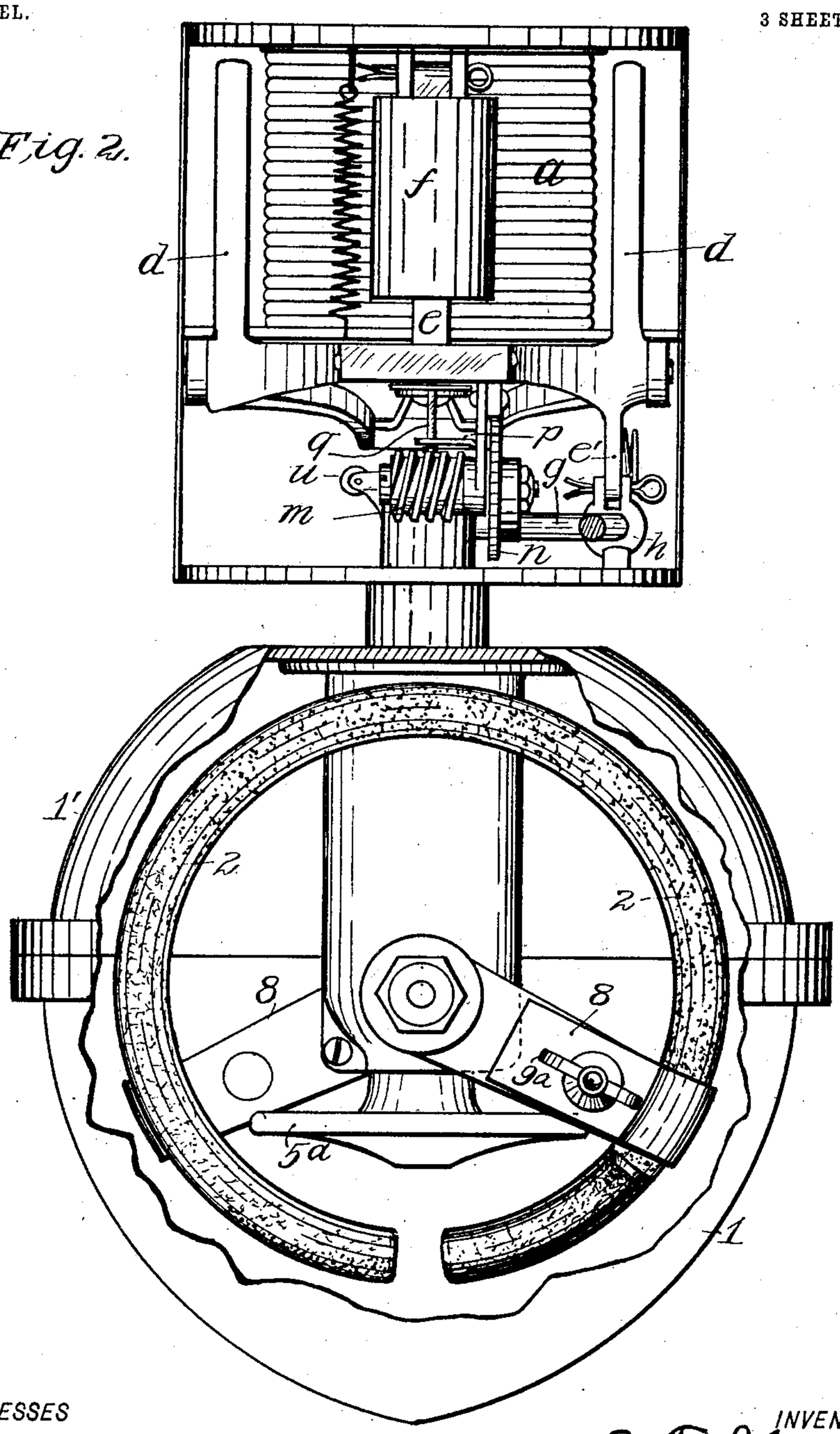
NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



WITNESSES

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Fig. 4.

