(No Model.) 5 Sheets—Sheet 1.

J. E. GASTON.

ELECTRIC ARC LAMP.

No. 482,240. Patented Sept. 6, 1892.

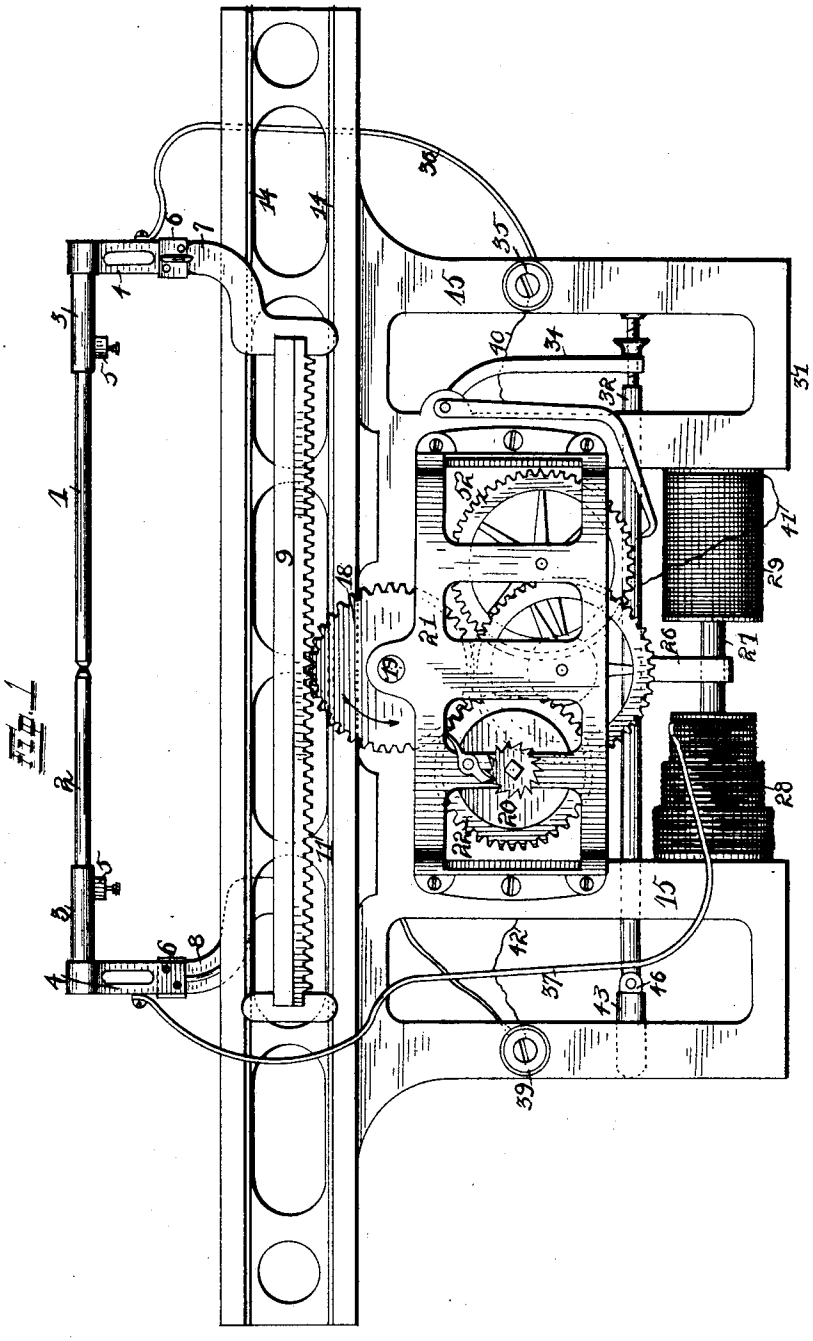

Fig. 1.

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J. E. GASTON.

ELECTRIC ARC LAMP.

No. 482,240. Patented Sept. 6, 1892.

