(No Model.) 4 Sheets—Sheet 1.

J. E. GASTON.

ELECTRIC ARC LAMP.

No. 475,727. Patented May 24, 1892.

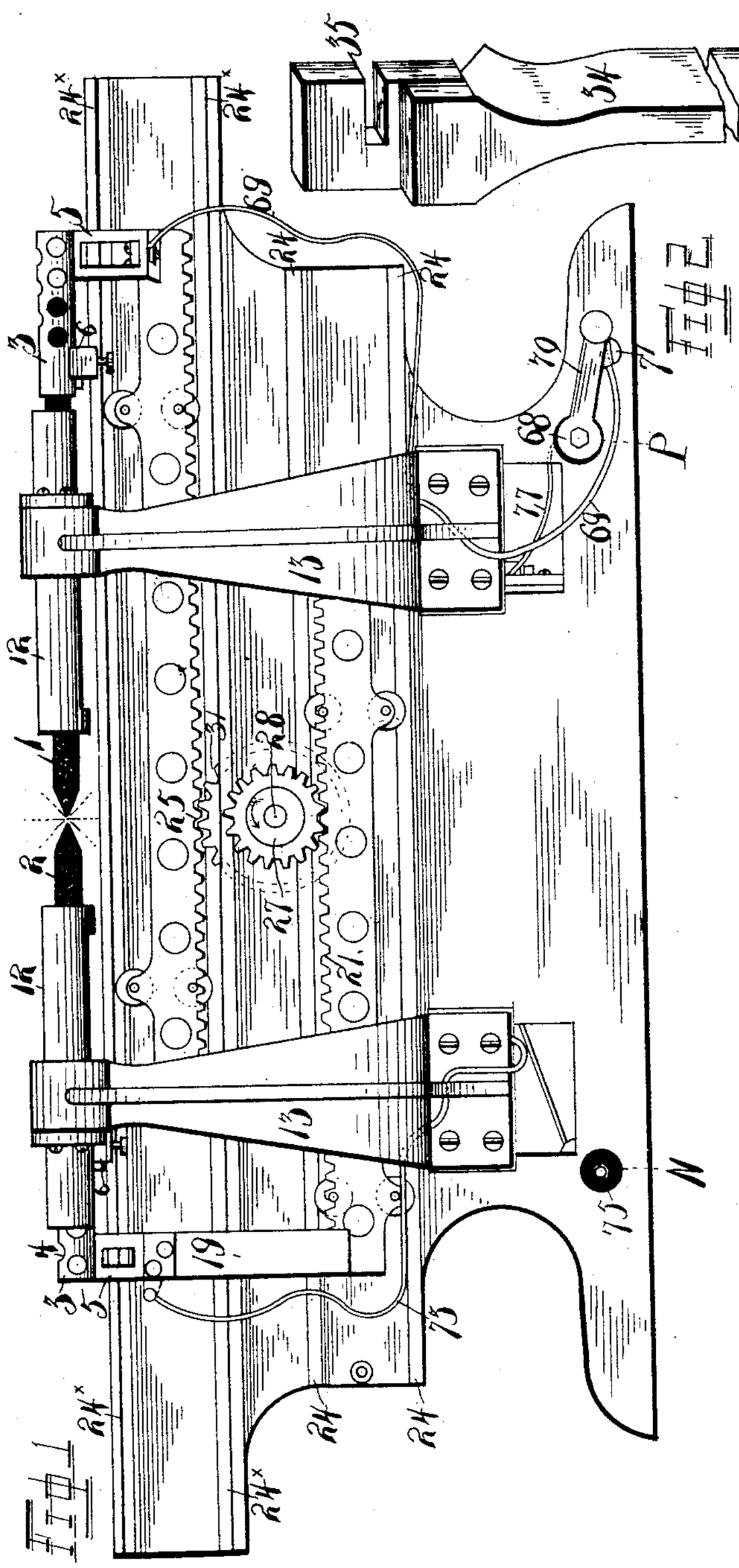


FIG 1.

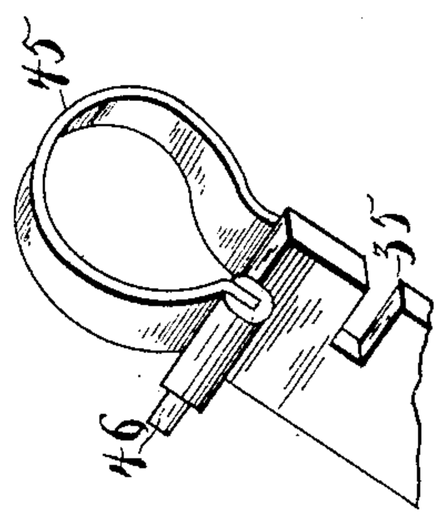


FIG 4.

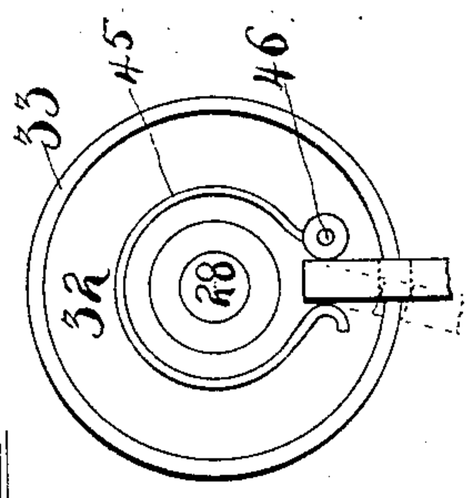


FIG 3.

