(No Model.)

2 Sheets—Sheet 1.

W. A. NICHOLSON.

ELECTRIC ARC LAMP.

No. 464,132. Patented Dec. 1, 1891.

Fig. 1.

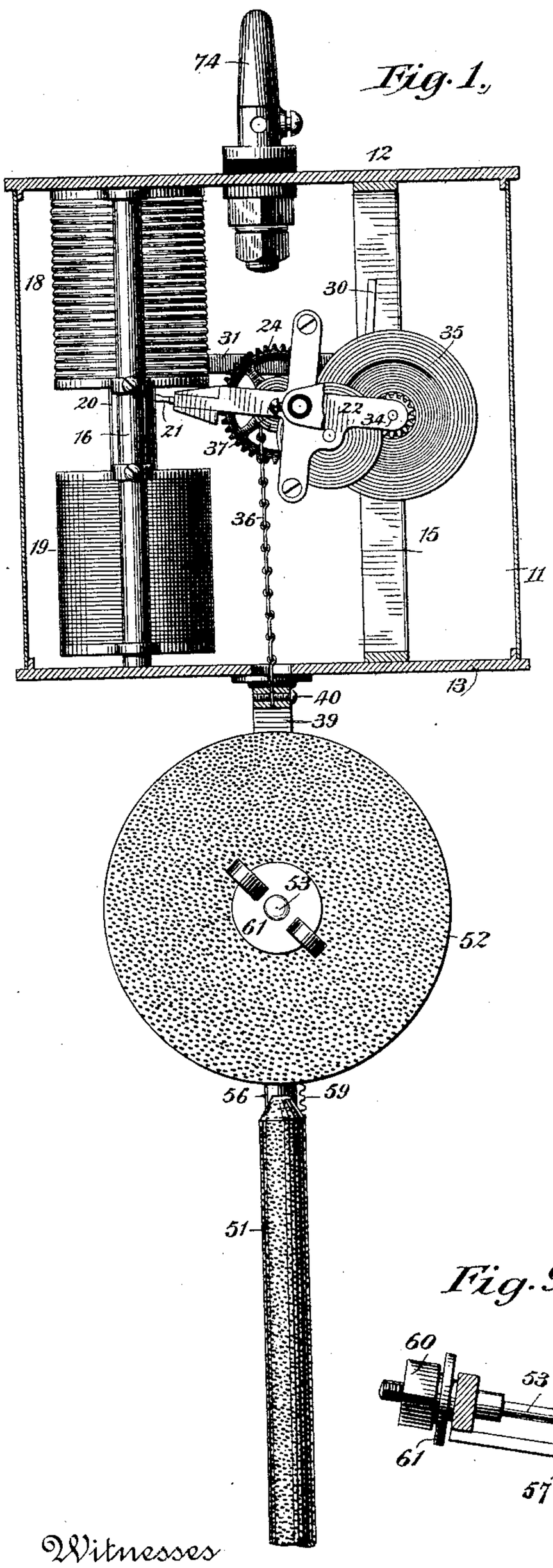

Fig. 2.