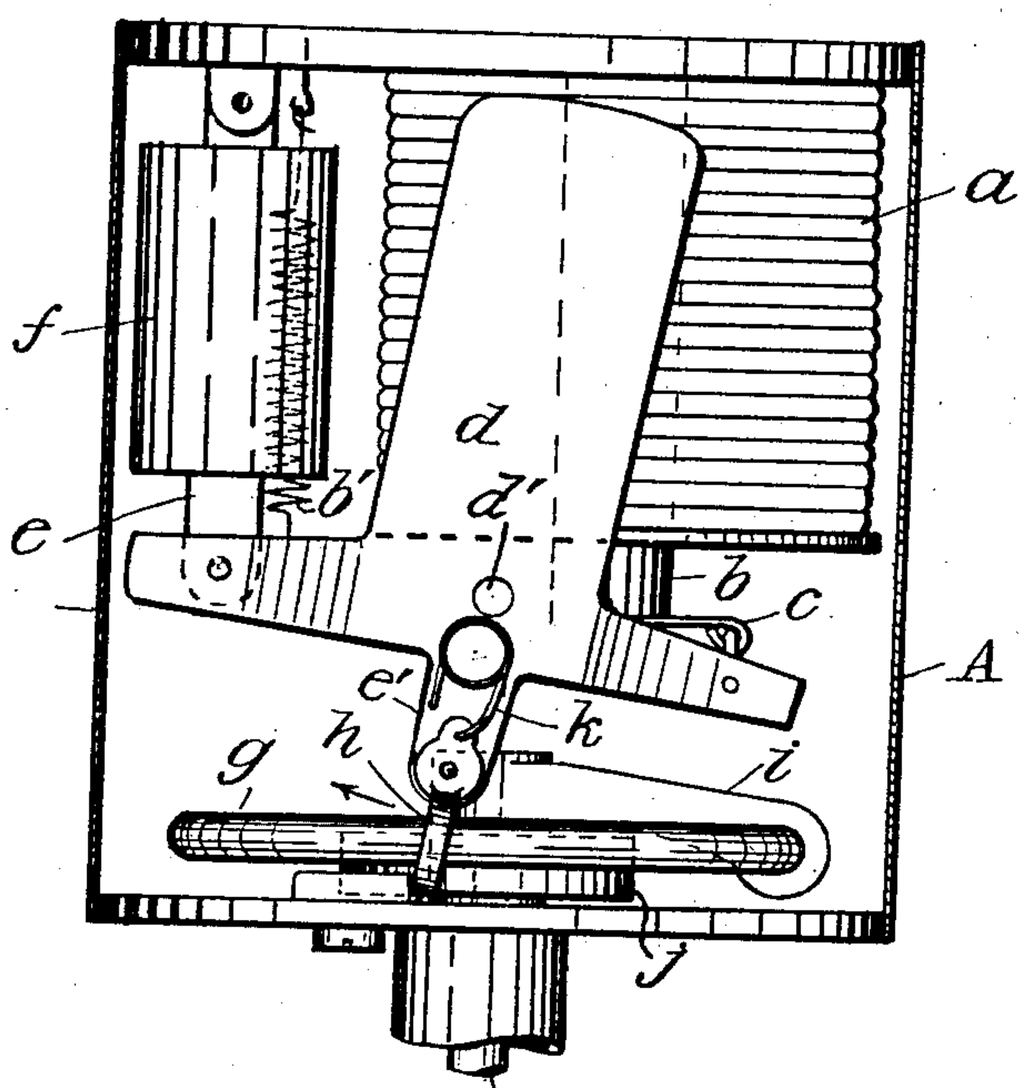


Fig. 5.

