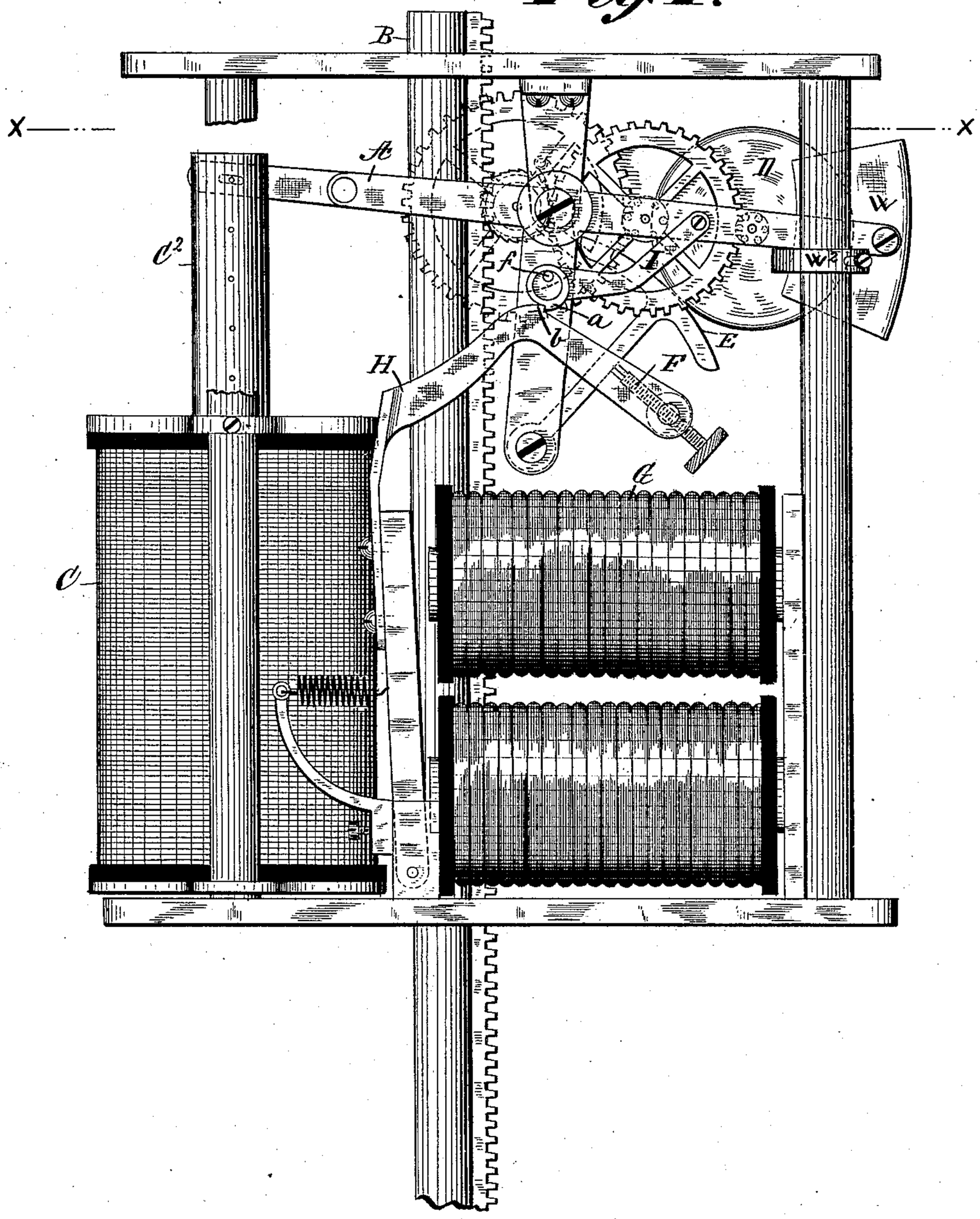
(No Model.) 4 Sheets—Sheet 1.

M. J. WIGHTMAN & H. LEMP.

ELECTRIC ARC LAMP.

No. 367,568. Patented Aug. 2, 1887.

Fig. 1.



WITNESSES:

Gabriel. J. W. Galbreth.