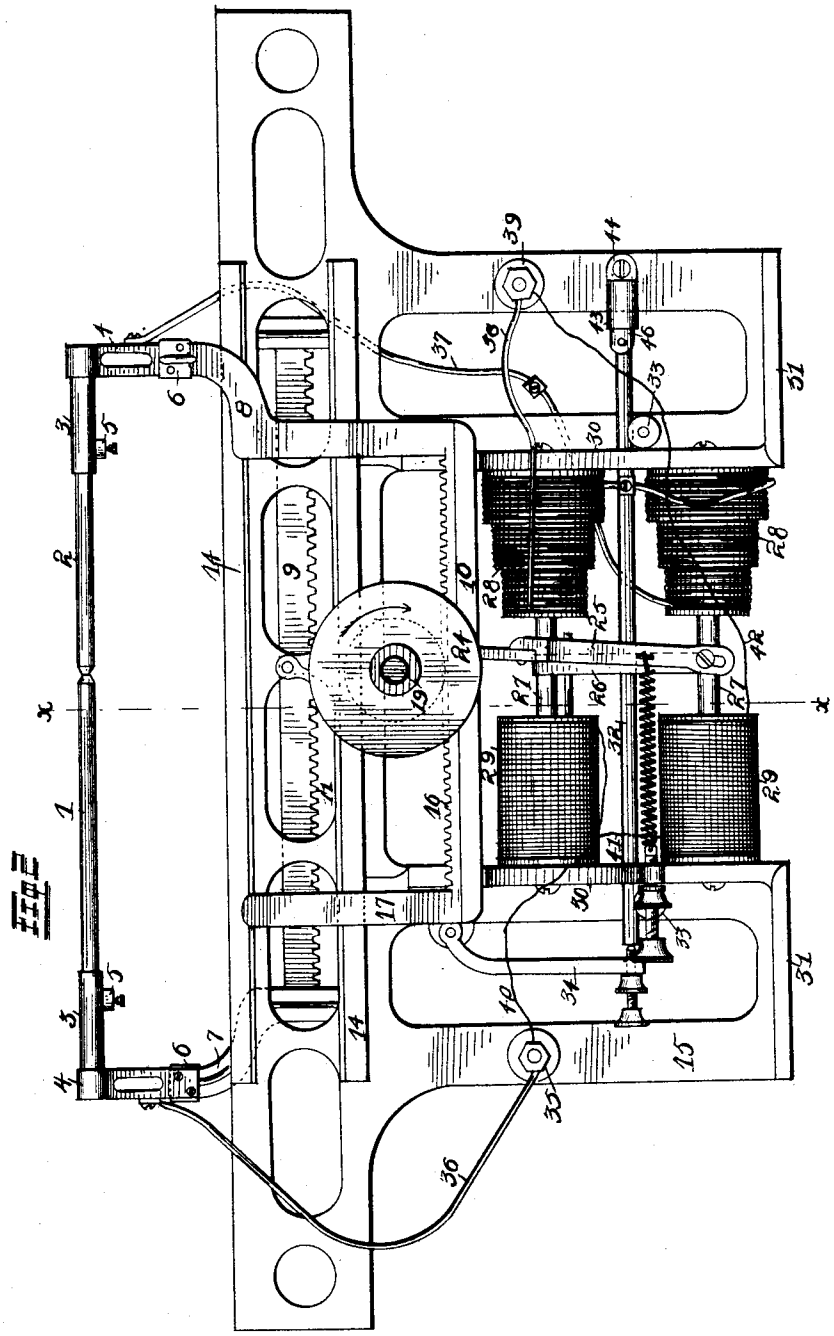

Fig. 2.

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J. E. GASTON.

ELECTRIC ARC LAMP.

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Fig. 4

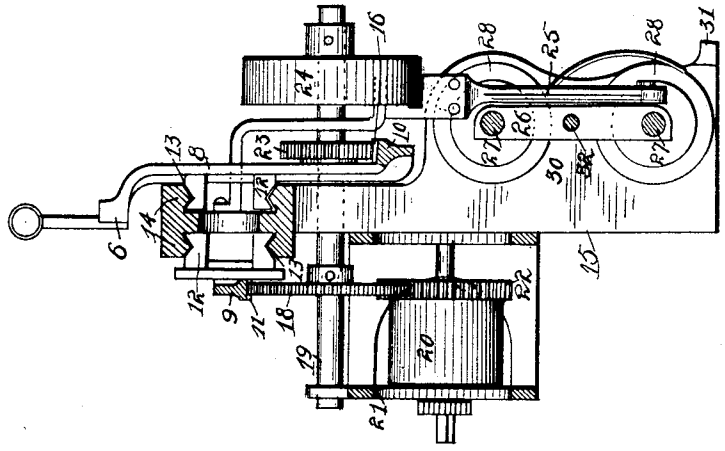
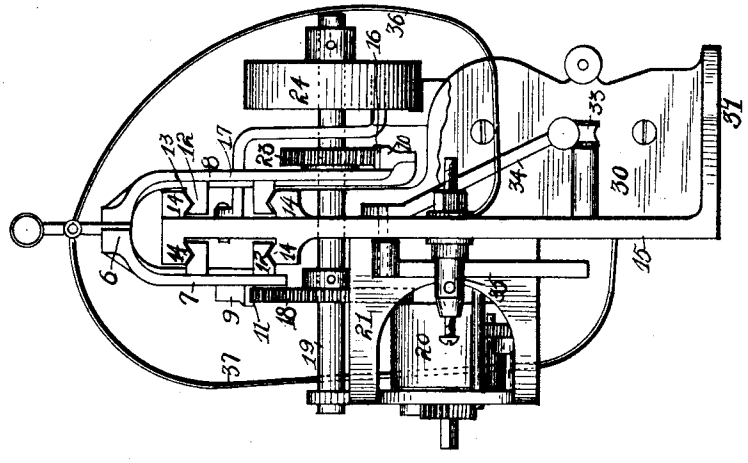


Fig. 3



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ELECTRIC ARC LAMP.