WITNESSES

A. A. Eicke

Ed. E. Longan

INVENTOR

James E. Gaston

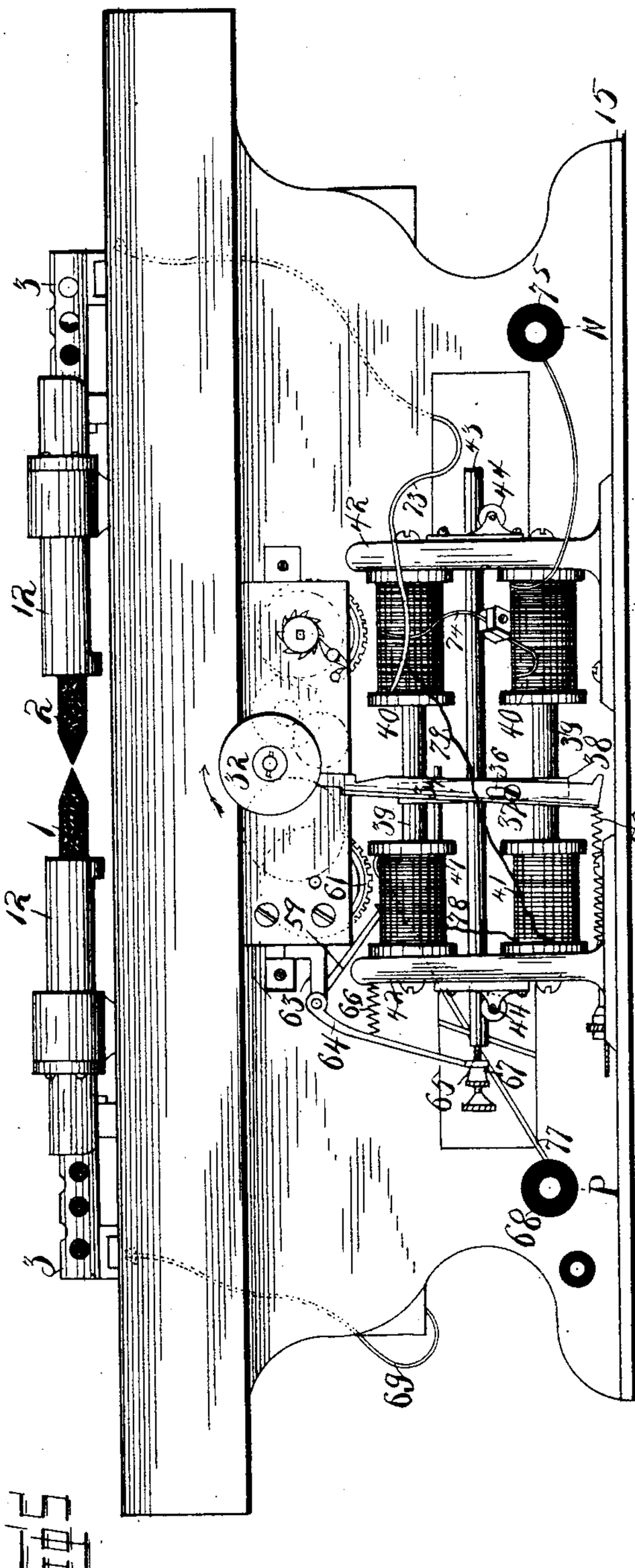
By Hyde & Hyde Attorneys.

(No Model.) 4 Sheets—Sheet 2.

J. E. GASTON.

ELECTRIC ARC LAMP.

No. 475,727. Patented May 24, 1892.



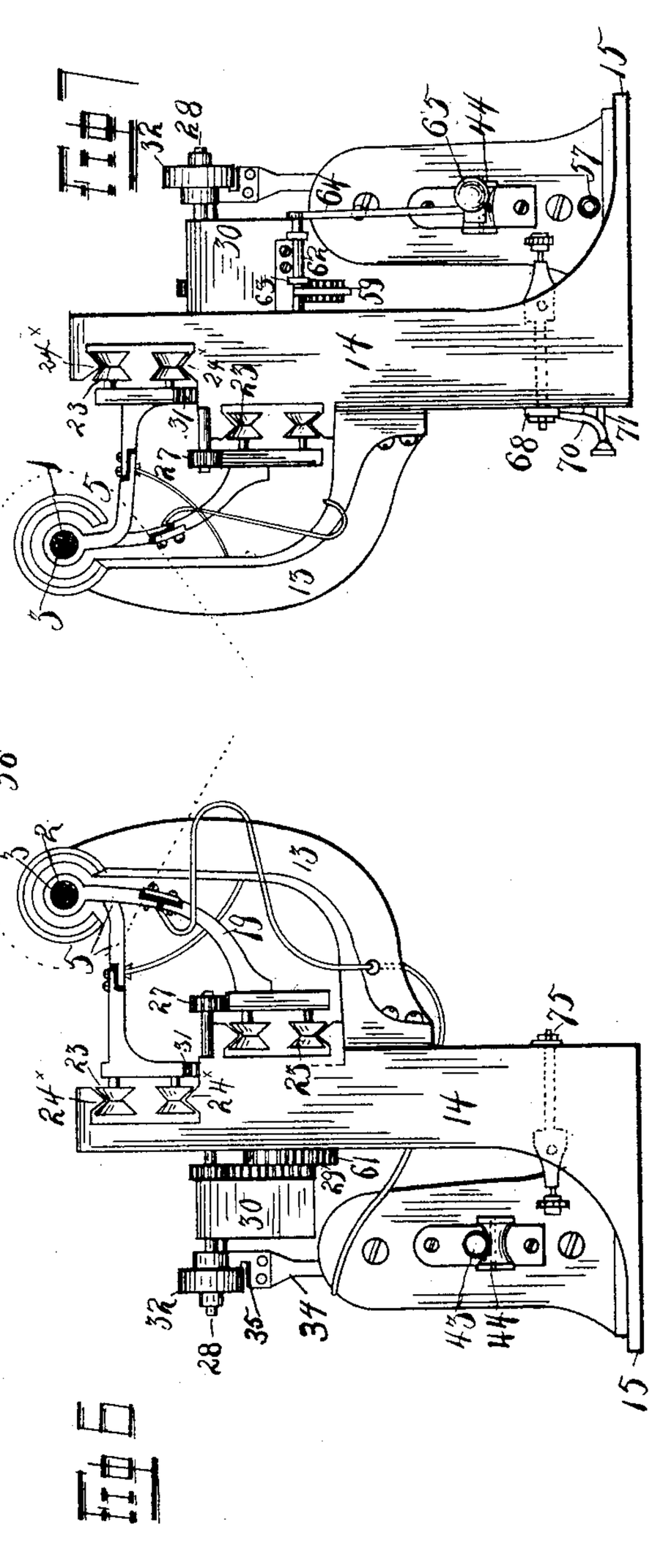


FIG. 5.

WITNESSES

A. A. Eicher

Ed. E. Longan

INVENTOR

James E. Gaston.

By Hijdon & Hijdon Attorneys

(No Model.) 4 Sheets—Sheet 3.

J. E. GASTON.

ELECTRIC ARC LAMP.

No. 475,727. Patented May 24, 1892.