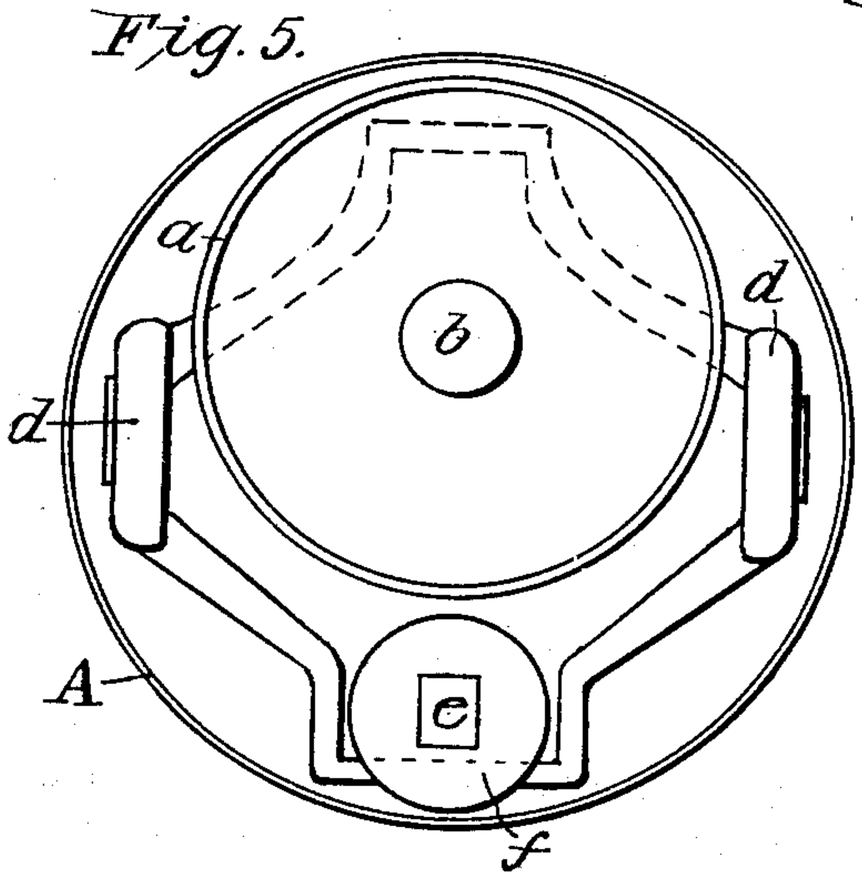
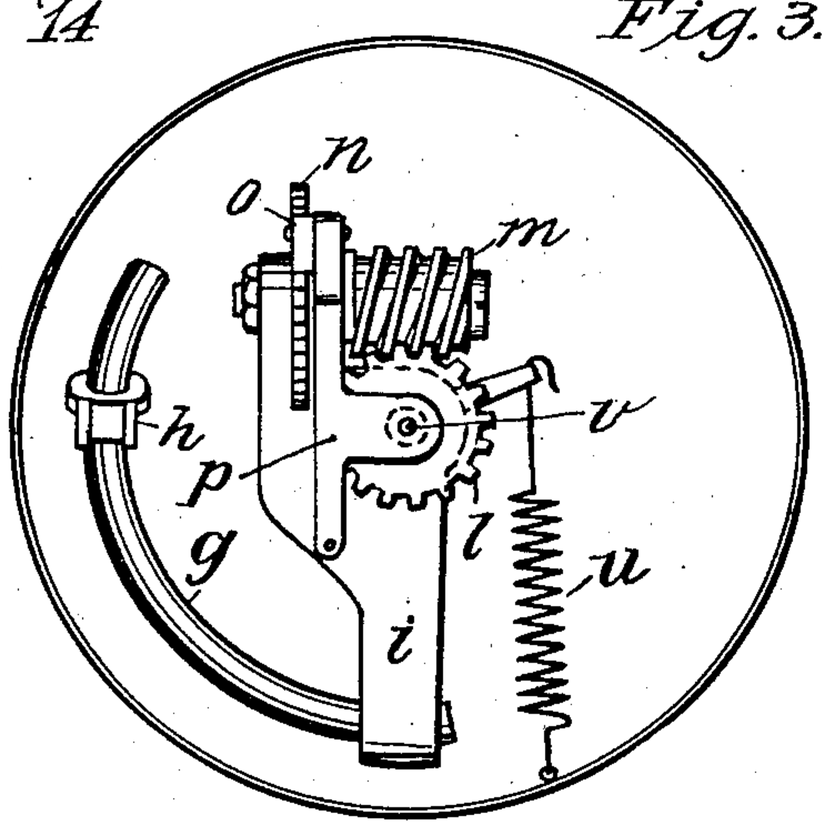


Fig. 3.



WITNESSES

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UNITED STATES PATENT OFFICE.

ALBERT FERDINAND SHORE, OF NEW YORK, N. Y., ASSIGNOR OF TWO-THIRDS TO DANIEL N. HURLBUT, OF NEW YORK, N. Y.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 719,149, dated January 27, 1903.

Application filed January 29, 1900. Renewed July 19, 1902. Serial No. 116,245. (No model.)

To all whom it may concern:

Be it known that I, ALBERT FERDINAND SHORE, a citizen of the United States, and a resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Arc-Lamps, of which the following is a specification.

My invention relates to arc-lamps, more particularly to the kind in which the carbons are in the forms of rings. It relates chiefly to the feeding mechanism for the light-giving carbons and to the manner in which the said mechanism is operated.