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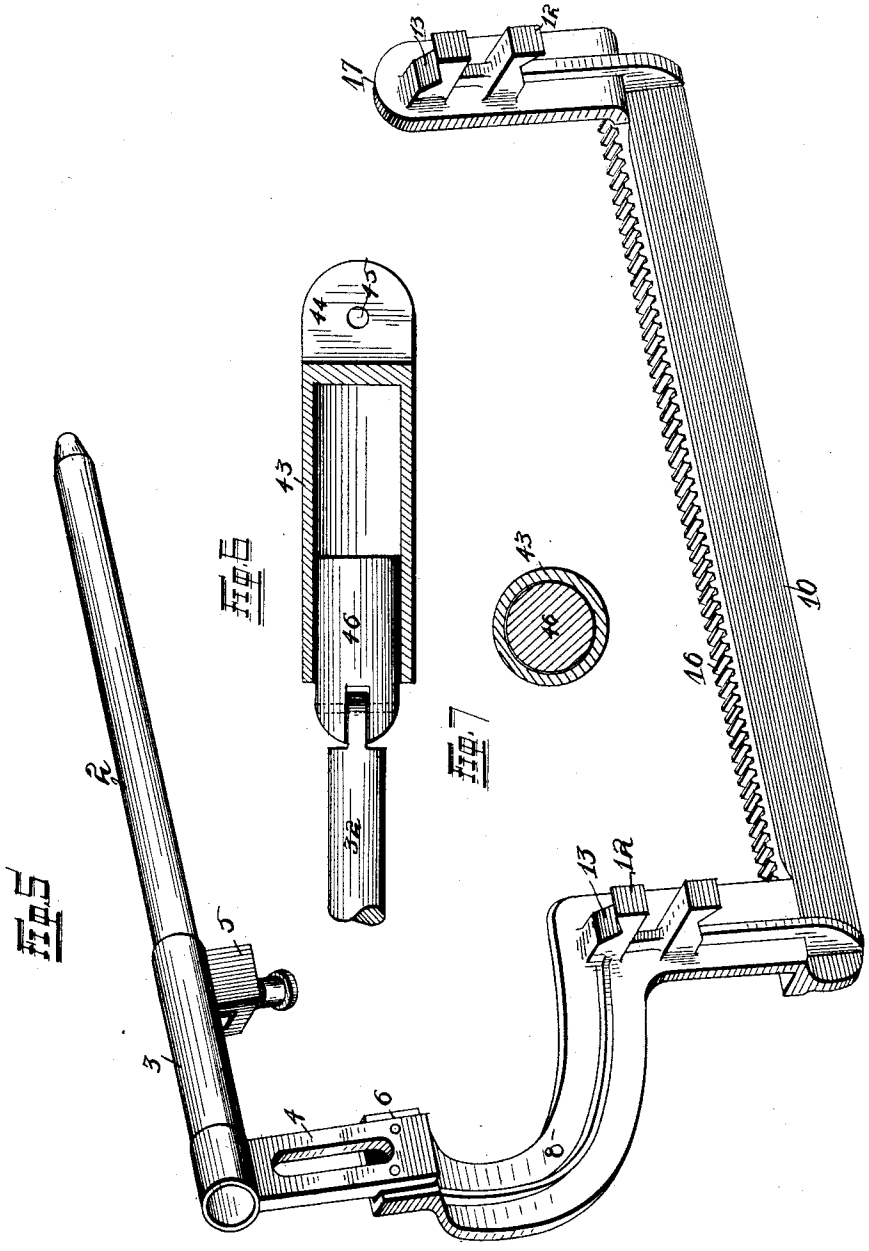

FIG. 5

FIG. 6

FIG. 7

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(No Model.) 5 Sheets—Sheet 5.

J. E. GASTON.

ELECTRIC ARC LAMP.

No. 482,240. Patented Sept. 6, 1892.