Wm. H. Capel

INVENTORS

Hermann Lemp

Merle J. Wightman

BY

Townsend & MacArthur

ATTORNEYS.

(No Model.) 4 Sheets—Sheet 2.

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Fig. 2.

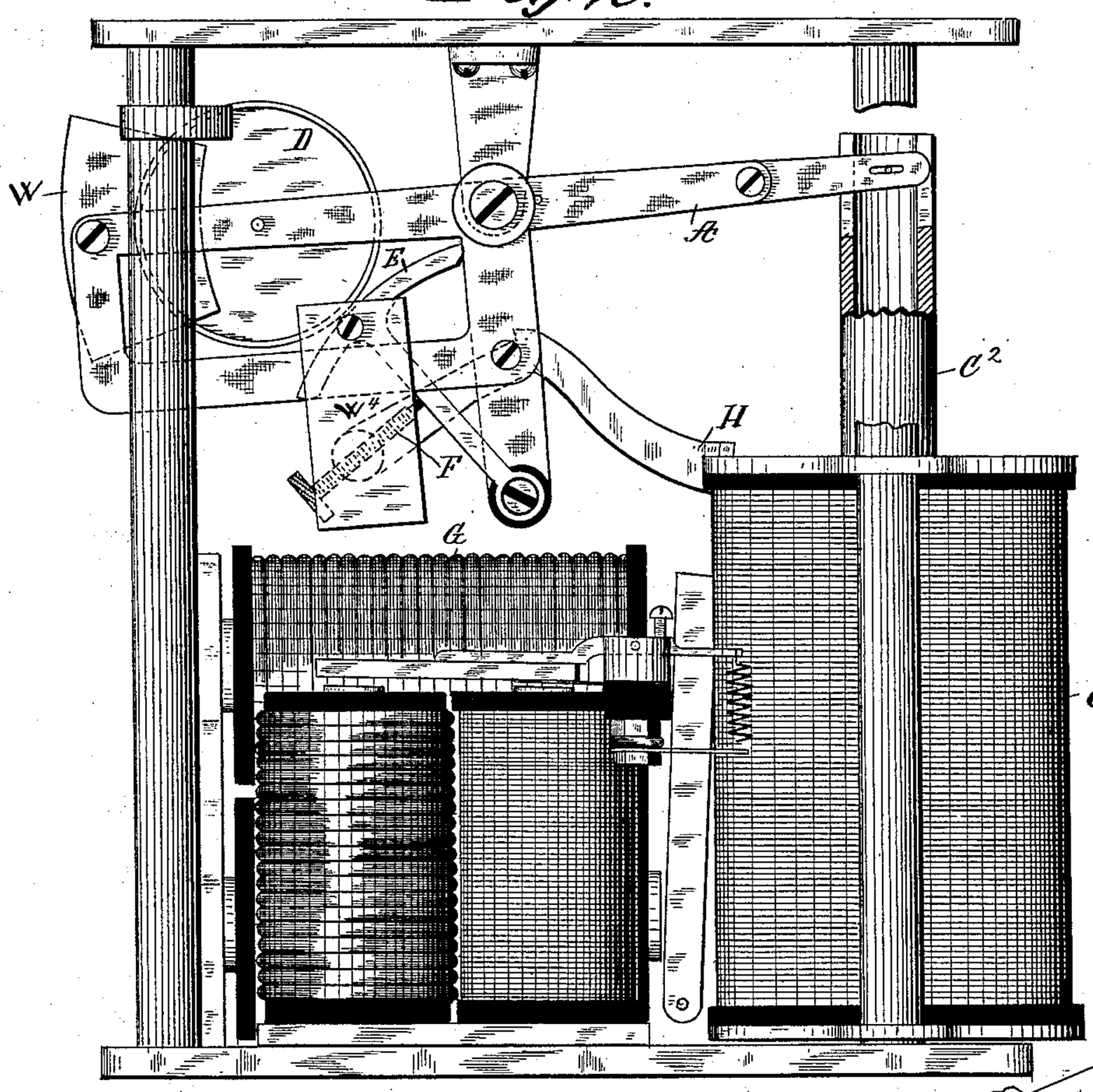