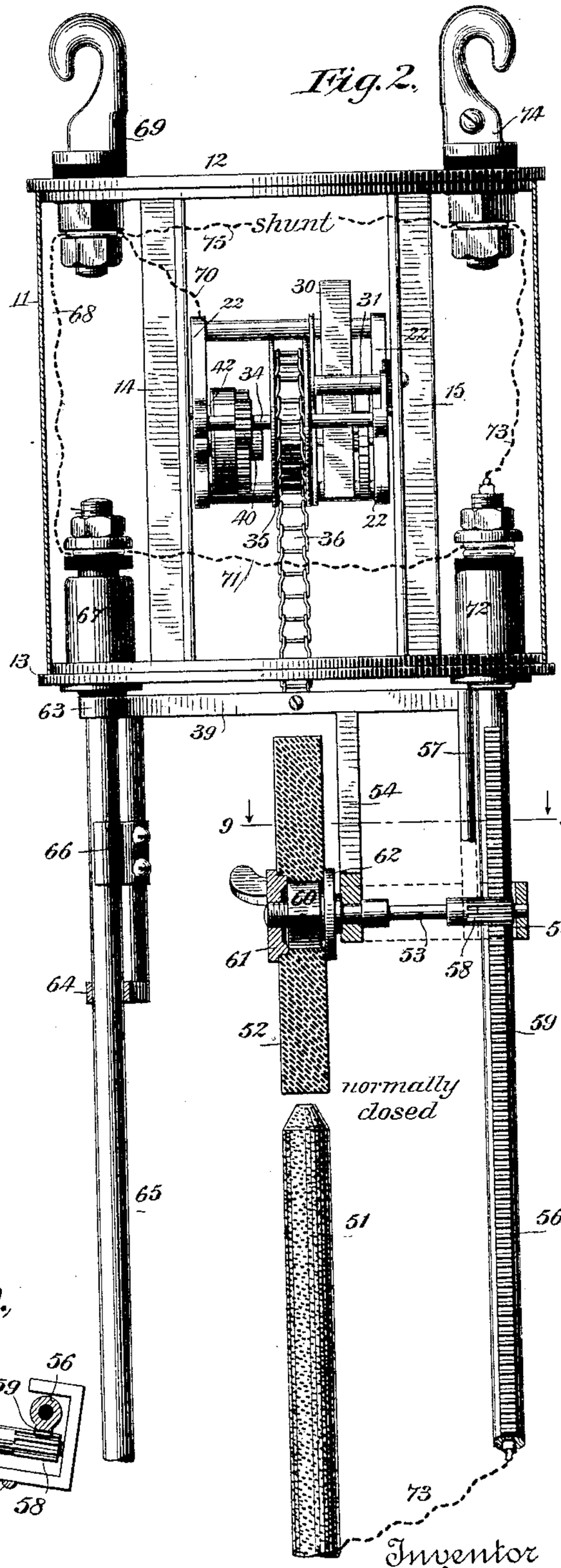

Fig. 9.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

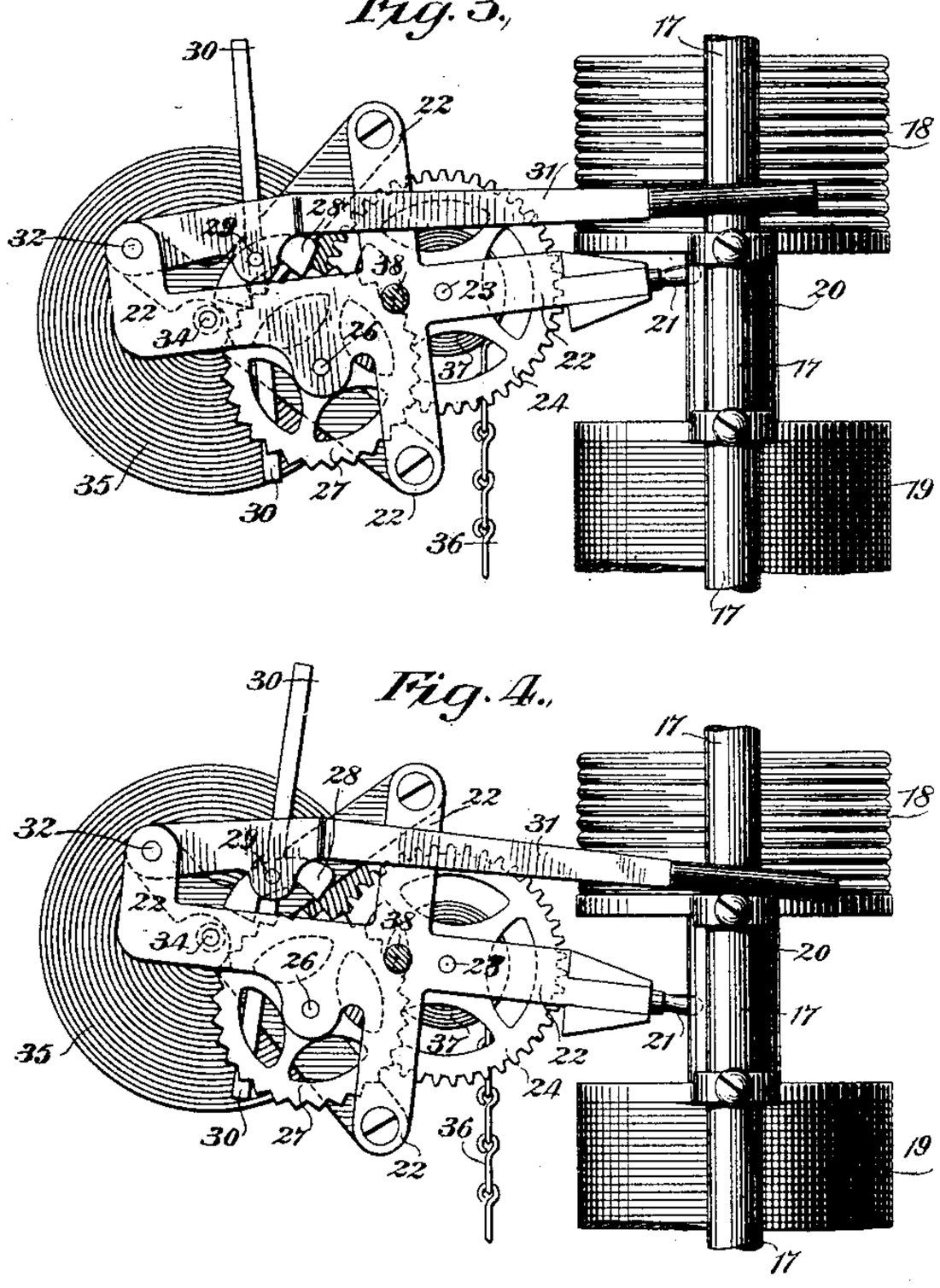


Fig. 6.