Fig. 8

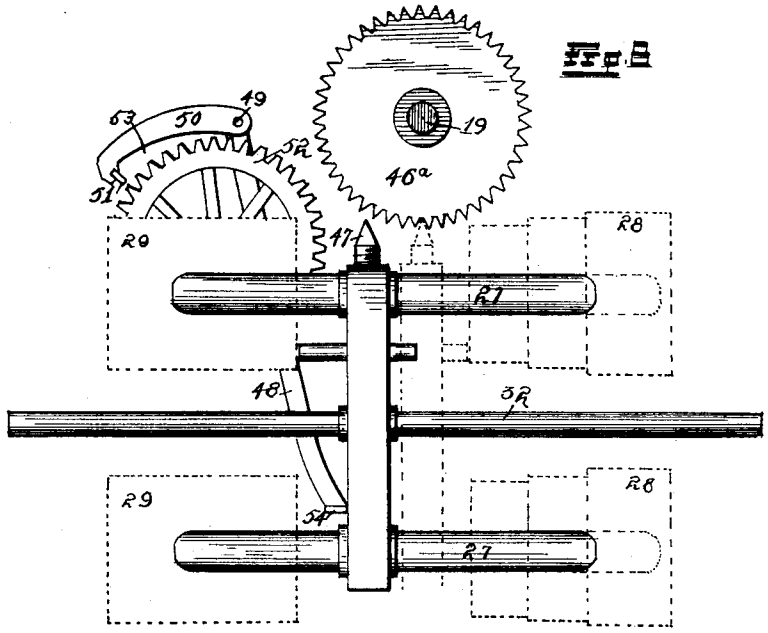

Fig. 9

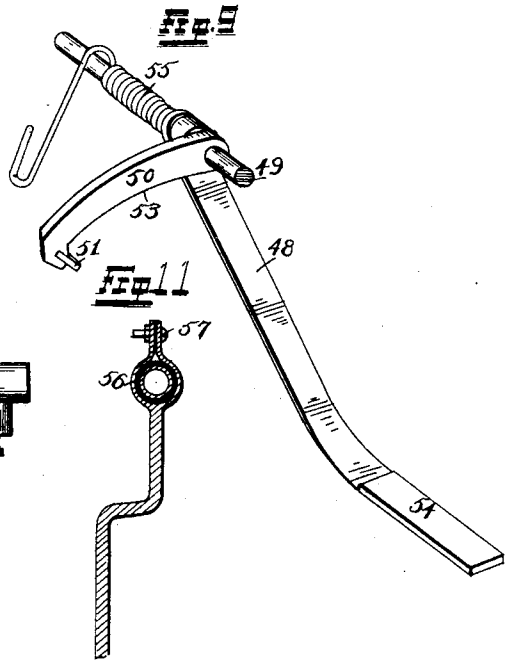

Fig. 10

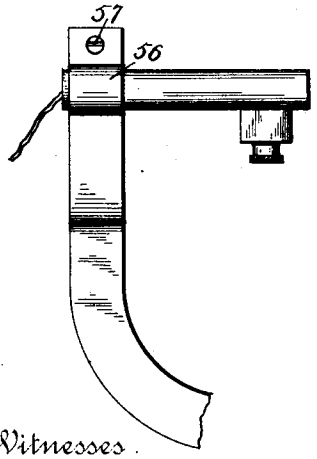

Fig. 11

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UNITED STATES PATENT OFFICE.

JAMES E. GASTON, OF SPARTA, ILLINOIS, ASSIGNOR TO THE GASTON ELECTRICAL MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 482,240, dated September 6, 1892.

Application filed May 31, 1892. Serial No. 435,000. (No model.)

To all whom it may concern:

Be it known that I, JAMES E. GASTON, of the city of Sparta, Randolph county, State of Illinois, have invented certain new and useful Improvements in Horizontal-Carbon Electrical 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 is designed as an improvement in the horizontal-carbon electric head-light patented to me May 24, 1892, by United States Letters Patent No. 475,727.

The object of the invention is to improve upon the general construction shown in said patent.

In the drawings, Figure 1 is a front elevation of my improved horizontal-carbon arc lamp for locomotive head-lights with reflector removed. Fig. 2 is a rear elevation of the same. Fig. 3 is an end view of the same, looking toward the right-hand of Fig. 2. Fig. 4 is a transverse sectional elevation, the section being taken on the line *x x* of Fig. 2. Fig. 5 is a perspective view of one of the two sliding frames made use of in carrying out the invention. Fig. 6 is a detail sectional side elevation of a dash-pot made use of. Fig. 7 is a cross-section through the same, taken on the line *y y* of Fig. 6. Fig. 8 is a rear view of a modified form of clutch and dogging mechanism with parts of the lamp-frame removed. Fig. 9 is a detail view of the modified brake and clutch lever. Fig. 10 is a detail side view of a modification of the carbon-holder, and Fig. 11 is a transverse section through the same on line *z z* of Fig. 10.