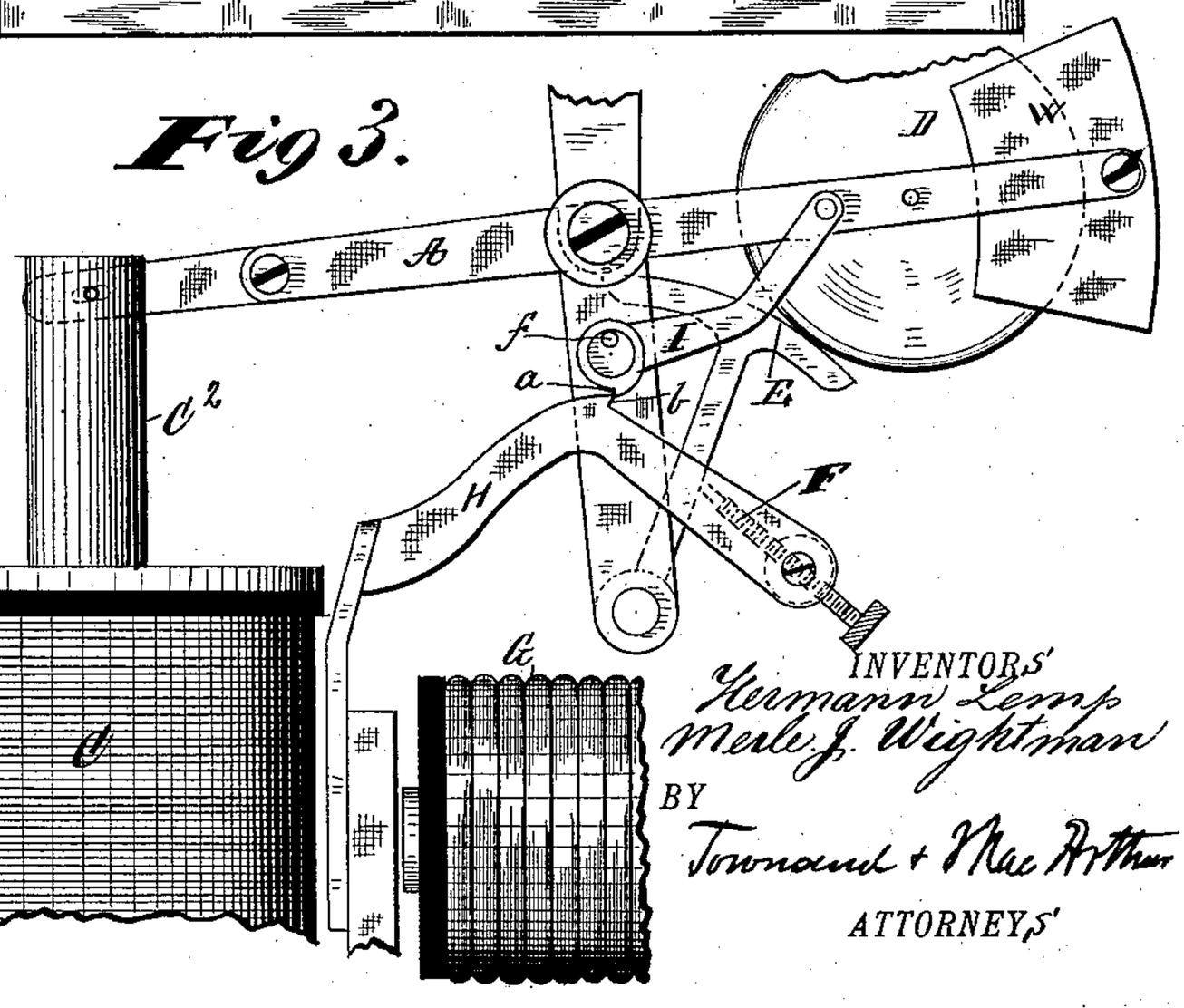


Fig 3.



WITNESSES:
Gabriel J. W. Galsley.
Wm. H. Capel

INVENTORS'
Hermann Lemp
Merle J. Wightman
BY
Townsend & MacArthur
ATTORNEYS'

(No Model.) 4 Sheets—Sheet 3.

