(No Model.) 3 Sheets—Sheet 1.

M. N. LYNN.

ELECTRIC ARC LAMP.

No. 313,006. Patented Feb. 24, 1885.

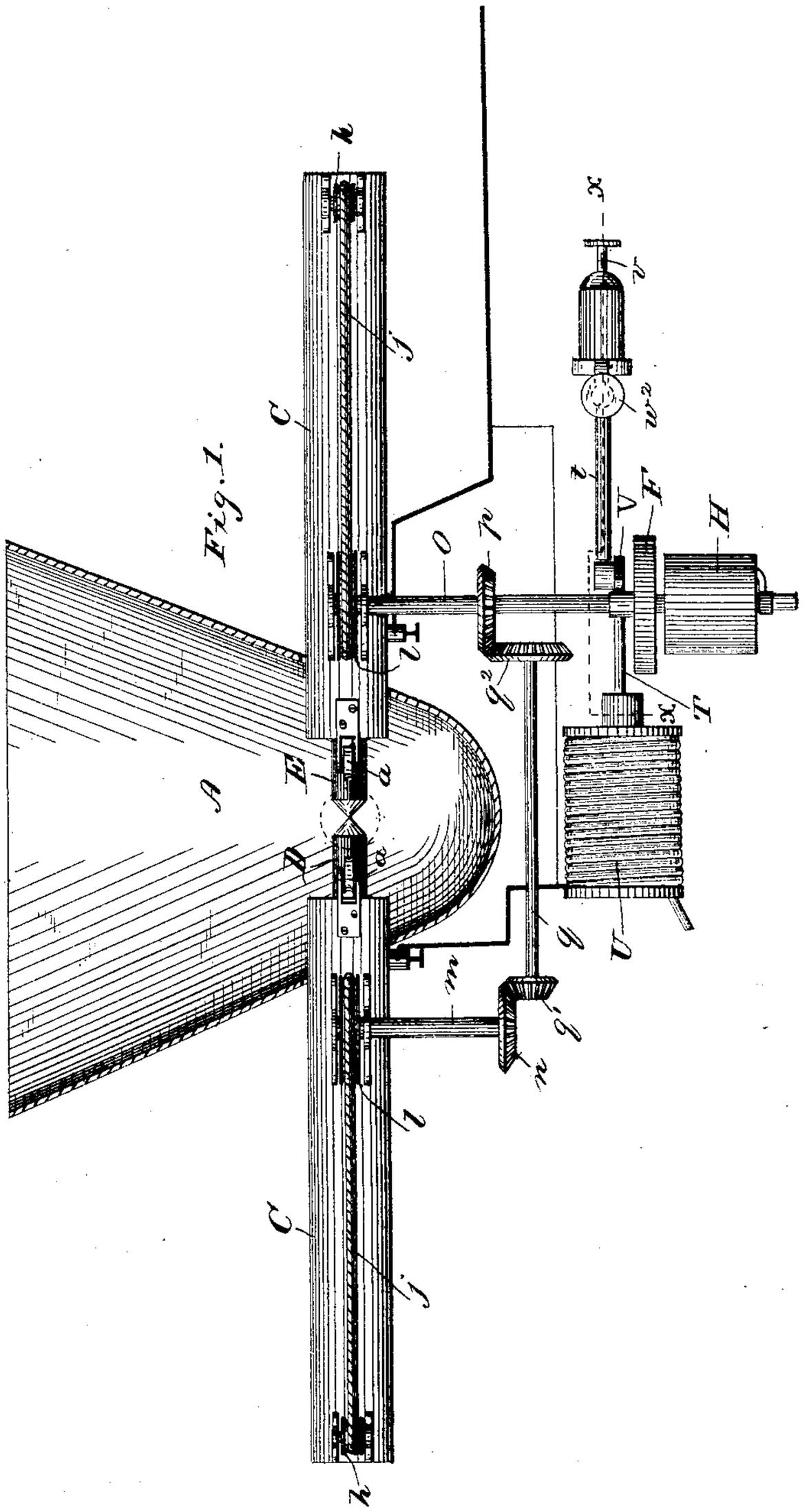

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Fig. 2.