1 indicates the positive carbon, and 2 the negative carbon, both of which are located in a horizontal position and properly held by carbon-holders, each consisting of a tubular socket 3, mounted at its outer end upon (or formed integral with) a shank 4, so as to be held at a right angle to said shank, and carrying at its free inner end any suitable carbon-clamp 5.

Initiatory to further description I may call attention to the fact that in the improved horizontal-carbon lamp I have discarded all carbon-steadying devices adjacent the arc.

The inner end of each carbon in use is adapted to project through apertures formed in the sides of the reflector, (not shown,) so that their adjacent ends will rest normally in contact. The shanks 4 of both positive and negative carbon holders are constructed of about the same size and shape, so that but one pattern is used in casting both. Both shanks are constructed so that their lower ends snugly fit in sockets 6, formed upon the projecting upper extremities 7 and 8 of the positive and negative sliding frames 9 and 10, respectively, and are firmly secured in such position by means of suitable screws or bolts; but at the point of junction said shanks are carefully insulated from said sliding frames. The arm 7 is preferably cast integral with the outer end of the positive sliding frame 9, which has the rack 11 cut upon its under edge.

Projecting from the rear surface of frame 9, adjacent to each end of same, are a series of guide-blocks or projections 12, having in their opposite outer edges V-shaped or otherwise-shaped grooves 13, which extend in a direction parallel to the horizontal body of said frame, and which grooves are adapted to engage with correspondingly-shaped horizontal tracks 14 oppositely located in or formed upon the vertical plate 15 of the lamp-frame. (See Figs. 3 and 4).

The shank 4 of the negative carbon 2 is connected, as above set forth, to an additional sliding frame 10, which is somewhat similar to the frame 9 in general construction, with the exception that it is provided with a series of guide-blocks 12 on its front surface and has a rack 16 cut upon its upper edge. Said sliding frame 10 also differs from the frame 9 in that it has a vertical arm 17 secured to its terminal which is opposite the end to which the carbon-holder is attached, said arm 17 having a free upper end. It will also be observed that the frame 10 is constructed with its horizontal body portion carrying the rack 16, located in a plane some distance below the body portion of the other sliding frame 9. The purpose of this construction will appear farther on. The arm 7 of the sliding frame 9 and the arm 8 of the sliding frame 10 are curved or diverged outwardly toward the end of the frame of the lamp to which they are the most closely adjacent, for a purpose hereinafter stated. I

desire to state that the purpose of the guide-blocks 12 is to hold and guide the sliding frames to which they are attached in or upon the oppositely-located tracks 14 of the vertical plate 15, and although I here show said blocks constructed with V-shaped grooves in their edges, yet it should be evident that other forms of grooves may be substituted for said V-shaped form and that the form of the blocks themselves and the form of the contacting surfaces of the said tracks may be changed without departing from the scope of my invention. The said sliding frame 10 is mounted on the rear side of the vertical frame-plate 15, with its guide-blocks 12 engaging a second pair of horizontal tracks 14, similar to those which are engaged by the guide-blocks of the frame 9, the said second pair of tracks being formed in or located upon the rear side of said vertical plate. The tracks for both the frame 9 and the frame 10 are located in the same plane, one on the front and one pair of tracks on the rear side of the vertical frame-plate 15, and all extend parallel and horizontally. This latter construction is what I claim to be a novel and important feature in an arc lamp for electric head-lights, for the reason that it permits the carbon-carrying frames 7 and 8 to be located very close together, thereby economizing the very limited space commanded in such apparatus and permitting other parts of the machine to be located in the space formerly occupied by one of said frames and its tracks when the same were arranged as shown in my patent hereinbefore mentioned. The rack 11 of the frame 9 is engaged by a pinion 18, mounted upon a short transversely-located shaft 19, which has imparted to it by a clock-train 20 a tendency to rotate in a given direction. The construction is such, as will be hereinafter stated, that the carbons are fed by means of a coil-spring and clock-train, thereby making a force-feed lamp. The shaft 19 is suitably journaled upon the vertical frame-plate 15 and the frame 21 of the clockwork. It will be noticed that the pinion 18 not only engages the rack 11 of the frame 9, but is itself engaged by the gear-wheel 22 of the clock-train, thereby forming a direct-geared connection between the spring-barrel of said train and the said rack and avoiding the use of intermediate pinions and gears for said purpose. It will further be noticed that the pinion 18 is located upon the shaft 19 in a position in front of the vertical frame-plate 15 and the tracks which carry the sliding frame 9. In fact, the entire clock-train is located upon the front side of the vertical frame-plate. Upon said shaft 19 is also fixed on the opposite side of said vertical frame-plate another pinion 23, which is only about one-half the size of the pinion 18. This pinion 23 meshes with the rack 16 of the sliding frame, which carries the negative carbon 2. The clock-train, by the connection described, tends to drive the carbons into contact with each other and moves the positive carbon through about twice the distance that it does the negative carbon, owing to the fact before stated that the pinion governing the positive carbon is about twice as large as the pinion controlling the negative carbon, in accordance with the well-known practice of providing positive carbons of twice the length possessed by the negative carbons. Also mounted on the shaft 19 near its rear end is a clutch-wheel 24, and located adjacent to this wheel is a vertical swinging lever 25. The purpose of this clutch wheel and lever is to control the movement of the clock-train in feeding the carbons; but as the same forms no part of my present invention further description thereof need not be made herein. The said swinging lever 25 is connected near its lower end to the vertical cross-bar 26, carried by the core-pieces 27 of solenoids 28 and 29. These solenoids (or they may be termed "magnets") are preferably supported with poles facing each other by means of vertical transverse plates 30, rising from the horizontal base-plate 31 and projecting from the rear face of the vertical plate 15, and said core-pieces are supported so as to move with little friction by means of a horizontal bar 32, rigidly secured to the vertical cross-bar 26 and extending in a direction parallel to said core-pieces and with the opposite ends of said bar passing through apertures in the plates 30 and supported upon anti-friction rollers 33, fixed upon the sides of these plates opposite the ones to which the solenoids are attached. The solenoid 28 is in main-line circuit and the other solenoid 29 is in a shunt-circuit, as hereinafter mentioned. As the construction of the said solenoids and their operative connections are substantially the same as that shown in my patent hereinbefore mentioned, and as such form no part of my present invention, I do not deem it necessary to give herein a minute description of their construction and operation.