The object of my invention is to produce an arc-lamp which shall be economical to construct and which by its compactness shall be adapted for use in places from which the arc-lamp is at present excluded.

Another object of my invention is to produce a lamp which shall require much less attention than those at present in use and whose carbons shall last longer.

A further object is to provide in the improved feeding mechanism a double feed, one momentary, the other practically continuous, and so arranged that while both are positive in their action either may work independently of the other.

In my improved lamp the carbons are bent into circular form, and these carbon-rings are rotatably mounted within the framework of the lamp at an angle to each other, so that the carbons will be maintained normally in contact and preserve the arc in its proper length and position as the carbons are consumed. For feeding the carbons I employ simple and efficient mechanism whose motion is controlled entirely by the current flowing in the lamp, thereby securing a movement of the rotating parts which perfectly compensates the consumption of the carbon and insures the proper length of arc. I also so arrange my mechanism for feeding the lamp that in case the continuous feeding portions are out of order the parts employed for striking the arc will continue the feeding.

Figure 1 is an elevation of the complete lamp with the lower portion mostly in section. Fig. 2 is a side elevation, the lower portion being partially broken away in order to show the carbons and their holders. Fig. 3 is a view of a portion of the feeding apparatus looked at from above, showing the part that directly moves the main feeding-shaft. Fig. 4 shows the arrangement of the form of feed in which the arc-striking device also serves as the feed; and Fig. 5, a view of the relative positions of the solenoid, plunger, dash-pot, and weighted rock-lever on a horizontal section through the top portion of Fig. 4.

1 1′ represent the lamp-body proper, containing the carbons 2 2, the lower transparent portion 1, swinging by the hinge 3 on the upper metallic portion 1′ and retained in position by the spring-catch 4. The lamp being designed to work on the inclosed-arc principle, the joint between these two portions is made as nearly air-tight as possible by means of the asbestos or similar washer 4ª. Attached to the metallic top 1′ is the frame 5 5, designed to serve as support for various portions of the rotating feed mechanism of the lamp. 5ª is a circular reflector situated above the arc and secured to the frame 5 by the screw 5ᵇ. Mounted rotatably on ball-bearings within the frame 5 is the shaft 6, carrying the carbon-supporting mechanism. Through this shaft, which acts as a bushing, passes insulated therefrom the pin 7, electrically connected with the clamps 8, holding the carbon-rings. These clamps are held in position by screw-nuts 9, and the carbons are fixed in the clamps by means of the thumb-screw bolt 9ª 11. The carbon-holders turn in the frame 5 on ball-bearings 12. Motion is imparted to the carbon-holders by means of roughened bevel-wheels 13 13, which are in contact with the bevel-wheel 18 on the main rotating shaft 14. By "roughened" bevel-wheels I mean that the contact-surfaces of the beveled wheels are roughened as distinguished from smooth surfaces and also from ordinary gear or toothed wheels. The smooth wheels would not have the necessary grip, and I have found the regular toothed wheels impracticable for my purpose on account of the lost motion and also on account of the binding between the teeth when crowded together to prevent the lost motion and rotated. Any roughening of the surfaces that affords sufficient grip will

answer temporarily; but as it is necessary to obtain successful working that the surfaces be held together by spring or smilar pressure I have found that teeth rounded off at the top and bottom answer the purpose perfectly. There is then no binding of the teeth when pressed together by means of a spring or other device and absolutely no lost motion when I have used this form of tooth, the action of the secondary shaft being as prompt as if it were a continuation of the primary shaft. This shaft 14 is provided with a fixed collar 15, a vertically-movable collar 16, a spiral spring 17, and ball-bearings at the top. The collar 16 is prevented from turning on the shaft 14 by a pin working in a vertical groove in said shaft. These coöperate to keep the pressure constant and sufficient between the bevel-wheels 13 13 and 18.

19 is a sleeve for the shaft 14.

20 is a spring-contact for conducting the current to and from the carbons. The course of the current is line 23, solenoid 22, conductor 21, spring-contact 20, pin 7, carbon-holder 8, carbon 2 to the other carbon 2, and thence through the carbon-holder, pin, spring-contact, conductor to line.