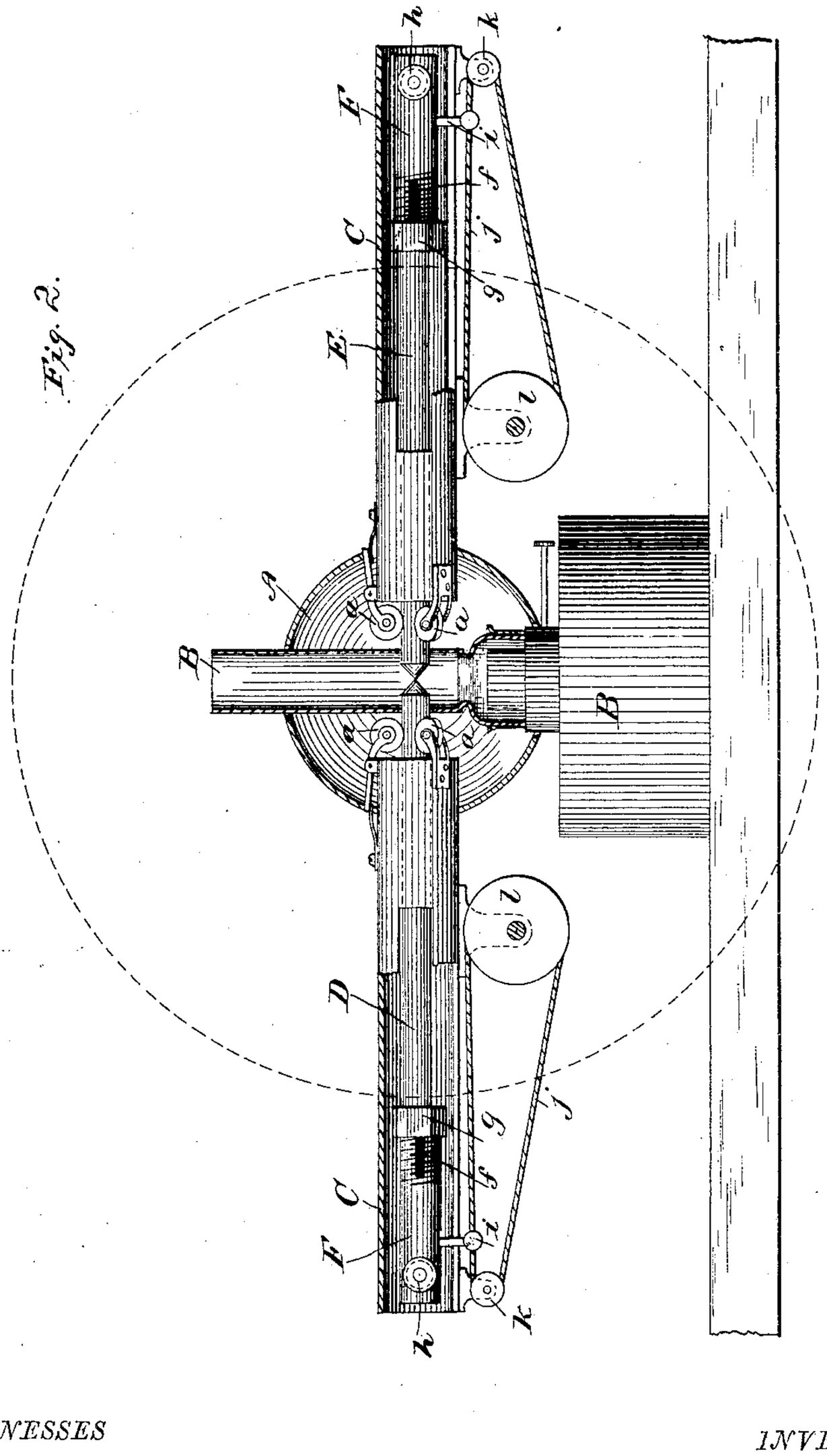

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Fig. 3.