Fig 8

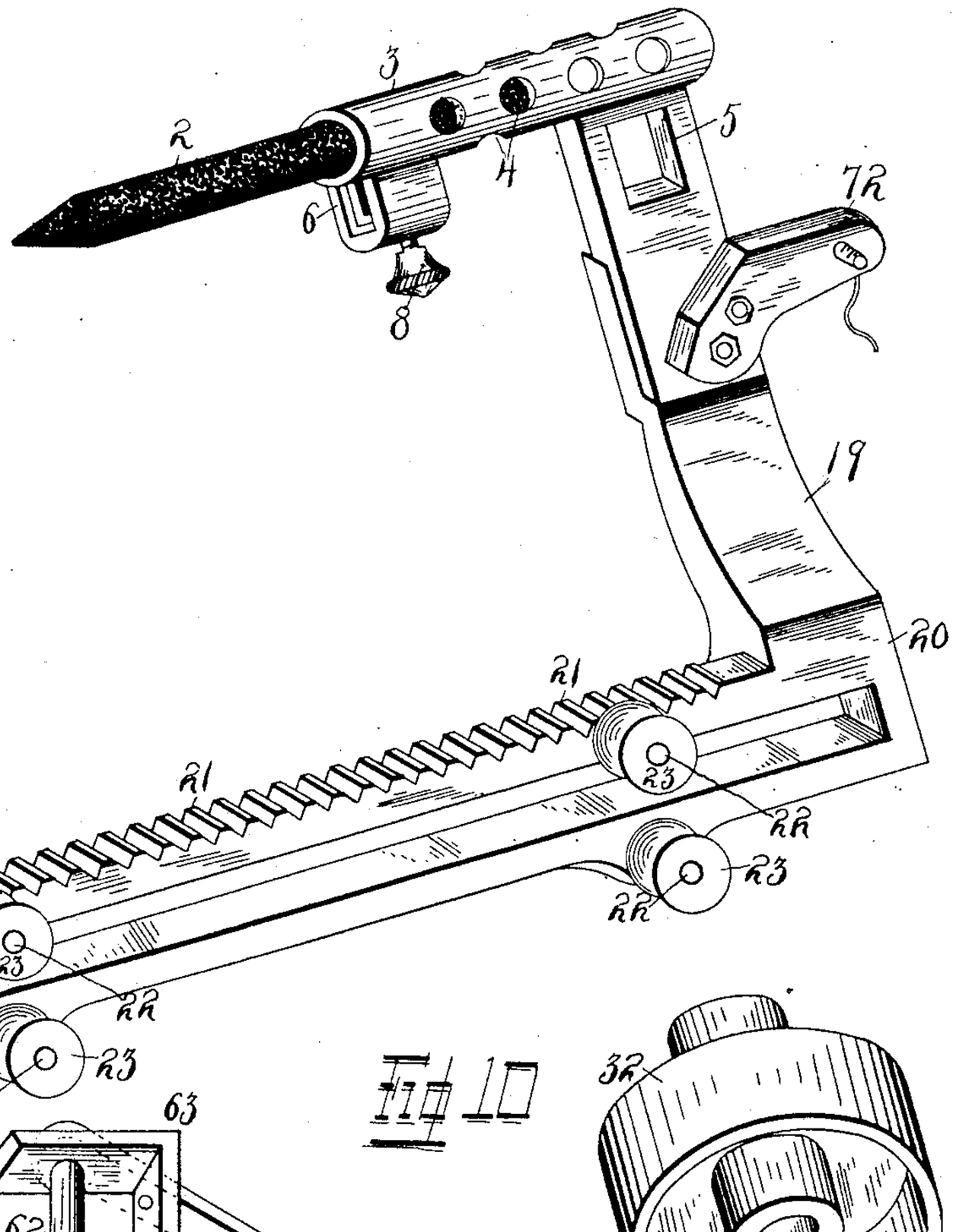


Fig 9

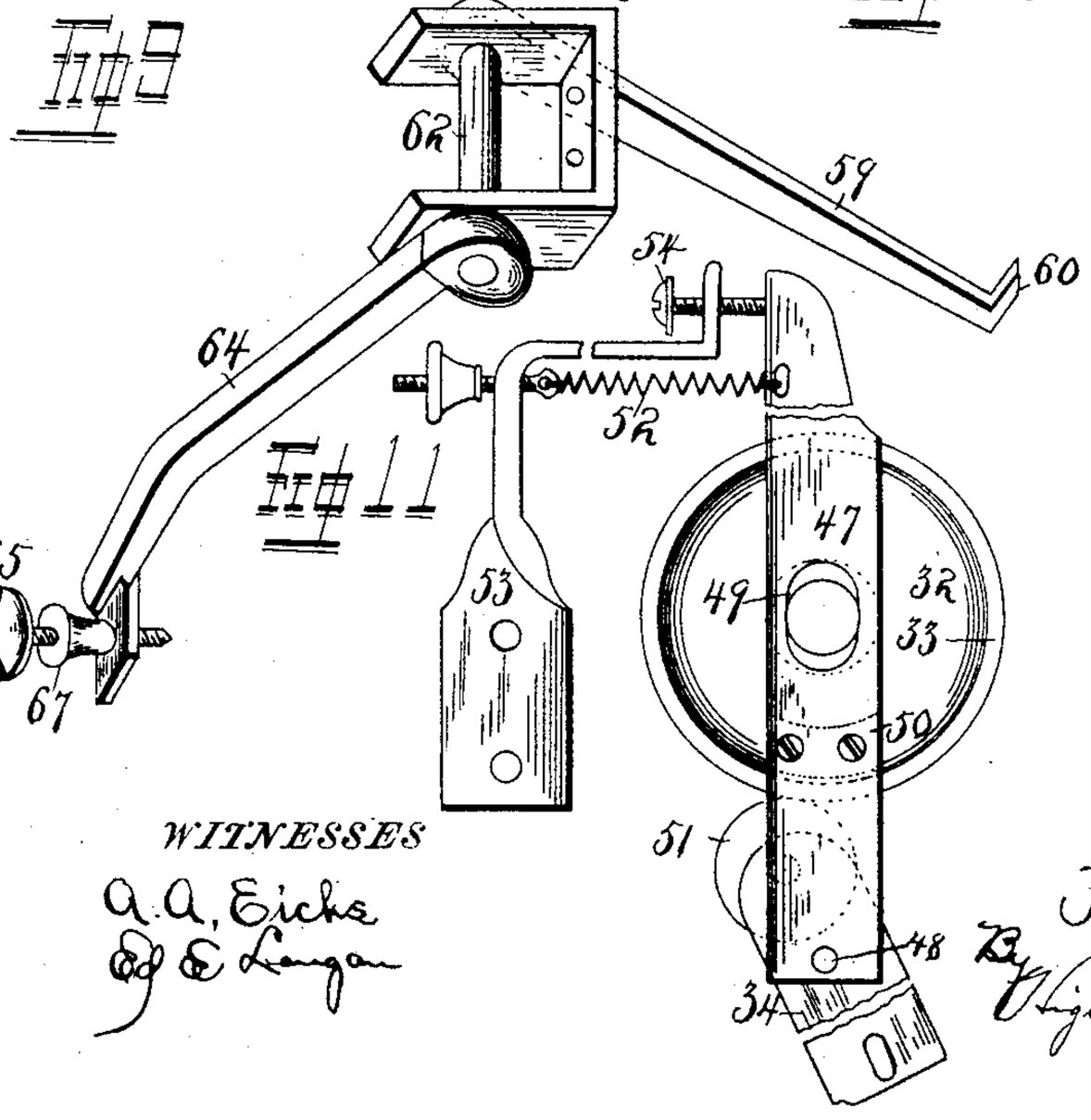


Fig 10

Fig 11

WITNESSES

A. A. Eicke
Edgar Langan

INVENTOR

James E. Gaston

By Wigdon & Wigdon Attorneys

(No Model.) 4 Sheets—Sheet 4.