The electrically-controlled feeding mechanism is contained in the upper portion A of the lamp, and I have shown two varieties thereof—one, Fig. 4, in which the arc-striking mechanism may in case of need serve for feeding the carbons at predetermined intervals, the other, Figs. 1, 2, and 3, in which there are added thereto other parts for making the feeding practically continuous. The object of these two independent though cooperating feeding devices is to always insure one being in condition to accomplish the feed should the other fail to work.

a is a solenoid in series with the carbons; *b*, a plunger working in said solenoid; *c*, a strip attached to plunger *b* and moving with it. *c* is also looped through an eye on the weighted rocking lever *d* and controls the movement of the latter. The end of the rock-lever *d* opposite to *c* is connected with a piston *e*, working in the dash-pot *f*.

f' is a spring attached to the rock-lever *d* for maintaining it when the lamp is not working in the position shown in Fig. 4, which is its normal position when the carbons are together. The rock-lever *d* swings on *d'* as a center, and attached to a lower projecting lip *e'* is the clutch-ring *h*, whose grip is controlled by the spring *k*.

g is a metallic or similar ring supported in the frame *i*, which is connected with the shaft 14. To this frame *i*, carrying the circular feed-rod *g*, is attached by one of its ends the spiral spring *j*, while the other end of the spring *j* is fastened to the base of the casing A. The tendency of this spiral spring *j* is to urge the circular feed-rod *g* in the direction of the arrow, and thereby rotate the shaft 14, so as to bring the carbons 2 into contact with each other.

The operation of the parts shown particularly in Fig. 4 is as follows: In the position shown the spring *j* has brought the carbons 2 into contact. Suppose now a current be sent through the lamp. The plunger *b* will be drawn upward into the solenoid *a*, carrying with it the strip *c* and tilting the rock-lever *d* on its center of support *d'*. The motion of the lip *e'* will cause the clutch *h* to grip the circular feed-rod *g* and carry it in the opposite direction to that indicated by the arrow. This will result in separating the carbons 2 and striking the arc. The arc will continue, and after the carbons have somewhat burned away, the resistance increasing and the current decreasing, the plunger *b* will descend, tilting the rock-lever *d*, slackening the grip of the clutch *h*, and allowing the spring *j* to urge the circular feed-rod *g* in the direction of the arrow, turning the shaft 14 and bringing the carbons 2 nearer together, when the arc assumes its normal length. This is a reasonably constant feeding method; but to assure great continuity in the feed I have added the auxiliary devices in Figs. 1, 2, and 3.

To make the feed constant and continuous, I provide the main shaft 14 at the top with a cog-wheel *l*, the teeth of which mesh with the worm *m*. Attached to the same shaft as the worm *m* and moving with it is the ratchet-wheel *n*. With this wheel engages a pawl *o*, attached to a rock-lever *p*, which rock-lever is raised by the movement of the weighted lever *d* through the intervention of the rod *q*, attached to the lever *d*, and bent at its lower portion so as to engage the long arm of the lever *p*. *r* is a spring which keeps the lever in the position shown in Fig. 1 when the carbons are together. Fastened to the piston of the dash-pot *f* and swinging thereon as a fulcrum is the hook *s*, designed to engage with the short arm of the lever *p* when it is tilted back, which takes place when the current is flowing through the lamp. *t* is a stop to prevent the hook *s* falling too far. The operation of this feeding arrangement is as follows: Suppose the lamp not working and the carbons 2 to be together. A current being sent through the lamp, the plunger *b* is drawn upward, carrying with it the strip *c*. The strip raises the hooked rod *q*, which engages with the long arm of the lever *p*, tilting it backward until it comes into such a position that it can engage with the hook *s*, which it does as soon as the weighted rock-lever *d* has been raised, the right arm of said lever rising and the left arm lowering. The lever *p* is then locked by the hook *s*. As the rock-lever *d* tilts the clutch *h* attached thereto forces the circular feed-rod *g* around, and this causes the worm *m* to act on the gear-wheel *l*, attached to the shaft 14, thereby separating the carbons and striking the arc. As the current varies the plunger *b* will work up and down in the solenoid *a* and carry with it a motion of the rock-lever *d*, rod *q*, and the

lever *p*. The spring *r* will tend to draw the long arm of the lever *p* downward, which will cause the pawl *o* attached thereto to rotate the ratchet-wheel *n*. This will cause the worm *m* on its shaft to engage with the gear-wheel *l*, rotating the shaft 14 and feeding the carbons. As the weighted rock-lever *d* oscillates the hook *s* will permit the lever *p* a certain amount of movement sufficient to enable the pawl *o* to feed the ratchet-wheel *n* without becoming detached from the hook *s*. Should, however, any disarrangement occur in this gradual feeding mechanism and the arc become too long, the plunger falling will detach the hook *s* from lever *p*, release the grip of the clutch *h* on the circular feed-rod *g*, and the spring *u*, attached to the frame *i*, Fig. 3, will turn the frame *i* on the center *v* and through the worm *m*, the gear-wheel *l*, and shaft 14 force the carbons together. Plenty of current will again flow, the solenoid will act on the plunger, the arc will be struck, and the previous cycle be repeated.