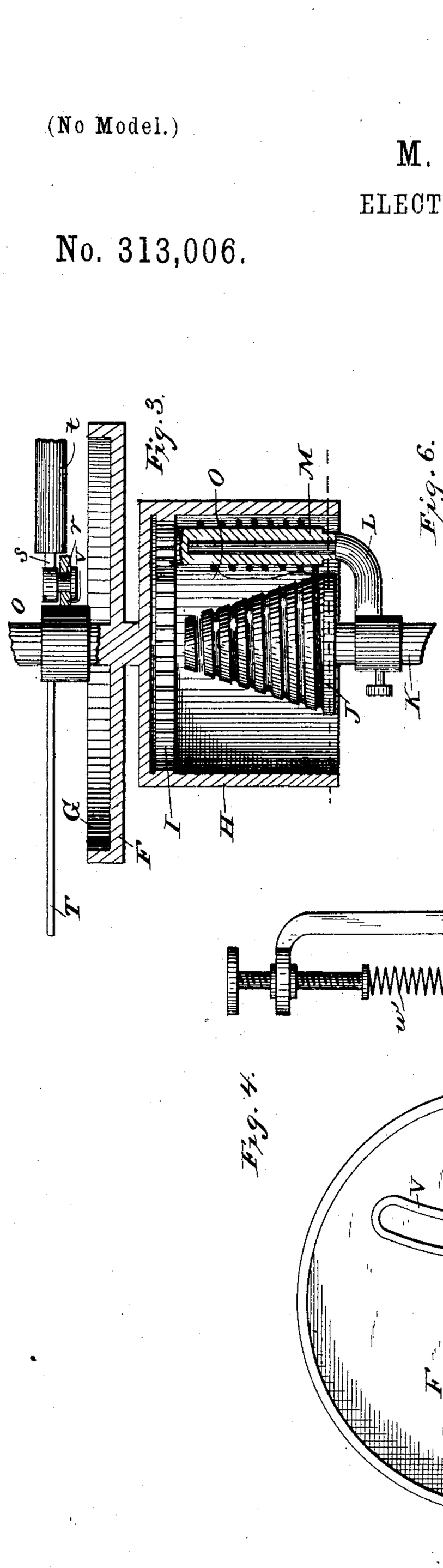


Fig. 6.

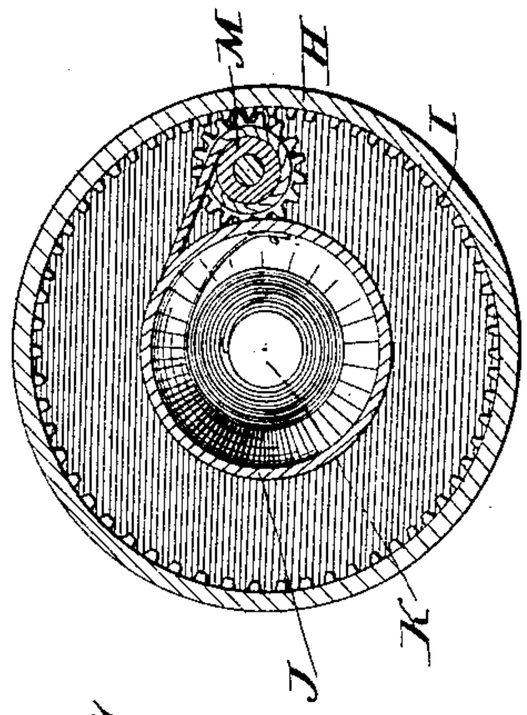


Fig. 5.