J. E. GASTON.

ELECTRIC ARC LAMP.

No. 475,727. Patented May 24, 1892.

Fig 12

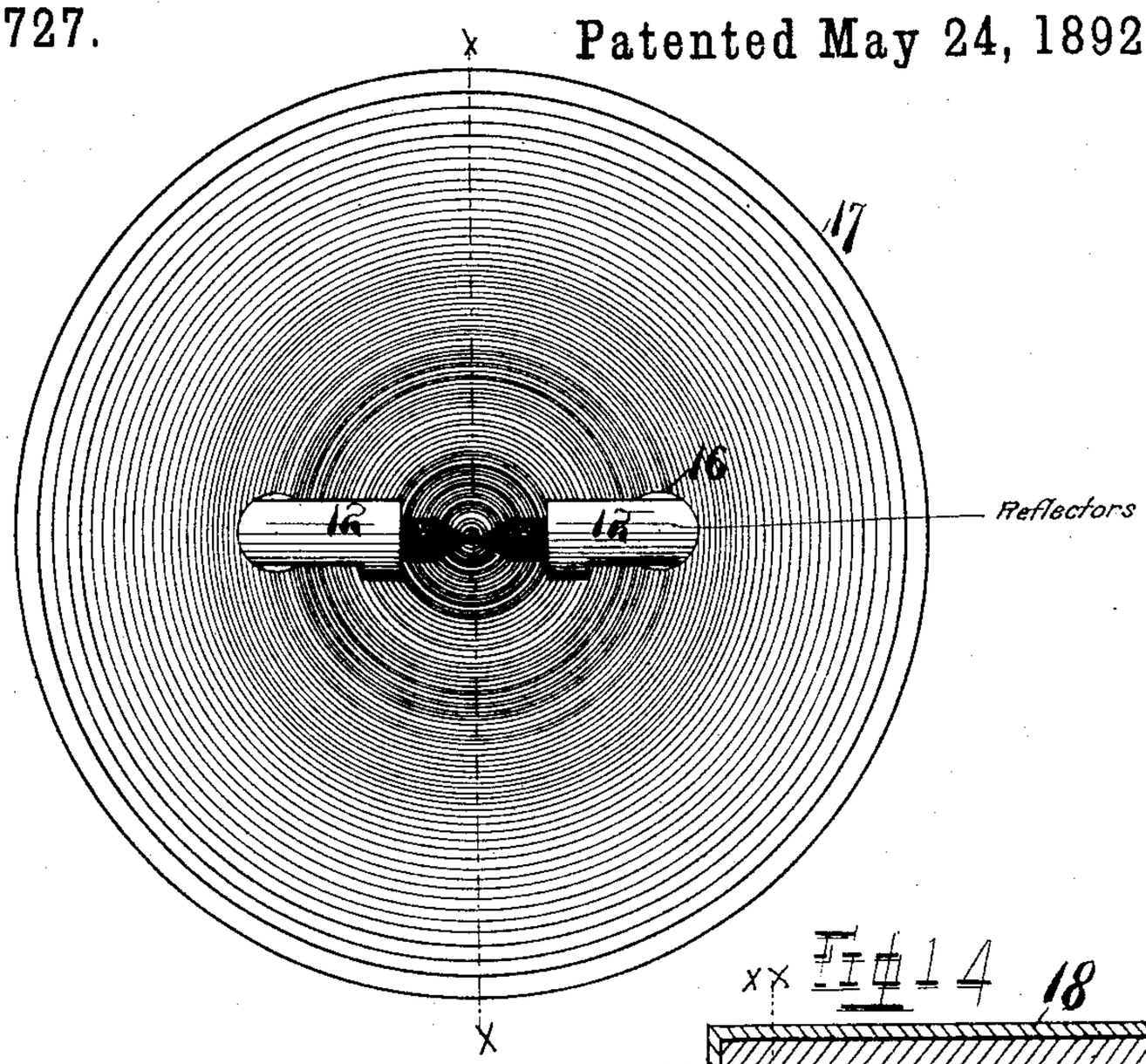


Fig 13

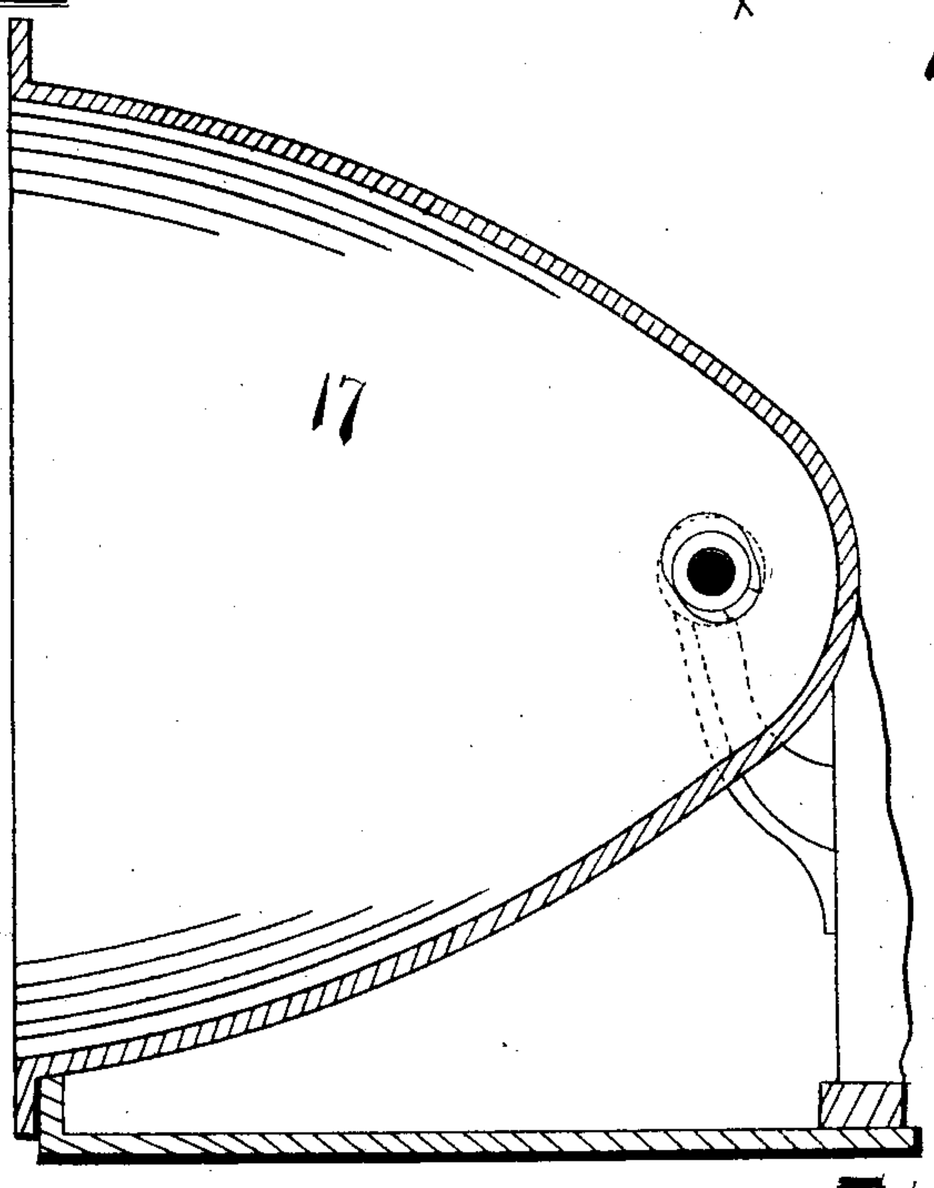


Fig 14

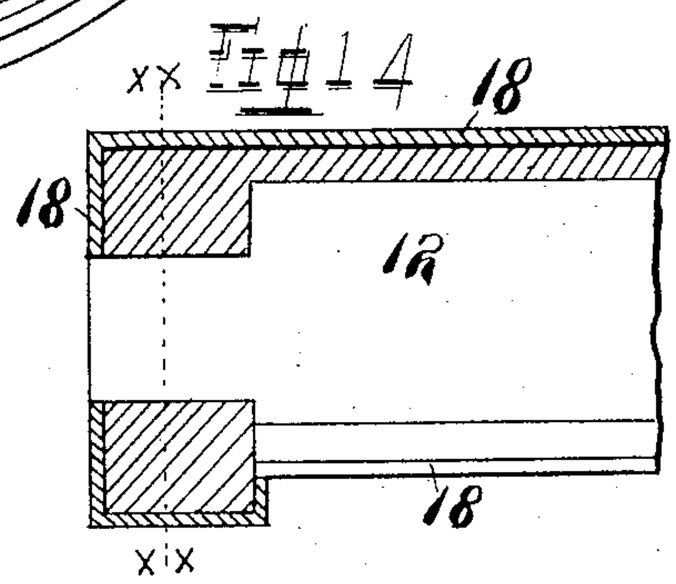


Fig 15

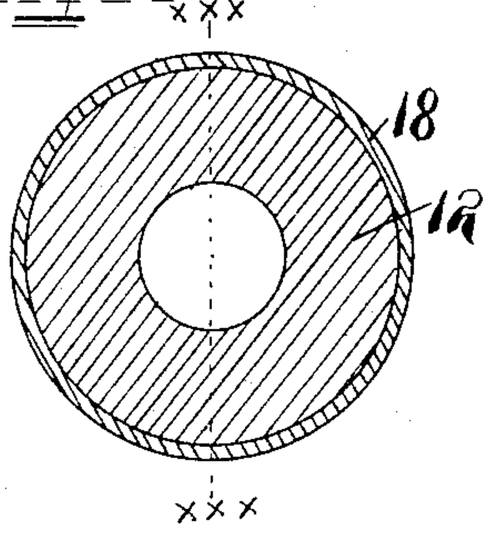
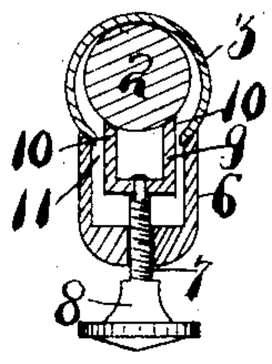


Fig 16



WITNESSES

A. A. Eicks

Ed. E. Lonyan

INVENTOR

James E. Gaston

By Hijdon & Hijdon Attorneys

UNITED STATES PATENT OFFICE.

JAMES E. GASTON, OF SPARTA, ILLINOIS, ASSIGNOR TO THE GASTON ELECTRIC HEAD LIGHT COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 475,727, dated May 24, 1892.

Application filed September 4, 1891. Serial No. 404,729. (No model.)

To all whom it may concern:

Be it known that I, JAMES E. GASTON, of the city of Sparta, in the county of Randolph and State of Illinois, have invented certain new and useful Improvements in Horizontal Carbon Electric Head-Lights, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My present invention may be construed as an improvement on the apparatus patented to me July 10, 1888, by United States Letters Patent No. 385,705.

The object of the invention is to improve the power of the reflector in electric head-lights, to simplify the construction of the lamp mechanism, and render more positive and steady the carbon holding and feeding devices.