34 indicates a portion of the dogging mechanism made use of in operating the lamp; but as it forms no part of this invention I will not describe it.

43 indicates a dash-pot cylinder, which is provided with a bore of suitable size having its free end open and provided at one end with a lug 44, provided with a perforation 45 for the passage of a suitable bolt or screw used in securing said cylinder in place upon the vertical frame-plate 15, adjacent to and in alignment with the end of the horizontal bar 32, which is opposite the end engaged by the dogging device 34. 46 is a piston fitted within said cylinder 43 and adapted to reciprocate therein. The outer end of this piston is pivotally or loosely connected to the projecting end of the horizontal bar 32, so that when said bar is slid back and forth said piston will be correspondingly reciprocated within the cylinder 43. The stroke of the piston of course corresponds with the length of the cylinder, so that some portion of the piston will at all times

be mounted in said cylinder. (See Fig. 6.) This forms what I may term a "dash-pot connection" for the core-pieces of the solenoids, the purpose of which is to prevent violent movement of and shocks by the reciprocations of said core-pieces when the lamp is suddenly thrown in circuit. To illustrate: Suppose the lamp is thrown in circuit suddenly, as by snap-switch. The main-line solenoids 28 will violently draw the core-pieces toward themselves, which is toward the right hand in Fig. 2, and if it were not for the intervention of the dash-pot connection the several parts would be subjected to a violent and perhaps injurious jar or shock; but with the dash-pot connection applied as here shown such jar or shock will be prevented by reason of air in the cylinder 43 being compressed and permitted to escape gradually around the periphery of the piston, the fit of the piston being sufficiently loose to permit this.

Referring now to Figs. 8 and 9, I show a modified form of clutch and dogging mechanism, by means of which I do away with the clutch-wheel 24 and its swinging lever 25. In this modified form of clutching and dogging mechanism 46ª indicates a clutch-wheel having a series of teeth arranged around its periphery, which teeth have sharpened or attenuated outer extremities, for a purpose hereinafter mentioned. This wheel 46ª is mounted on shaft 19 in the place where the usual clutch-wheel 24 is mounted. 47 indicates a vertical projection having an attenuated upper extremity and fixed at its lower end upon the upper end of the cross-bar 26 of the armature or fixed to some other portion of said armature, so that its pointed end will project upwardly and engage the teeth of the wheel 46ª when the cross-bar 26 is drawn toward the right hand in Fig. 8 by the action of the main-line solenoids when the lamp is thrown in circuit, and the pointed end of the projection 47 will be moved out of engagement with the teeth of said wheel when the cross-bar 26 is moved in a reverse direction, which action will permit the said wheel 46ª to revolve in the direction indicated by the arrow. I also do away with the dogging mechanism 34 in some cases and substitute that which I shall now describe.