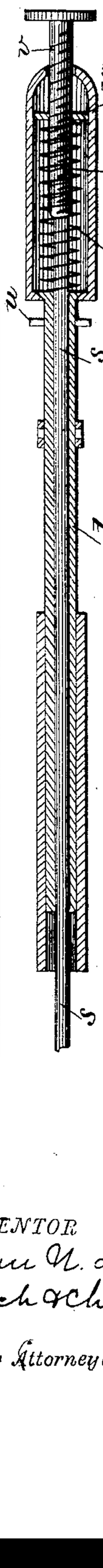
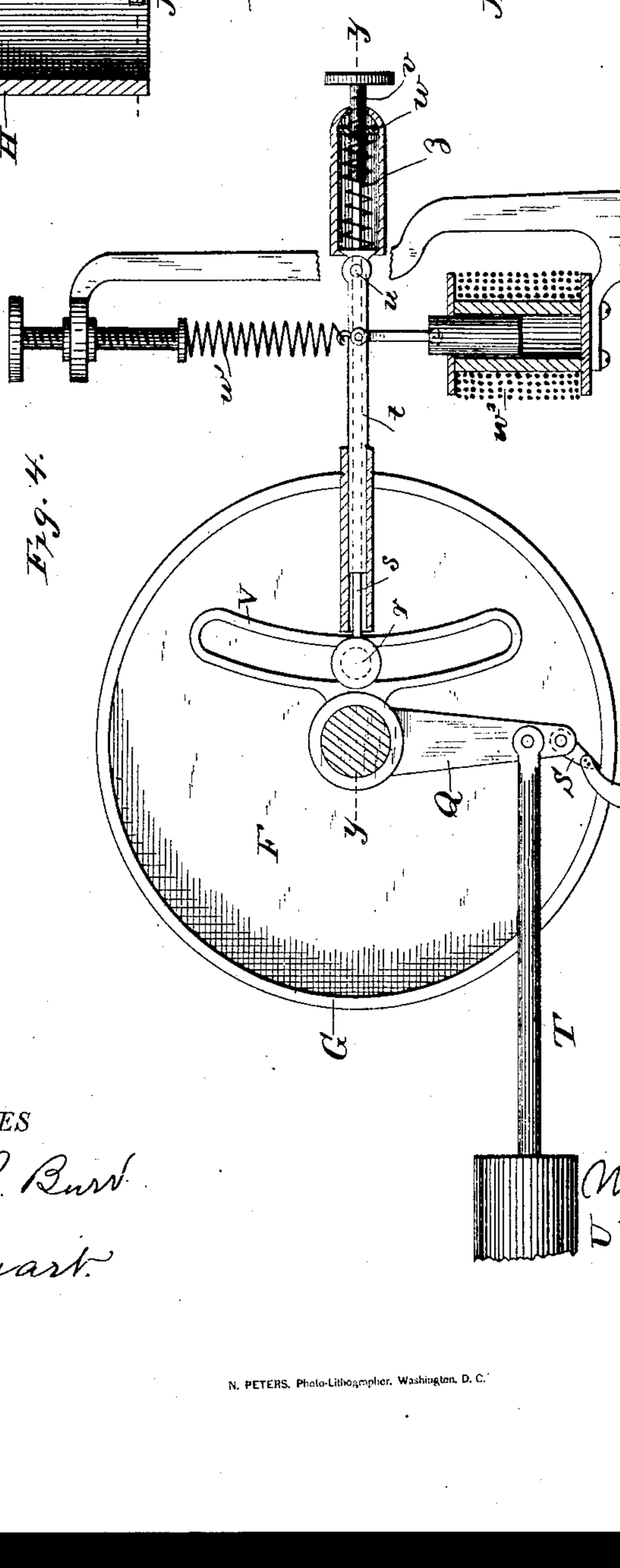


Fig. 4.



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UNITED STATES PATENT OFFICE.

MIRABEAU N. LYNN, OF RISING SUN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE AMERICAN ELECTRIC HEADLIGHT COMPANY, OF INDIANAPOLIS, INDIANA.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 313,006, dated February 24, 1885.

Application filed April 3, 1884. (No model.)

To all whom it may concern:

Be it known that I, MIRABEAU N. LYNN, of Rising Sun, in the county of Ohio and State of Indiana, have invented certain new and useful Improvements in Electric-Arc Lamps; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

My invention has for its object to provide an electric-arc lamp adapted to maintain not only a uniform and constant arc, but an arc whose position remains unchanged during the consumption of the carbons, enabling it to be maintained at the focusing-point of a reflector.

It has for its special object the construction of a lamp which shall be adapted for use upon locomotives, steamboats, and other moving bodies, and which shall be adapted for use in connection with ordinary head-lights, either as supplemental to or in displacement of or in connection with the customary oil or gas-burning devices of such head-lights.

I will first describe my invention with reference to the accompanying drawings, and will then point out its special features of novelty in the claims at the end of this specification.

In said drawings, Figure 1 represents a bottom plan view of an electric lamp constructed in accordance with my invention and applied to a reflector such as is ordinarily used on locomotives and steamboats. Fig. 2 is a front elevation of the same. Fig. 3 is a sectional view of a portion of the mechanism for causing the approach of the carbons. Fig. 4 is a sectional view taken on the line *x x*, Fig. 1. Fig. 5 is a sectional view taken on the line *y y*, Fig. 4. Fig. 6 is a transverse section of the feeding mechanism, Fig. 3, showing the spring within the spirally-grooved cone.

Similar letters of reference in the several figures indicate the same parts.