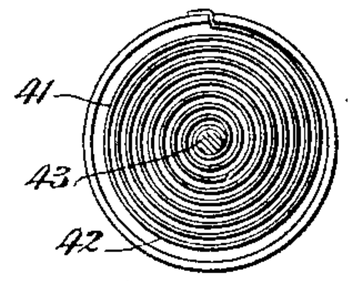


Fig. 4.

Fig. 7.

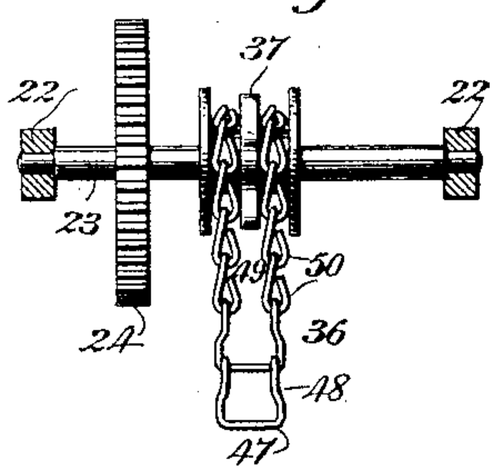


Fig. 5.

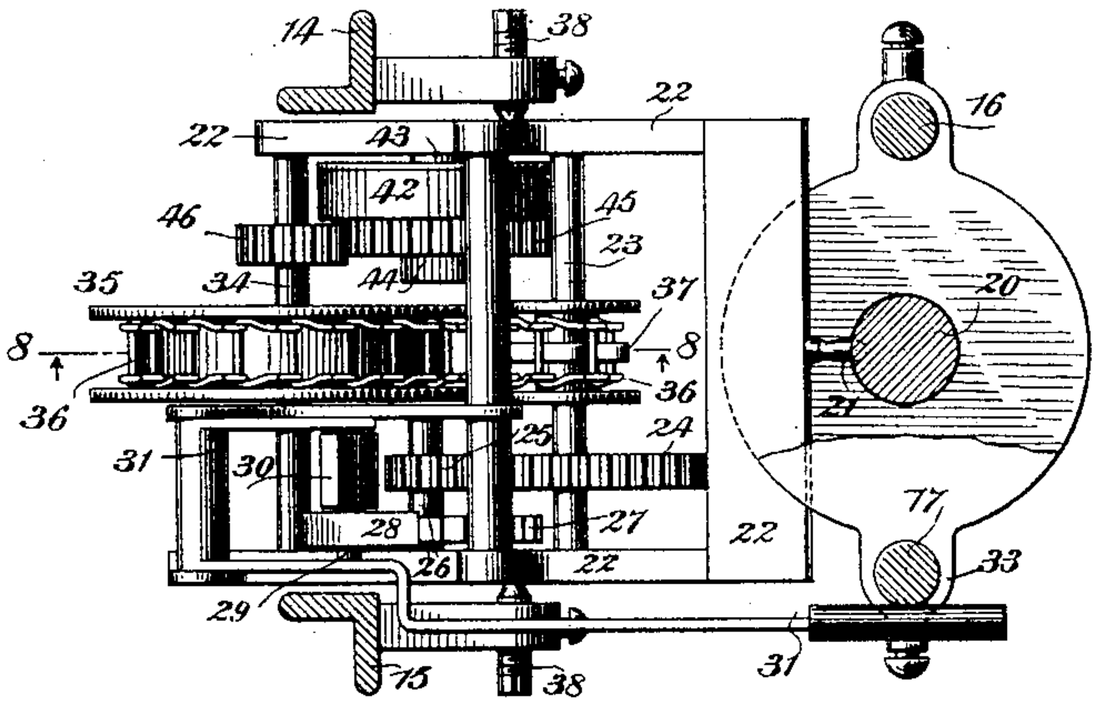
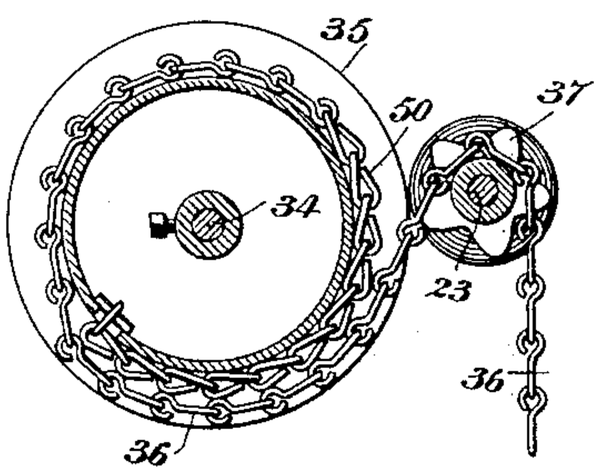