Referring again to Figs. 8 and 9, 48 indicates a swinging lever, which is pivotally mounted at its upper end by being connected to a short transverse shaft 49, which latter has bearings in suitable portions of the clock-frame 21. A combined detent and brake-shoe 50 is rigidly secured upon the shaft 49 so as to project at about a right angle to the lever 48 and carries at or near its free end a projection 51, which is adapted to engage and lock the teeth of one of the high-speed wheels 52 of the clock-train 20. The combined detent and brake-shoe 50 is arranged in a curved contact-face 53, the curvature of which corresponds to the curvature of the periphery of the wheel 52, so that said curved contact-face may contact with a considerable number of the teeth of said wheel during operation. The lower end of the lever 48 is provided with a projection 54 at its lower end or near thereto, which normally rests in engagement with one side of the cross-bar 26 and is held in engagement at all times by a suitable spring 55, which is coiled about the shaft 49 and has one end fixed to move with said shaft and the other end attached to some stationary portion of the clock-frame 21. In some cases I may construct the shanks 4 of the sliding frames 9 and 10 integral with the curved arms 7 and 8 of such frames, and such construction I have illustrated in Figs. 10 and 11. I may also use a modified form of carbon-holder, which I show in said last-named figures, wherein the tubular socket 3 is shown removably inserted in a pair of clamping-jaws 56. These clamping-jaws have their lower ends formed integral with the shanks 4 and their bodies suitably curved to fit the tubular socket and their upper ends constructed to be forcibly urged toward each other by means of a suitable thumb-screw or bolt 57. Of course the tubular socket 3 is suitably insulated from the jaws 56, and the conducting-wire is connected to the outer end of the socket 3 in any suitable manner.

The operation is as follows: The clock-train normally drives the shaft 19 in the direction of the arrows shown in Figs. 1 and 2 and slides the frame 9 and 10 upon their tracks and urges the carbons in contact with each other. This is the position of the parts shown in said Figs. 1 and 2. The current enters the lamp by way of a binding-post 35 (insulated from the vertical frame-plate 15) and then proceeds by way of a slack wire 36 direct to the shank 4 of the positive-carbon holder, thence to the pisitive-carbon holder and the positive carbon 1, thence to the negative carbon 2 and its carbon-holder and shank, thence by way of another slack wire 37 to one terminal of the main-line solenoids 28, and thence by way of a conductor 38 to the negative binding-post 39. When the lamp is first thrown in circuit, a larger part of the current at first passes through the main-line solenoids 28 by way of the contacting carbons. This draws the vertical cross-bar 26 and the lower end of the swinging lever 25 toward the main-line solenoids, causing the upper end of said lever to engage the clutch-wheel 24, (in the manner which need not be stated.) Further movement of the lever 25 toward the main-line solenoids will cause the clutch-wheel 24 and the shaft 19 to be slightly revolved in a direction the reverse of that indicated by the arrows in Figs. 1 and 2. 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 the shunt-solenoids 29 by way of conductors 40, 41, and 42 to the negative binding-post 39. The passage of

current through the shunt-solenoids draws the lever 25 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 still farther in said direction—that is, toward said shunt-solenoids—which movement releases the clutch-wheel from the said lever. The manner of this release need not be explained here, it being fully described in my patent hereinbefore mentioned. This release of the clutch-wheel will permit the clock-train to again feed the carbons toward each other, and so on. It will thus be seen that the arc is controlled by the lever 25 and the clutch mechanism, which are in turn controlled by the oppositely-located main and shunt solenoids, either restraining the tendency of the carbons to feed, permitting them to feed, or moving them from each other.

The object in constructing the horizontal body portion of the sliding frame 10 in a plane below the plane in which the body portion of the other sliding frame 9 is located is to prevent the location of one frame above the shaft 19 and the other frame below the same, and thereby economize in space necessary for such parts and compact them as much as possible.

Regarding the main frame of the lamp, I call attention to the fact that all its parts are cast integral, the vertical plate 15 being cast solid with the base-plate 31, and the tracks for both frame 9 and frame 10 are cast integral with said vertical plate, are located in the same plane, one on the front and one on the rear of said vertical plate, and all extend parallel and horizontally.