The letter A indicates a reflector such as is ordinarily used in the construction of locomotive head-lights, and B is the oil-lamp within the same. Through the opposite sides of the reflector project tubes C C, preferably of metal, and within these tubes are arranged the carbon pencils D and E, the latter constituting the positive and the former the negative electrode. Each of the carbon pencils is supported at its inner end by a carrier, F, arranged within the tube C, and at its outer end by a series of friction-rollers, *a*, preferably two or more in number, and some or all of which are mounted upon arms which are spring-seated, so as to adjust themselves to and hold truly the pencil. The inner end of the carbon pencil may be connected to the carrier F in any suitable manner; but I preferably make the carrier tubular, so as to adapt it to receive the end of the carbon pencil, and I slot it, as shown at *f*, so as to permit of its being contracted upon the pencil by the operation of a nut, *g*, applied as shown in Fig. 2. By preference also I provide the carrier with friction-rollers *h*, adapted to bear upon the interior of the tube C or to travel in guides arranged within the tube, and I secure to the carrier an arm, *i*, which projects through a slot in the tube C, and is adapted to play back and forth therein. This arm *i* is connected to a cord, *j*, which passes around pulleys *k* and *l*. One of the pulleys *l* is secured to a short shaft, *m*, having upon its lower end a bevel gear-wheel, *n*, while the other of said pulleys *l* is mounted upon a longer shaft, *o*, having upon it a gear-wheel, *p*. A cross-shaft, *q*, having upon one end a small bevel-pinion, *q'*, and upon its other end a larger bevel-pinion, *q²*, serves to communicate the motion of the shaft *o* to the shaft *m*, and thus cause a simultaneous motion of both the carbon-carriers C C toward or from each other, according to the direction in which the shaft *o* is rotated.

While the movements of the carriers and their respective carbon pencils are simultaneous, they are not of equal extent by reason of the difference in size of the two bevel-pinions, *q q'*, this difference in size causing the carbon pencil E, constituting the positive electrode, to travel about twice as fast as the carbon pencil D, constituting the negative electrode, in conformity to well-known laws regulating the consumption of the carbons of electric lamps.

Upon the continuation of the shaft *o* is formed or secured a wheel or disk, F', having a friction-rim, G, and a drum, H, provided with an internal gear, I, as shown in Fig. 3.

Within the drum H is arranged a spirally-grooved cone, J, mounted upon a fixed shaft, K, so as to turn freely thereon, and connected to one end of a suitable spring concealed within it, the other end of said spring being connected to said shaft K.

Upon an arm, L, projecting from the shaft K into the drum, is mounted so as to turn freely a sleeve, M, having a pinion, N, at one end, which meshes with the gear I of the drum, and having secured to it and wound upon it a cord, O, which is also connected to the cone J, and is adapted to be wound in the spiral groove thereof. The tension of the spring within the cone J is exerted to rotate the said cone, so as to wind the cord O thereupon, and to cause, through the instrumentality of the sleeve M, pinion N, and internally-toothed drum H, the rotation of the shaft *o* in the direction which will cause the carbon pencils to be brought together in contact, as shown in Fig. 1. An arm, Q, is mounted loosely upon the shaft *o*, in close proximity to the wheel or disk F, and its outer end is connected to a gravitating pawl or friction-clutch, S, which is adapted to co-operate with the rim G of said wheel F and with an adjustable disengaging-stop, S'. Also connected to this arm Q is a rod, T, controlled by a solenoid, U, arranged in the main light-circuit, as shown in Fig. 1.

When the carbon pencils are held together by the operation of the spring-cone, as shown in Fig. 1, and the current put onto the light-circuit, the solenoid U is energized, and the lever Q, through the instrumentality of the rod T, will be swung in a direction opposite to that in which the wheel F tends to rotate under the influence of the spring-cone and connections, and this movement of the lever will cause the pawl or friction device S to bind upon the rim G and rotate the wheel F backward against the influence of the spring-cone a sufficient distance to establish the normal arc between the carbon pencils. Upon the lengthening of the arc due to the consumption of the carbons, the current traversing the light-circuit will be weakened and the energy of the solenoid decreased to such an extent as to enable the spring-cone and connections to assert themselves and effect a forward rotation of the wheel F sufficient to cause the carbons to be fed up and preserve the normal arc.

For the purpose of insuring the prompt and efficient action of the lamp, I prefer to employ an arrangement for to some extent counteracting the mechanical action of the spring-cone and connections on the one hand and of the electrical action of the solenoid on the other hand, and one embodiment of this part of my invention I have illustrated in the drawings.