Fig. 8.



Witnesses
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H. W. Lloyd.

Inventor
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UNITED STATES PATENT OFFICE.

WILLIAM A. NICHOLSON, OF NEW YORK, N. Y.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 464,132, dated December 1, 1891.

Application filed June 12, 1891. Serial No. 395,987. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. NICHOLSON, a citizen of the United States, residing at New York city, county and State of New York, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to electric-arc lamps, and certain features thereof have reference more especially to the class of lamps in which a rotary disk carbon is used for the upper carbon in place of the ordinary pencil form of carbon; and the invention consists in the certain novel and peculiar arrangements and combinations of the several parts of the lamp, all as hereinafter fully described, and then pointed out in the claims.

In the accompanying drawings, illustrating an embodiment of my invention in an electric-arc lamp, Figure 1 is a side view of the operative parts of the lamp, the lower-carbon holder being omitted. Fig. 2 is a side view of the same, taken at right angles to the view shown in Fig. 1. Fig. 3 is an enlarged detail view of the feeding mechanism for the upper carbon, with the parts thereof shown at their upper limit of movement, and Fig. 4 is a view of the same when the parts thereof are moved to their lowest point of movement. Fig. 5 is a top plan view of the mechanism shown in Fig. 3. Fig. 6 is a side view of the retracting spring and its case which automatically winds up the drum of the feeding mechanism. Fig. 7 is a detail view of the sprocket-wheel, its shaft and bearings, and the drive or feed chain connecting the drum of the feeding mechanism with the upper-carbon carrier. Fig. 8 is a sectional view of the drum, sprocket-wheel, and feed-chain, the section being taken on a plane indicated by line 8 8, Fig. 5. Fig. 9 is a detail view in section on the line 9 9, Fig. 2, showing the disk-carbon shaft, its feed pinion and rack, and the lower part of the carrier in which the shaft is mounted.

Referring to the drawings, in which like numbers of reference designate like parts throughout, 11 designates the casing, which is provided with the top and bottom plates 12 and 13 for inclosing the operative parts of the lamp, and 14 15 and 16 17 are the upright standards or posts fixed between the plates 12 and 13 for supporting said parts. The line and shunt magnets or solenoids 18 and 19, respectively, are fixed within the casing and control the vertical movements of the core 20, to which is loosely jointed or hinged the extension 21 of a rocking pivoted frame 22, which carries what is usually the feeding-shaft 23, the rotation of which is controlled by the gear 24, fixed thereon, the pinion 25, fast upon the shaft 26, which carries the escapement-wheel 27, which is engaged by the escapement 28, mounted upon the escapement-shaft 29. The latter shaft is provided with a governor 30, and is mounted across the pivoted end of a trip device 31, which is pivoted at 32 to one end of the frame 22, and has its other end prolonged and adapted and arranged to engage with a fixed point 33, which in the present construction consists in an extension of the base-plate or solenoid 18.