The operation of the modified clutch and dogging mechanism is as follows, (see Figs. 8 and 9:) The cross-bar 26 of the armature being in the position shown in Fig. 8 and the other parts being in the position shown in Figs. 1 and 2, and the lamp thrown in circuit, the cross-bar 26 will be drawn toward the main line solenoids 28, which will cause the vertical projection 47 to engage one of the teeth of the clutch-wheel 46^a and partially rotate said wheel in the direction indicated by the arrow in Fig. 8, which will cause the shaft 19 to be moved a corresponding amount, and this will cause the carbons to separate slightly. The arc having been established by this movement, a portion of the current now passes through the shunt-solenoids 29 by way of conductors 40, 41, and 42 (shown in Fig. 2) to the negative binding-post 39. The passage of current through the shunt-solenoids draws the attenuated projection 47 in a reverse direction, and when the carbons burn away and the arc becomes abnormally long the larger portion of the current traverses the coils of the said shunt-solenoids and draws said projection 47 still farther in said direction, which movement releases the wheel 46^a, and the clock-train revolves the shaft 19 and feeds the carbons, and so on. As soon as the carbons have been fed a sufficient distance to form a normal arc the cross-bar 26 is again drawn toward the main-line solenoids 28 until the projection 47 again engages one of the teeth of the clutch-wheel 46^a, which movement will suddenly arrest the further feeding of the carbons, and at the same time the spring 55 causes the projection 51 on the combined detent and brake-shoe 50 to engage the teeth of the high-speed wheel 52 and thereby lock said wheel against further movement. Meanwhile the curved face of the brake-shoe 50 has come in contact with a series of the teeth of the wheel 52 and materially aided in bringing said wheel to rest. This latter construction is what I term my "modified form of dogging mechanism," and the purpose of which is to form a double lock for the carbon-feeding mechanism, so that in case the projection 47 should inadvertently happen not to engage the teeth of the clutch-wheel 46^a at the proper time, or if the clutching mechanism (shown in Figs. 1 and 2) should happen to get out of order, the improved dogging mechanism will act and interrupt the feeding of the carbons at the proper moment. The dogging mechanism also acts as an aid to the clutching mechanism, taking a portion of the strain upon itself, instead of permitting all strain to be thrown upon the clutching mechanism in arresting the feed of the carbons. The combined detent and brake-shoe 50 also provides what I may term a "gradual release" for the clock-train in feeding the carbons, which is brought about by reason of the inner end of the said part 50 being raised out of contact with the teeth of the wheel before the projection 51 is disengaged from the teeth, permitting the clock-train to feed the carbons gradually and without sudden start from a position of rest.

What I claim is—

1. In an electric-arc lamp, the improved carbon-carrying sliding frame comprising the horizontal body portion provided with a rack 11 upon its under edge, guiding devices, as 12, projecting from one face adjacent its ends, and an outwardly-diverging arm 7, provided at its outer terminal with a socket 6, substantially as and for the purpose set forth.

2. In an electric-arc lamp, the improved carbon-carrying frame comprising the horizontal body portion provided with a rack 16 upon its upper edge, guiding devices, as 12, projecting from one face adjacent its ends, an outwardly-diverging arm 8, provided at its outer terminal with a socket 6, and a vertical arm 17, secured to the end of the body portion which is opposite that to which said outwardly-diverging arm is connected, substantially as and for the purpose set forth.

3. In an arc lamp, the frame-plate having opposite guiding-tracks 14 projecting from opposite sides of said frame-plate and the tracks projecting from one side of said frame-

plate in the same plane with those which project from the opposite side of the frame-plate, substantially as and for the purpose set forth.

4. In an arc lamp, the frame-plate having opposite guiding-tracks 14 projecting from opposite sides of said frame plate and the tracks on one side of the frame-plate located parallel with the tracks on the opposite sides of said frame, substantially as and for the purpose set forth.

5. The improved frame for arc lamps, comprising the horizontally-extending base-plate 31, adapted to support the lamp mechanism, the vertical plate 15, rising from said base-plate at a right angle thereto, and the tracks 14, located one pair on the front and one pair on the rear side of said vertical plate, the upper track of each pair extending horizontally in the same plane and all located parallel to each other and to said base-plate, substantially as and for the purpose set forth.

6. In a positive-feed arc lamp, the combination of a clutch-wheel having a series of teeth arranged with attenuated outer extremities and a projection having an attenuated extremity adapted to engage said teeth and turn said wheel in either direction, substantially as and for the purpose set forth.

7. In a positive-feed arc lamp, a clock-train having a high-speed wheel, as 52, in combination with the combined detent and brake-shoe 50, constructed and arranged to engage the teeth of said wheel simultaneously as a detent and a brake-shoe, substantially as and for the purpose set forth.

8. In an arc lamp, the improved carbon-holding arm comprising a shank 4, formed integral with the sliding frame, a pair of clamping-jaws 56, formed integral with the upper end of said shank, the tubular socket 3, removably located between said jaws and having a suitable carbon-clamp, and a screw, as 57, for causing said jaws to bind upon said tubular socket, substantially as and for the purpose set forth.

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

JAMES E. GASTON.

Witnesses:
HERBERT S. ROBINSON,
ALFRED A. EICKS.