Referring particularly to Figs. 1, 3, 4, it will be observed that to the hub of the arm Q is secured another arm, V, having a curved segmental slot therein, as shown in Fig. 4. Within this slot works a friction roller or pin, *r*, mounted on a bar, *s*, which passes through a tubular guide-bar, *t*, and is connected to a screw, *v*, which is threaded through a head, *w*, capable of a backward and forward, but not a rotary, motion in a chamber at the end of said bar *t*. Between the end of the said chamber and the sliding head *w* is a spiral spring, *z*, whose tension is exerted to draw the rod *s* outward. The bar *t* is pivoted at *u*, and to its upper side, forward of its pivot *u*, is connected an adjustable spring, *w'*, while to its under and opposite side, at the same point, is connected a solenoid, w^2, located in circuit derived from the main light-circuit, as shown in Fig. 1. When the normal arc is formed, the slotted arm *v* stands in the position indicated in Fig. 4, the pin or roller *r* on the rod *s* being midway of the slot, and the spring *z* operating upon arm *v* to preserve such normal arc, and the tension of the spring *w'* and the force of the solenoid w^2 being balanced. With the devices thus arranged an increase of current in the main light-circuit, tending to increase, through the solenoid U and connections, the length of the arc, would also increase the energy of the solenoid w^2 and cause the latter to overbalance the spring *w'* and swing the bar *t* downward, so that the pin or roller *r* would travel down the slot in the arm *v*, and the tension of the spring *z* would, through the rod *s* and said pin or roller, operate to resist the outward carbon-separating motion of the arm Q, while, on the other hand, a decrease in the current in the light-circuit would weaken the action of the solenoids U and w^2, and the spring *w'*, by overbalancing the solenoid w^2, would shift the pin or roller *r* toward the upper part of the slot in the arm V and tend to resist the action of the mechanical force of the spring-cone J in bringing the carbons closer together.

The amount of controlling force exerted by the spring *z* upon the forces which operate to prevent the formation of a too large or a too small arc can be regulated by a proper adjustment of the screw *v*.

As it is essential that the head-light of a locomotive should at all times be available, I prefer to employ both an oil or gas lamp and an electric lamp within the same reflector; and in order that the flame of the oil or gas lamp and the arc of the electric lamp may fall within the focus of the reflector, I preferably construct the chimney B' of the oil or gas lamp with apertures in its opposite sides, for the purpose of admitting the carbon pencils of the electric lamp, as shown in Fig. 2. By this provision either the oil or gas lamp or the electric lamp, or both of them at the same time, may be put into operation within the effective focusing area of the reflector, and the disarrangement of either of the sources of light will not prevent the maintenance of a proper light from the other source, and the danger of being without a light is obviated.

While I have described herein the carbon-carriers and their conducting-tubes as ar-

ranged in a horizontal position, it is obvious that they may be arranged vertically or otherwise, though where used as a locomotive head-light I prefer to have them horizontal, as in that position they are least subject to disarrangement.

In an application filed simultaneously herewith, and numbered 126,683, I have described a combined oil and electric lamp, and in a prior application filed November 5, 1883, and numbered 110,892, I have described an electric lamp containing a mechanism, substantially as herein shown, for effecting the forward feed of the carbons, also the means for guiding and supporting the carbons. The matters thus described and claimed in the aforesaid applications are herein disclaimed, as forming the subject-matter of said applications, my present invention being restricted to the several combinations as hereinafter set forth.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric lamp, the combination of carbon-carriers with mechanism tending to feed said carriers toward each other, mechanism tending to feed said carriers from each other, and the herein-described mechanism for acting in positive opposition to both the forward and backward feeding mechanisms, consisting of the slotted arm connected to the backward-feeding mechanism, the pivoted spring-seated rod and its guide, and the pin or roller working in the slot of the lever, the spring connected to the rod or its guide, and the electro-magnet acting in opposition to said spring, substantially as described.

2. The combination, with the main shaft of the gearing by which the carriers are given simultaneous though unequal motions, of the wheel mounted on the said shaft, the spring-cone and intervening mechanism for rotating said shaft in one direction, and the loosely-mounted arm, the clutch, and the solenoid operating upon the wheel to impart motion to the shaft in the opposite direction, substantially as described.