In the drawings, Figure 1 is a front elevation of my improved arc lamp for locomotive head-lights with reflector removed. Fig. 2 is a detail view of a clutch-lever. Fig. 3 is a detail front elevation, on enlarged scale, showing the clutching devices. Fig. 4 is a detail view of the upper end of the clutch-lever and its spring. Fig. 5 is a rear elevation of the lamp with reflector removed. Fig. 6 is an end view of same, looking from the right-hand of Fig. 5. Fig. 7 is a view similar to the last-named, but looking from the left hand of Fig. 5. Fig. 8 is an enlarged detail view in perspective of one of the two carbon-holding devices. Fig. 9 is a detail view in perspective of a dogging device made use of in carrying out the invention. Fig. 10 is a detail view in perspective of the clutch-wheel. Fig. 11 is a front elevation of a modified form of clutching mechanism. Fig. 12 is a front elevation of the reflector, having projecting thereinto the reflective carbon-steadying devices. Fig. 13 is a sectional elevation of the same, the section being taken on the line *x x* of Fig. 12. Fig. 14 is an enlarged sectional elevation of the inner end of one of the reflective carbon-steadying devices, the section being taken on line *xxx xxx* of Fig. 15. Fig. 15 is a transverse section through the same device on line *xx xx* of Fig. 14. Fig. 16 is a detail transverse section through the carbon-holder and a carbon therein.