The above-described parts operate in the usual well-known manner to so control the feed-shaft 23, by which the upper carbon is fed, as to regulate the arc and keep it uniform as the carbons are consumed.

Upon the shaft 34, which has its ends journaled in opposite sides of the pivoted frame 22, I secure a drum or barrel 35, which is provided with a suitable retractive spring, by means of which the drum normally tends to wind up thereon the flexible connection or chain 36, which has one end fastened thereto and is passed over the sprocket or chain wheel 37, which is mounted on the feed-shaft 23, located upon the opposite side of the pivotal point or center of oscillation 38 of the frame 22, from where the drum is mounted. The chain or connection 36 passes from the sprocket-wheel 37 to the upper-carbon carrier 39, hereinafter described, and to which it is conveniently made fast by means of the pin or screw 40 being passed through the end of the chain, which is set in a slit in the carrier, as indicated in Fig. 1. The retractive spring 41 for the drum consists in an ordinary coil-spring fixed in a box or case 42 and secured upon a stud or shaft 43, having

a cap 44, and to which is fixed a cog-wheel 45, gearing with a pinion 46, which is keyed upon the drum-shaft 34. In this way the spring 41 tends constantly to turn the drum, so as to wind on the chain 36. This spring may, of course, be applied directly to the drum-shaft, instead of connecting it therewith through the intermediary of the described gearing.

The operative parts of the lamp are so related that whenever the pivoted frame 22 is moved into about a horizontal position, or its inner end, which is connected with the solenoid-core 20, is tilted upwardly, so as to incline the frame, as shown in Figs. 1, 2, 3, and 5, the escapement 28 locks the gearing-train against movement. As the drum 35 is thus also locked, the carbon and carrier cannot descend by gravity as they would otherwise do. The lowering and raising of the inner end of the frame 22 between the limits of its horizontal and its uppermost positions serve to lower and to raise the chain accordingly, thereby lowering and raising the connected carbon without, however, paying off the chain from, the drum or taking it up thereby. In any position of the tilting frame 22 in which its inner end lies below the horizontal, as indicated in Fig. 4, the escapement does not lock the train, since the trip 31, being then in engagement with the fixed point 33, releases the escapement and leaves the train free to move under the weight of the carrier and its carbon, which is then fed by gravity until the current finds the low-resistance circuit over the line-magnet 18, when it is again checked. By virtue of having the drum 35 and the guide or chain-wheel 37, over which the feed-chain passes located upon opposite sides of the center of oscillation 38 38 of the pivoted frame 22, the letting off of the chain as the carbons waste away will compensate for the loss of weight by such wasting and thereby serve to keep the frame in equilibrium so far as these parts are concerned, for the chain is gradually transferred from the drum side of the frame 22 to the carbon-carrying side thereof relative to the pivotal axis on which the frame rocks. This balancing of the parts continues throughout the operation of the lamp and is one of the features of my improvements.