3. The combination of the driving-shaft of the carbon-carrier-feeding mechanism with the wheel or disk secured to said shaft, the arm loosely mounted on said shaft, the clutch, and the solenoid in the main light-circuit, substantially as described.

4. The combination, with the main shaft of the carbon-carrier-feeding mechanism, of the mechanical devices acting upon the said shaft to feed the carriers forward, the wheel secured to said shaft, the arm mounted loosely on the shaft, the clutch and solenoid in the main circuit, the slotted arm connected to the arm on the shaft, the pivoted spring-seated rod having the pin or roller, and the spring and solenoid, acting in opposition to each other, substantially as described.

5. The combination, with a reflector, of a gas or oil light arranged in the focus of said reflector, and an electric lamp having its carbon pencils projecting through openings in the chimney of the oil or gas lamp so as to bring the arc within the focus of the reflector, substantially as described.

6. In an electric lamp, and in combination with the carbon-carriers and mechanism for causing their simultaneous movement in opposite directions to feed the carbons, mechanism for limiting and controlling such feed, and an independent mechanism acting in conjunction with said controlling mechanism to augment or decrease its resistance to the feeding mechanism, substantially as described.

7. In an electric lamp, and in combination with the carbon-carriers, feeding mechanism for effecting their simultaneous approach, and mechanism for acting in opposition to said feeding mechanism to control the latter, and a governing mechanism acting upon the regulating mechanism to increase or decrease its power in proportion to the resistance of the arc, substantially as described.

8. In an electric lamp, and in combination with the carbon-feeding mechanism thereof, mechanism actuated by a solenoid in the main circuit for controlling the feed, and a spring and intermediate mechanism connected to the controlling mechanism and actuated by the differential power of a spring and solenoid in a branch circuit to apply the force of said first-mentioned spring in unison with or opposition to the solenoid of the feed-controlling mechanism, substantially as described.

9. In an electric lamp, the combination, with the carbon-feeding and feed-controlling mechanism thereof, of an auxiliary governing mechanism acting in conjunction with the feed-controlling mechanism to increase or diminish its resistance to the feed mechanism in proportion to the strength of the current in a branch circuit, substantially as described.

10. In an electric lamp, the combination, with the mechanism tending to feed the carbon continuously in one direction, of a solenoid acting to control the rate of feed in proportion to the strength of current passing through its coils, and an auxiliary spring-governor acting in conjunction with said feed-controlling solenoid to increase or diminish its power, the application of said auxiliary governor being determined by a solenoid in a branch circuit and an opposing spring, substantially as described.

11. In an electric lamp, the combination of carbon-carriers with mechanism tending to feed such carriers toward each other, and independent mechanism acting in positive opposition to the forward-feeding mechanism, and a spring acting in positive opposition to the backward-feeding mechanism, said spring being actuated and controlled by an electro-magnet or solenoid in a derived circuit, substantially as described.

12. In an electric lamp, and in combination with the mechanism for feeding the carbons, a clutch and an actuating electro-magnet or solenoid for resisting and controlling the for-

ward feed of the carbons in proportion to the strength of the current traversing said solenoid, a lever connected to said controlling mechanism, a spring attached to said lever by a movable connection, and an electro-magnet and opposing spring operating to shift the point of attachment of said first-mentioned spring upon the said lever, whereby the leverage exerted by the spring is made proportional to the strength of the current, and the power of the feed-controlling mechanism is increased or diminished, substantially as described.

13. In an electric lamp, the combination, with the carbon-carriers, of a mechanism operating to feed the carbons together with a uniform power, an electro-magnet and mechanism acting in opposition to the feeding mechanism to restrain and control the latter, an electro-magnet in a shunt circuit, and an auxiliary spring-governor controlled thereby and acting in conjunction with the feed-controlling mechanism to increase or diminish its opposition to the feed, substantially as described.

14. In combination with a gas or oil lamp provided with a chimney, an electric lamp whose carbons are projected through openings in said chimney and above the burner, substantially as described.

15. In combination with an oil or gas lamp whose flame occupies a focal position within a reflector, an electric lamp the carbons whereof are projected from opposite sides of the reflector, and terminate at one end within the chimney of the gas or oil lamp and in proximity to the burner thereof, substantially as described.

MIRABEAU N. LYNN.

Witnesses:
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FRED F. CHURCH.