The operation of the mechanism in the lower carbon-containing portion of the lamp is easily understood from the drawings. The shaft 14 is rotated and, acting through the bevel-wheel 18 on the bevel-wheels 13, advances or withdraws the carbons, whose holding-frames 8 are attached to the shafts carrying the bevel-wheels 13.

Having thus fully described and illustrated my invention, what I claim is—

1. In arc-feeding mechanism, the combination of a solenoid, a plunger working in said solenoid, a weighted rock-lever, a circularly-rotating frame attached to the main feeding-shaft, and means for rotating said frame by the motion of the rock-lever, substantially as set forth.

2. In arc-feeding mechanism, the combination of a solenoid, a plunger in said solenoid, a rock-lever attached to the plunger and moving therewith, a clutch on the rock-lever, a frame with which the clutch engages attached to the main feeding-shaft, and a spring urging the feeding-shaft in a direction opposite to that produced by the rock-lever, substantially as set forth.

3. In arc-feeding mechanism, the combination of a solenoid, a plunger working in said solenoid, a weighted rock-lever attached to said punger, a clutch attached to and worked by said lever, a circular feed-rod on which said clutch operates and a main feeding-shaft controlling the movement of the light-giving carbons, substantially as described.

4. In an arc-striking mechanism, the combination of a pair of ring carbons rotatably mounted, a main shaft for imparting movement to said carbons, a spring for holding the carbons normally in contact, a clutch attached to a weighted rock-lever, adapted to work against the said spring, a plunger controlling the movements of the rock-lever, and a solenoid operating the said plunger, substantially as described.

5. In arc-feeding mechanism, the combination of a solenoid, a plunger, a rock-lever attached to said plunger, a clutch on said rock-lever, a main carbon-rotating shaft, and means for operating the said shaft by the movement of the clutch, substantially as described.

6. In arc-feeding mechanism, the combination of a solenoid, a plunger, a clutch operated by said plunger and engaging a circular feed-rod, a carbon-rotating shaft, and a spring for bringing the carbons into contact, substantially as described.

7. In arc-feeding mechanism, the combination of a solenoid, a plunger working in said solenoid, a weighted lever controlled by said plunger, a dash-pot for regulating the movement of said lever, a clutch attached to the lever, a rotating carbon-shaft, and means for communicating motion to said shaft from the said clutch, substantially as described.

8. In arc-feeding mechanism, the combination of a pair of ring carbons, a shaft for rotating said carbons, a gear-wheel attached to said shaft, a frame carrying a worm engaging with said gear-wheel, and a spring attached to said frame for maintaining the ring carbons in contact, substantially as set forth.

9. In arc-feeding mechanism, the combination of a pair of ring carbons, a shaft for rotating said carbons, a gear-wheel attached to said shaft, a worm engaging said gear-wheel, a ratchet-wheel attached to the shaft of the worm, a pawl working in said ratchet-wheel and attached to a bent lever, a rock-lever controlling the movements of said bent lever, a plunger to which said rock-lever is attached, and a solenoid in which said plunger works, substantially as set forth.

10. In arc-feeding mechanism, the combination of a pair of ring carbons, a shaft for rotating said carbons, a gear-wheel attached to said shaft, a worm engaging said gear-wheel, a ratchet-wheel attached to the worm-shaft, a pawl working in said ratchet-wheel and attached to a bent lever, a rocking lever controlling the movement of said bent lever, a hook attached to one arm of the rocking lever and adapted to engage with and hold the said bent lever, a plunger controlling the movement of said rocking lever, and a solenoid in which said plunger works, substantially as set forth.

11. In arc-feeding mechanism, the combination of a solenoid-plunger, a clutch connected with said plunger and operated thereby, a circular feed-rod controlled by said clutch, all adapted to change the vertical motion of the plunger into a horizontal motion of the circular feed-rod, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 25th day of January, A. D. 1900.

ALBERT FERDINAND SHORE.

Witnesses:
D. N. HURLBUT,
C. L. BELCHER.