In order to prevent the arc from continuing after the upper carbon is consumed and thereby burning the carrier or holder, I so construct and arrange the connections between the carrier and the feeding mechanism that when the upper carbon is consumed, or nearly so, the connection will be instantly released from its positive feeding action and allowed to drop, so as to throw the carrier into contact with the lower carbon, or its carrier if it be burned out, thereby closing the arc and preventing the destruction of the carrier. This is also a feature of my invention, and I have shown the following means by which the same is accomplished, though of course there are a variety of ways in which it may be carried out. The feed-chain 36, which throughout the feeding-movement while the upper carbon lasts is let off from the sprocket-wheel 37 with a positive movement by reason of the cross-bars 47 of its links 48 engaging the teeth of the wheel, is provided toward the end nearest the drum with a long opening or slot 49 by forming the links 50 without cross-bars, so that when this part of the chain is presented to the sprocket-wheel it will be quickly pulled over the wheel, whether the wheel be at rest or in motion, as will be more particularly understood from Figs. 7 and 8. The arrangement is such that as the upper carbon is entirely consumed, or nearly so, the lost motion comes into play by reason of the long opening 49 being presented to the sprocket-wheel. This allows the upper carrier of the carbon to be closed on the lower in an evident manner. There are obvious equivalents of the feed-chain 36 which may be used—for instance, a perforated tape or band—and the same may be formed with the lost-motion opening 49, for the purpose described. The upper carbon 52 is disk-shaped, and is mounted by its center fast upon the shaft 53, which is conveniently mounted in the hanger 54 and the bracket 55 of the carrier 39. The hanger 54 depends from near the center of the top of the carrier and the bracket 55 extends horizontally from the foot of the hanger to and around the lamp-rod 56, upon which it has a loose bearing, in order to assist in steadying the vertical movements of the carrier. The end of the bracket 55, which forms the lower part of the carrier, is provided with a stay-piece 57, extending from the upper part of the carrier to the bracket at a point near the lamp-rod 56. This serves to hold the carbon-shaft 53 firmly in horizontal position as the carrier descends and rises and causes its driving-pinion 58 to run in true engagement with its operating-rack 59, which extends vertically along the rod 56. The disk carbon 52 is securely mounted upon the shaft by means of the squared portion 60, taking in a similarly-shaped central eye of the disk, and a thumb-nut 61, working on the reduced screw-threaded end of the shaft. The nut 61 when turned down binds the disk carbon between it and the washer 62, which is fixed upon the shaft upon the opposite side of the disk. The other side of the carrier 39 from where the rack and pinion are located is provided with two points of bearing 63 and 64 on the other lamp-rod 65, and at this side is also arranged a contact-brush 66 for collecting the current from the rod 65, with which it has a sliding contact and which is connected through posts 67, wire 68, and the posts 69 direct to line. In addition to this path for the supply-current in reaching the upper carbon 52 another one is also provided by way of post 69, wire 70, thence over the feeding mechanism and feeding-chain 36 to carrier 39, and still another path leads from post 67, wire 71, post 72, and

rod 56 to the carrier 39. The circuit from the lower carbon 51 to the main line is made over the insulated wire 73, which passes up through the interior of the lamp-rod 56, thence to line by way of post 74, the rod 56 being formed tubular for this especial purpose. The shunt-circuit 75, which, like the other described ones, is shown in dotted-in lines, lies between the binding-posts 69 and 74 and includes the high-resistance magnet 19. Ample provision is thus made for the current to reach the upper carbon, which is turned on its axis as the carrier 39 rises and falls, and which is gradually rotated, so as to continually present a different part of its periphery to the arc while the carrier slowly approaches the lower part of the lamp.

The lamp-rods 56 and 65, in addition to performing their usual functions as supports and conductors, serve as guide-rods for the upper-carbon carrier, though, of course, instead of using these rods as guideways two extra rods may be provided; but this would increase the cost and also the weight of the lamp and would somewhat detract from its appearance. I therefore prefer the construction shown, though any other equivalent one may be adopted.

From the drawings and foregoing description the operation of the apparatus will be readily understood and may be briefly described as follows: When the current is turned on the lamp, the carbons being normally together or closed, the main and low resistance solenoid 18 will be so energized as to raise the carbon disk 52 and thereby establish the arc, which is thereafter maintained and regulated by the feeding mechanism in the manner hereinbefore described. This continues until the upper carbon is consumed, at which time the feed-chain 36 is released and the carrier 39 dropped into contact with the lower carbon, so as to destroy the arc. When the lamp is started with new carbons, the feed-chain is of course wound up to its fullest limit on the drum, and it is gradually paid off therefrom by gravity as the escapement permits. When the carrier 39 is raised by hand to renew the carbon, the spring of the drum automatically winds up the chain thereon, which, as before stated, is held from unwinding so long as the pivoted frame 22 is held in horizontal position by the controlling-core 20, or in any position between horizontality and its upper limit of movement.

By the use of the flexible connection 36 I am enabled to reduce materially the length of the lamp when compared with the disk-carbon lamps heretofore in use.

Other marked advantages of my invention are found in the steady vertical movements of the disk-carbon carrier, the trueness with which the pinion of the disk-shaft is held in engagement with its rack, the automatic balancing of the pivoted frame 22 by the unwinding feed-chain replacing the continuous loss of weight in the disk carbon, and the automatic closing of the upper-carbon carrier on the lower carbon when the upper carbon is consumed.

Having thus described my improvements in electric-arc lamps, what I claim as my invention, and desire to secure by Letters Patent, is—

1. In an electric-arc lamp, the combination, with the upper disk carbon provided with means for rotating it as it is fed, of a carrier for said disk carbon provided with guide-rods engaged by bearings thereon for steadying the feeding movements of the carbon, feeding mechanism, and a flexible connection intermediate the same and the said carbon-carrier.