1 indicates the positive carbon, and 2 the negative one, both of which are held in proper position by carbon-holders, each consisting of a tubular socket 3, having a series of perforations 4 in the walls thereof, (to obviate weight,) mounted at its outer end upon (or formed integral with) a broad thin shank 5, so as to be held at right angles to said shank, and having at its free inner end an improved clamp, now to be described. The tubular socket 3 is fitted near its inner end with a raised laterally-projecting housing 6 or hollow shell having a screw-threaded perforation 7, within which perforation a set-screw 8 is mounted, so that its inner end will loosely engage and carry, without turning the same, a U-shaped clamping-piece 9, located within a chamber in said shell and having two clamping-arms 10, which latter pass through a suitable perforation 11 in said socket 3 and engage with carbon 2 at separate and distinct points upon the peripheral surface thereof, neither one of which is directly opposite the point at which the carbon is engaged by the socket 3, thereby forming what I may term a "self-centering" clamp for carbon-holders. The carbons are adapted to slide in carbon-steadying devices, which are in the form of slotted tubes 12, which latter are supported in proper position by brackets 13, secured at their lower ends to the upright frame-plate 14, extending from the base 15 of the lamp or by any other suitable means. The inner ends of the tubes 12 project through apertures 16 into the interior of the reflector 17, so that their adjacent ends will be completely inclosed or encircled by the walls of the said reflector and will rest closely adjacent to the location of the arc or point of illumination within said reflector, which latter is preferably of the usual concave parabolic form. The adjacent ends of the steadying devices or tubes 12, which thus project into the interior of the reflector, are provided with a coating 18, of any suitable reflecting substance, such as silver or other burnished metal, the purpose of which will appear hereinafter.

The shank 5 of the negative carbon-holder is clamped to a broad flat arm 19, connected to mechanism hereinafter described for moving said carbon back and forth; but the said

shank 5 is insulated from the said arm 19. The shank 5 on the carbon-holder and the housing 6 thereof are in alignment and are adapted to slide back and forth in the slots in the slotted carbon-guiding devices 12. The arm 19 is formed integral with or connected to the outer end of the reciprocating frame 20, having the rack 21 cut upon its upper edge.

Projecting from the rear side of frame 20 is a series of pins or pintles 22, upon which is mounted a series of rollers 23, having in the peripheral faces thereof V-shaped grooves, which latter are adapted to engage with the V-shaped tracks 24, oppositely located or formed upon the frame 14 of the lamp. (See Figs. 6, 7, and 8.)

The shank 5 of the positive carbon 1 is connected to a frame 20, similar to the one just described, but without the intervention of an arm, such as 19, and this frame also has a rack 25 cut upon its lower edge, and is also fitted with pintles 22 and rollers 23 upon its rear side, which are adapted to engage opposite V-shaped tracks 26, similar to those just described, and formed in the frame 14 at a point some distance in advance of the tracks 24, but in a plane below the same, thereby permitting proper movement and operation of said parts. The rack 21 of the frame 20 is engaged by pinion 27, mounted upon the shaft 28, which has a tendency imparted to it to rotate in a given direction by a clock-train 29, feeding the carbons by means of a coil-spring and clock-train, making what might be termed "positive" or "force" feeding lamps. This shaft 28 is suitably journaled upon the frame 14 and the frame 30 of the clock-work. Upon said shaft is also mounted at some distance in the rear of said pinion a spur-wheel 31, which is about twice the size of the pinion. This spur-wheel 31 meshes with the rack 25 of the frame which carries the carbon-holder of the positive carbon 1. The clock-work mechanism by the connections and gearings described tends to drive the carbons in contact with each other and moves the positive carbon through twice the distance that it does the negative carbon, owing to the fact that the spur-wheel governing the positive carbon is twice as large as the pinion controlling the negative carbon in conformity with the well-known practice of providing positive carbons of twice the length possessed by the negative ones. Also mounted upon the shaft 28 (controlled by the clock-work) at the rear end of said shaft is a clutch-wheel 32, having a forwardly-projecting annular flange or rim 33. Located adjacent to this wheel is a vertical swinging lever, such as 34, having cut in its rear edge and near to the upper extremity thereof the biting-slot 35, the edges of which slot are adapted to engage said rim or flange 33 of the wheel in a manner hereinafter mentioned. The weight of said lever 34 is supported by the upper side of the slot 35, bearing upon the internal periphery of the flange 33, so that said lever is free at all times to swing back and forth or oscillate in a manner similar to a clock-pendulum, and at a point a little below the middle of the length thereof said lever is provided with an elongated bearing or slot 36, which is loosely engaged by a screw or pin 37, projecting from the rear side of the vertical cross-bar 38, carried by the core-pieces 39 39 and solenoids 40 and 41. It may be well to state here that the core-pieces 39 39, and the vertical yoke on cross-bar 38 form an I-shaped armature. These solenoids (or they may be termed "magnets") are preferably supported with the poles facing each other by means of upright plates 42, rising from the rear portion of the base-plate 15, and the core-pieces are supported so as to move freely with small amount of friction by means of a horizontal bar 43, rigidly secured to the vertical yoke 38 and extending in a direction parallel with said core-pieces, and with the opposite ends of said bar 43 passing through holes in the plates 42 and supported upon anti-friction rollers 44, fixed upon the exterior of these plates. The solenoid 40 is in main-line circuit and the other solenoid 41 is in shunt-circuit, as hereinafter mentioned. It may be mentioned here that the I-shaped armature just described is by the addition of the horizontal bar 43 formed into what I may term an "⌶-shaped armature."

In the operation of the swinging lever 34 it is necessary that its upper end be held against movement in direction of movement of its lower end, and for this purpose I provide a suitable spring, such as 45, which is curved to a smaller radius than that of the flange 33 and adapted to be contained within the cavity of said clutch-wheel 32. One end of spring 45 is rigidly secured to a projection 46, extending rearwardly from a clock-frame 30 the proper distance, and the other end of the spring is extended around the shaft 28 and engages the upper end of lever 34 and normally presses same in contact with said projection 46.

In Fig. 11 I show a modification of the upper end of lever 34, wherein I show said lever provided with an additional lever 47, which is pivoted at its lower end at 48 to the upper end of said lever 34, which latter in this case is of course devoid of the biting-slot 35. The lever 47 has an elliptical bearing 49 on the shaft 28, so as to be permitted to play slightly in a vertical direction. Upon the rear side of lever 47 is fixed a brake-shoe 50, so as to bear upon the inner periphery of flange 33 at the proper time. Upon the rear side of lever 34, near its upper end, is mounted a roller 51, which is adapted to bear against the outer periphery of flange 33 and grip said flange between it and said brake-shoe whenever said lever 34 is swung in the direction hereinafter mentioned. This arrangement of lever 34 and lever 47 produces what I may term a "toggle" movement, whereby when said levers are thrown toward the position they would assume

when in alignment said roller 51 will be forced against the flange 33, and said flange will be, as before stated, clamped between the roller and the brake-shoe 50, and vice versa.

52 is a spring attached at one end to the upper portion of lever 47 and at the opposite end to a bracket 53, mounted upon some portion of the machine adjacent to the wheel 32, so as to normally draw the upper end of said lever 47 toward said bracket 53, whereby what I may term "slack" will be automatically taken up between the brake-shoe 50 and the roller 51, and these parts are normally held at the proper adjustment for making an instantaneous clutch or brake.

For adjusting the tension of spring 52 I provide a suitable threaded nut and screw, and for limiting and adjusting a movement of the upper end of lever 47 I provide an adjusting-screw 54, which is threaded through a portion of the bracket 53, so that the upper end of said lever may come in contact with its projecting ends, so that when the brake-shoe and other portions of the clutch mechanism wear away proper adjustment for such wear may be made by turning said adjusting-screw 54 in either direction required. (See Fig. 11.) Of course it will be understood that this clutching mechanism just described may be applied to the lamp instead of the clutching mechanism shown in the other figures of the drawings.

A stop 55, carried by the vertical yoke 38, is adapted to come in contact with the inner end of the spool of one of the solenoids 41, and thereby limit the movement of said yoke, and consequently the swinging lever 34, in one direction, and a spring 56, attached to the lower end of said lever 34, is adapted to retard movement of said lever in the opposite direction. As before stated, one end of said spring 56 is attached to lever 34. Its other end is attached to an adjusting-screw 57, passing through one of the vertical frame-plates 42, and a threaded nut 58 is mounted on said screw outside of said plate 42 for adjusting the tension of said spring and normally retaining said lever 34 in the proper position. (See Figs. 5 and 7.)

As an auxiliary to the clutching mechanism just described, I provide a dogging device, which I will now describe. (See Figs. 5, 7, and 9.) The object of this dogging device is to remove all strain from the clutch-wheel 32 and the clutching devices after they have performed the function of interrupting the movement of said clutch-wheel.

In the operation of locomotive head-lights I have found that it is almost impossible to provide an efficient clutching mechanism operated solely by friction, owing to the fact that the jarring and jolting of the parts consequent upon movement of the locomotive at rapid speed is liable to loosen the frictional clutching devices, and thereby permit the carbons to come in contact with each other and extinguish the arc accidentally.

59 indicates a swinging dogging-lever which has a dog 60 formed upon its inner free end, which latter is adapted to engage the teeth of a gear-wheel 61, which is geared to the shaft 28 through pinion 27 and spur-wheel 31, previously described. The outer end of the dogging-lever 59 is rigidly attached to a short rock-shaft 62, mounted in bearings in a bracket 63, which latter is fastened to one end of clock-frame 30. (See Figs 5 and 7.) There is also rigidly attached to said rock-shaft 62 the upper end of another swinging lever or arm 64, the free lower end of which projects downward and carries an adjusting-screw 65 in alignment with (and in the path of) the horizontal bar 43 at one end thereof. A spring 66, having one end attached to said arm 64 and the other end secured to one of the plates 42 or some other stationary part of the lamp, normally pulls said arm inwardly and presses the end of the adjusting-screw 65 against the said end of said bar 43. A suitable lock-nut 67 may also be mounted on the screw 65, (in the well-known manner,) and for the purpose of locking said screw at any desired adjustment. (See Figs. 5, 7, and 9.)

The operation is as follows: The clock-train normally drives the shaft 28 in the direction of the arrows shown in Figs. 1 and 5 and slides the frames 20 upon their tracks or rails and urges the carbons in contact with each other. This is the position of the parts shown in said Fig. 5, except that the carbons are shown a little separated and a small arc between them. The current enters the lamp by way of a binding-post 68 (insulated from the frame-plate 14) and then proceeds by way of a slack wire 69 direct to the shank 5 of the positive-carbon carrier—or not directly either, for it first passes to a switch-handle 70, pivotally but electrically connected to said binding-post 68 (on the opposite side of the vertical frame-plate) and thence to a contact 71, fixed upon, but insulated from, the frame, and thence (if said switch-handle be thrown to said contact) to the wire 69 and the carbon-holder of the positive carbon 1, and thence to the negative carbon 2 and its carbon-holder and shank 5, (which latter is insulated from arm 19,) thence to a metallic projection 72 on said shank, thence to another slack wire 73 to one terminal of the main-line solenoids 40, thence by wire 74 to the other terminal of said solenoids, and thence to the negative binding-post 75. When the lamp is first thrown into circuit, the larger part of the current at first passes through the main coils 40 by way of the contacting-carbons. This draws the yoke 38 and the lower end of swinging lever 34 toward the main-line solenoids, causing the biting-slot 35 (or rather the opposite edges thereof) to grip the flange 33. Of course if the modified form of gripping mechanism shown in Fig. 11 is made use of the brake-shoe 50 and roller 51 will grip said flange 33, as before described. Further movement of the lever 34 toward the main-line solenoids will cause the friction-wheel 32

and the shaft 28 to be slightly revolved in a direction the reverse of that indicated by the arrows in Figs. 1 and 5. This causes the carbons to separate slightly, the movement being in the reverse direction to that imparted to them by the clock-train. The arc having been established by this movement, a portion of the current now passes through shunt-solenoids 41 by way of wires 77, 78, and 79, said wire 77 leading from the binding-post 68 to one of said solenoids, the wire 78 leading from one solenoid to the other, and the wire 79 connecting said solenoids to the wire 73, which forms a portion of the main line. (See Fig. 5.) The passage of current through the shunt-solenoids draws the lever 34 in a reverse direction, and when the carbons burn away and the arc becomes abnormally long and thereby increases the resistance in the main circuit the larger portion of the current traverses the coils of the shunt-solenoids and draws said lever 34 still farther in said direction—that is, toward said shunt-solenoids—which movement releases the edges of the binding-slot 35 from the flange 33 of the clutch-wheel. This release is occasioned by locating the edges of said slot 35 in such position that said flange 33 will pass loosely between them; or in case the clutching mechanism shown in Fig. 11 is made use of the reverse movement just described will release the grip upon the flange 33 which is imposed by the brake-shoe 50 and the roller 51. This will permit the clock-train to again feed the carbons toward each other.