2. In an electric-arc lamp, the combination, with the upper disk carbon provided with means for rotating it as it is fed, of a carrier for said disk carbon provided with guides engaged by bearings thereon for steadying the feeding movement of the carbon, feeding mechanism comprising a rocking pivoted frame having a spring-actuated retractive drum mounted thereon, and a chain or flexible connection attached to the said drum and the carbon-carrier.

3. In an electric-arc lamp, the combination, with the vertical guide-rods, the upper disk carbon, the carrier therefor consisting in a bracket having bearings loosely engaging each of said guide-rods for steadying the vertical movements of the carrier, and connections intermediate the carrier and the feeding mechanism, of a shaft mounted on the carrier and carrying at one end the said disk carbon and provided with a pinion, and a fixed vertical rack in mesh with said pinion, whereby as the carrier is raised and lowered the disk carbon may be rotated.

4. In an electric-arc lamp, a carbon, a carrier, feeding mechanism therefor comprising a rocking pivoted frame and a spring-actuated retractive drum, and a guide or chain wheel mounted upon the frame at opposite sides of the pivotal point or center of oscillation thereof, of a drive-chain or flexible connection secured intermediate the said drum and carbon-carrier and passing over said wheel, whereby as the carbon is fed the chain or connection thereby paid off from the drum to the guide or chain wheel side of the pivoted frame may compensate for the loss of weight of the carbon due to its wasting away, thereby tending to keep the pivoted frame in equilibrium.

5. In an electric-arc lamp, the combination, with a carbon-carrier and feeding mechanism therefor comprising a rocking pivoted frame and a retractive drum and sprocket-wheel mounted upon opposite sides of the pivotal axis thereof, of a feed-chain secured intermediate the said drum and carrier and passing over the said sprocket-wheel, and an escapement for said wheel controlled by the movements of the pivoted frame.

6. In an electric-arc lamp, the combination,

with the upper and lower carbons and mechanism for feeding the upper carbon, of a flexible connection between said feeding mechanism and the upper-carbon carrier for raising and lowering the same and constructed and arranged to release the connection from positive engagement when the upper carbon is consumed and throw the carrier into contact with the lower carbon to close the arc.

7. In an electric-arc lamp, the combination, with the upper and lower carbons, a feeding mechanism for the upper carbon comprising a let-off and take-up device for the feed-chain, of the feed-chain secured between the said device and the upper-carbon carrier and having the links of the end portion thereof nearest said device free from cross-bars, so as to release the chain when the upper carbon is consumed.

8. In an electric-arc lamp, the combination, with the upper and lower carbons and a feeding mechanism for the former comprising a retractive drum and a sprocket-wheel, of a feed-chain secured between the drum and the upper-carbon carrier and passing over the sprocket-wheel, the links of said chain at the end thereof nearest said drum being free from cross-bars, whereby the positive let-off movement of the chain is destroyed when such part is presented to the sprocket-wheel.

9. In an electric-arc lamp, the combination, with an upper-carbon carrier, of a feeding mechanism for the carrier comprising a pivoted frame 22, having the train mounted thereon, a retractive drum 35, a sprocket-wheel 37, also mounted upon said frame upon opposite sides of the pivotal axis thereof, and the feed-chain 36, connecting the said drum and carrier and passing over the sprocket-wheel, substantially as and for the purpose set forth.

10. In an electric-arc lamp, the combination, with an upper-carbon carrier and feeding mechanism therefor comprising a drum, of a feed-chain 36, connecting the drum and carrier and adapted to be gradually paid off while the upper carbon lasts and formed with an opening 49 for dropping the upper carbon into contact with the lower carbon when the upper one is consumed, substantially as and for the purpose set forth.

11. In an electric-arc lamp, the combination, with disk carbon 52 and its rotating shaft 53, provided with the drive-pinion 58, and a fixed rack for the pinion, of the carrier 39, in which said shaft is mounted, said carrier having a bracket 55 and provided with guides, such as 56 and 65, upon which it has bearings for steadying its movements, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand, this 11th day of June, 1891, in the presence of the two subscribing witnesses.

WILLIAM A. NICHOLSON.

Witnesses:
PAUL F. C. TUCKER,
WILLIS FOWLER.