The action of the dogging mechanism (see Fig. 9) in the above operation is as follows: Whenever the lever 34, and consequently the horizontal bar 43, is drawn toward the right hand in Fig. 5 by the power of the main-line solenoids, the spring 66 causes the arm 64 to follow up such movement, and thereby throw the dog 60 upward into engagement with the teeth of the gear-wheel 61 at about the same instant that the clutch-wheel 32 is brought to a standstill, (should it be revolving.) A reverse action to this takes place when said horizontal bar 43 is moved in a reverse direction by the power of the shunt-solenoids 41—that is, the arm 64 will be thrown outward and the dog 60 downward—thus releasing said wheel 61 and permitting it to revolve in train with the clutch-wheel 32. The advantages of this dogging device have already been stated. It will thus be seen that the arc is controlled by the improved dogging device and clutch mechanism, which latter are in turn controlled by the oppositely-arranged main and shunt solenoids, either restraining the tendency of the carbons to feed, permitting them to feed, or moving them from each other.

The operation of the hand-switch, the lever whereof is indicated by 70, is so obvious that it needs no further elucidation.

In inserting a carbon into my improved carbon-holder it can be seen that the U-shaped clamping-piece 9 will engage the carbon at two separate and distinct points upon the peripheral surface thereof, neither of which is directly opposite the point at which the carbon is engaged by (or engages) the socket 3, and that the carbon will thereby be substantially "centered" in the carbon-holder—that is, the carbons will not be pressed to one side of a line drawn through the center of the binding-screw 7 and said carbon-holder, as it might be were an ordinary clamping-screw devoid of the U-shaped clamping-piece made use of.

By projecting the inner ends of the carbon-steadying devices 12 through apertures in the reflector, so that their adjacent ends lie in close proximity to the arc within said reflector, I provide a very steady support for said carbons at a point where supports are most needed in electric head-lights, they being subjected to jolting and vibration, which are violent and long-continued at times, and in cases where such supports are not provided I have found by experiment that the horizontal carbons will shake and vibrate to such an extent as to greatly interfere with the regularity of the arc and jar loose from their carbon-holders; also, by providing the projecting ends of said steadying devices with a coating of reflecting substance, as hereinbefore described, I virtually make a convex reflector of each of said carbon-steadying devices, which, acting in combination with the main reflectors, diffuse the rays of light which are reflected from the main reflector, and thus considerably increase the power of the said main reflector, which, obviously, would be considerably decreased were said carbon-steadying devices not in the form of reflectors. Thus, further, the horizontal carbons are supported by reflectors—in fact, they are supported at a point closely adjacent to the arc by reflectors; but it should be clear that, instead of forming the projecting ends of the carbon-steadying devices 12 into reflectors, I may, as before stated, support the carbons by other forms of small reflectors, provided they be located within the main reflector 17. The specific cylindrical form in which I here show these small reflectors is only one of a various number of forms which I may in practice see fit to use. For this reason I do not desire to limit myself to small reflectors of cylindrical contour, as many other forms well known in the art may be substituted for them without departure from the spirit of my invention in this regard.

Regarding the reciprocating frames 20, which carry the carbon-holders, it can be observed that said frames lie in a horizontal position in different vertical and horizontal planes, one above and in the rear of the other, and that they are held in position and guided by V-shaped guides or tracks formed integral with the frame of the lamp, thus holding said frames rigidly in proper position during operation and preventing in a great measure the play and vibration which occurred in the

former apparatus of this nature invented by me. I also provide a frame for a locomotive head-light having horizontal carbons, which frame has its main vertical frame-plate with horizontal V-shaped guides cast integrally with its horizontal base-plate. This latter construction enables me to support the different parts very rigidly and to compact them within a small space. This combination of a horizontal base-plate and a vertical frame-plate having horizontal guides formed therein for the horizontal carbon-carrying devices I have found to be very essential to the satisfactory operation of a head-light in which horizontally-sliding carbons are employed.

What I claim is—

1. In an electric-arc lamp, a carbon-holder having a tubular socket 3, fitted near one end with a housing 6, having a screw-threaded perforation 7, and a set-screw mounted in said perforation, and a broad thin shank 5, located at the opposite end of said socket, so as to be held at right angles thereto and in alignment with said housing, whereby both the housing and the shank are adapted to slide within the slot of a slotted carbon-steadying device, substantially as set forth.

2. In an electric head-light fitted with an arc lamp, a reciprocating frame 20, having a rack 21 cut upon the edge thereof, a series of pins 22, projecting from one side of said frame and a series of rollers 23, having in the peripheral face thereof V-shaped grooves, in combination with the frame of the lamp comprising the base-plate 15, and vertical frame-plate 14, arising from said base-plate and having V-shaped guides or tracks 24 formed integral with said vertical plate and extending therein in a horizontal direction and adapted to hold and guide said reciprocating frames, substantially as set forth.

3. In an electric arc lamp, the combination of a suitably-impelled shaft adapted to control the carbons by its rotation, a clutch-wheel 32, mounted on said shaft and having a flange or rim 33, a spring, a stop-pin, a swinging lever 34, having a biting-slot 35 near its upper end, which slot is adapted to engage said flange on said wheel and lock said wheel in a fixed position when said lever is moved in a given direction, and solenoids or magnets adapted to control the movement of said lever, substantially as set forth.

4. In an electric-arc lamp, the combination of a frictional brake mechanism, a clock-work mechanism, and a dogging mechanism for said clock-work mechanism, the same adapted to operate in conjunction with said frictional brake mechanism and comprising a swinging lever having a dog upon its free end adapted to engage the teeth of the gear-wheel forming a portion of said clock-work mechanism, and thereby instantaneously interrupt the feeding movement of the carbons of the lamp, substantially as set forth.

5. In an electric-arc focusing-lamp, the combination of a frame-plate carrying two separate reciprocating frames for carrying the carbons and provided with carbon-holders, all horizontally arranged and parallel to each other, horizontally-arranged carbons, a clock-train provided with a coil-spring motor adapted to operate the reciprocating frames and feed the carbons together, horizontally-arranged main and shunt solenoids with connected armatures which act electrically and automatically on a clutch-lever-wheel device attached to the feed-shaft to arrest or rotate said shaft in a reverse direction to produce the arc and maintain it by regulating the feed of the carbons, a lever with a pawl or a dog device that engages automatically with the teeth of a gear-wheel in the clock-work and interrupts the feeding movement of the lamp, and a differential and a positive or force feed of carbons automatically controlled by the electric current, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES E. GASTON.

Witnesses:

D. P. BARKER,

E. E. LONGAN.