M. J. WIGHTMAN & H. LEMP.

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Fig. 4.

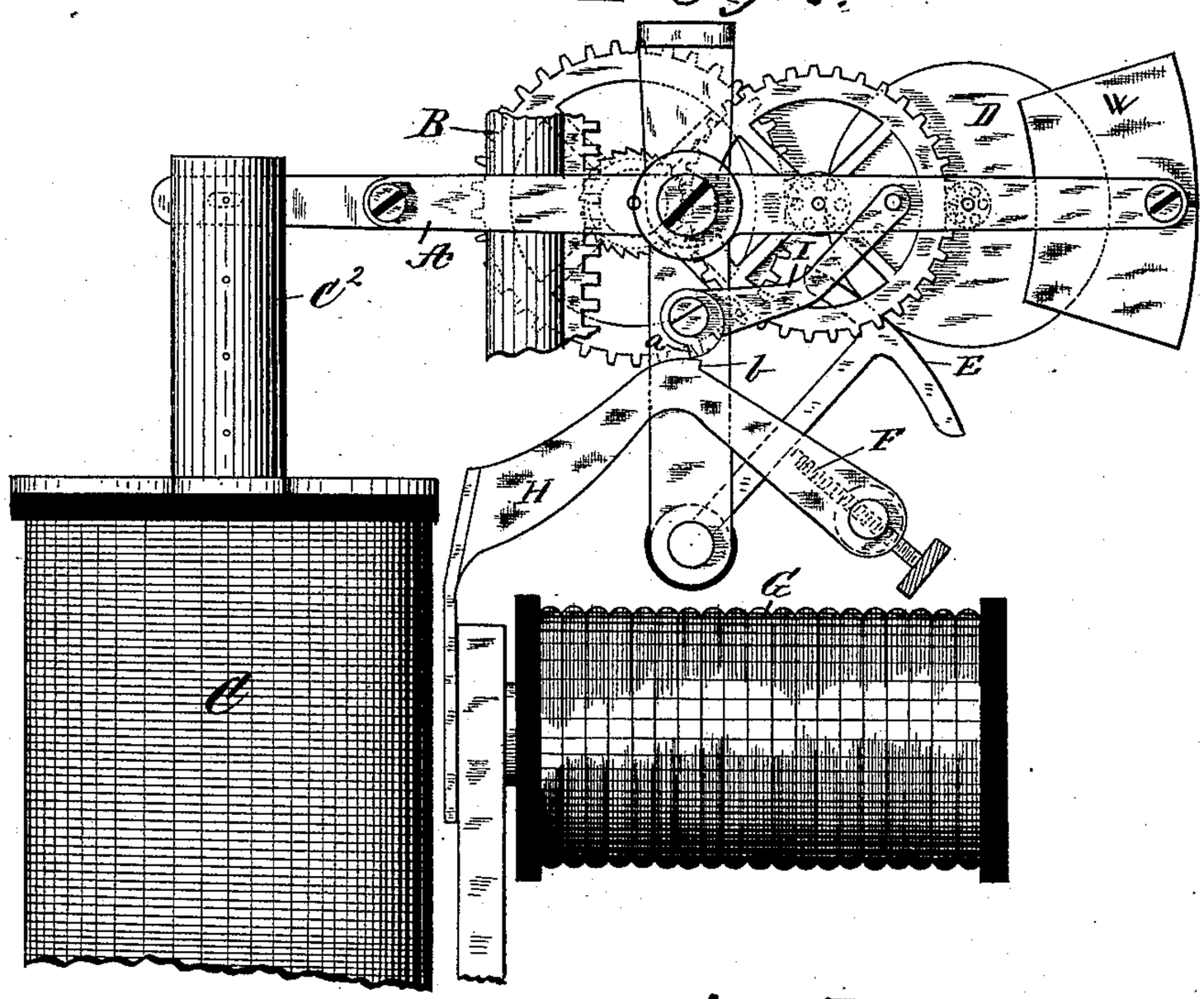
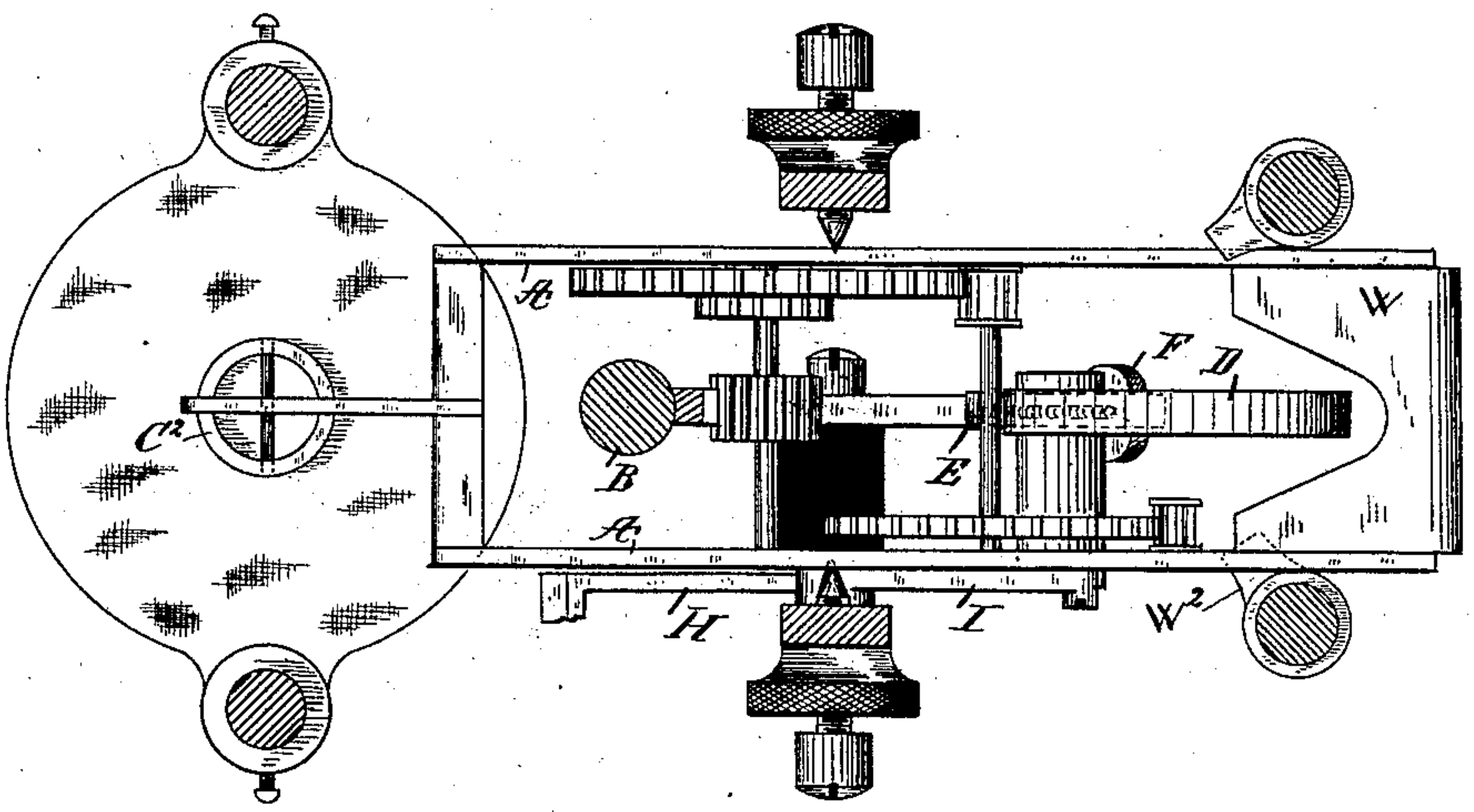


Fig. 5.



WITNESSES:

Gabriel J. W. Gabler

Wm. H. Capes

INVENTORS'

Herman Lemp

Merle J. Wightman.

BY

Townsend & MacArthur

ATTORNEYS'

(No Model.) 4 Sheets—Sheet 4.

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ELECTRIC ARC LAMP.

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Fig. 7.

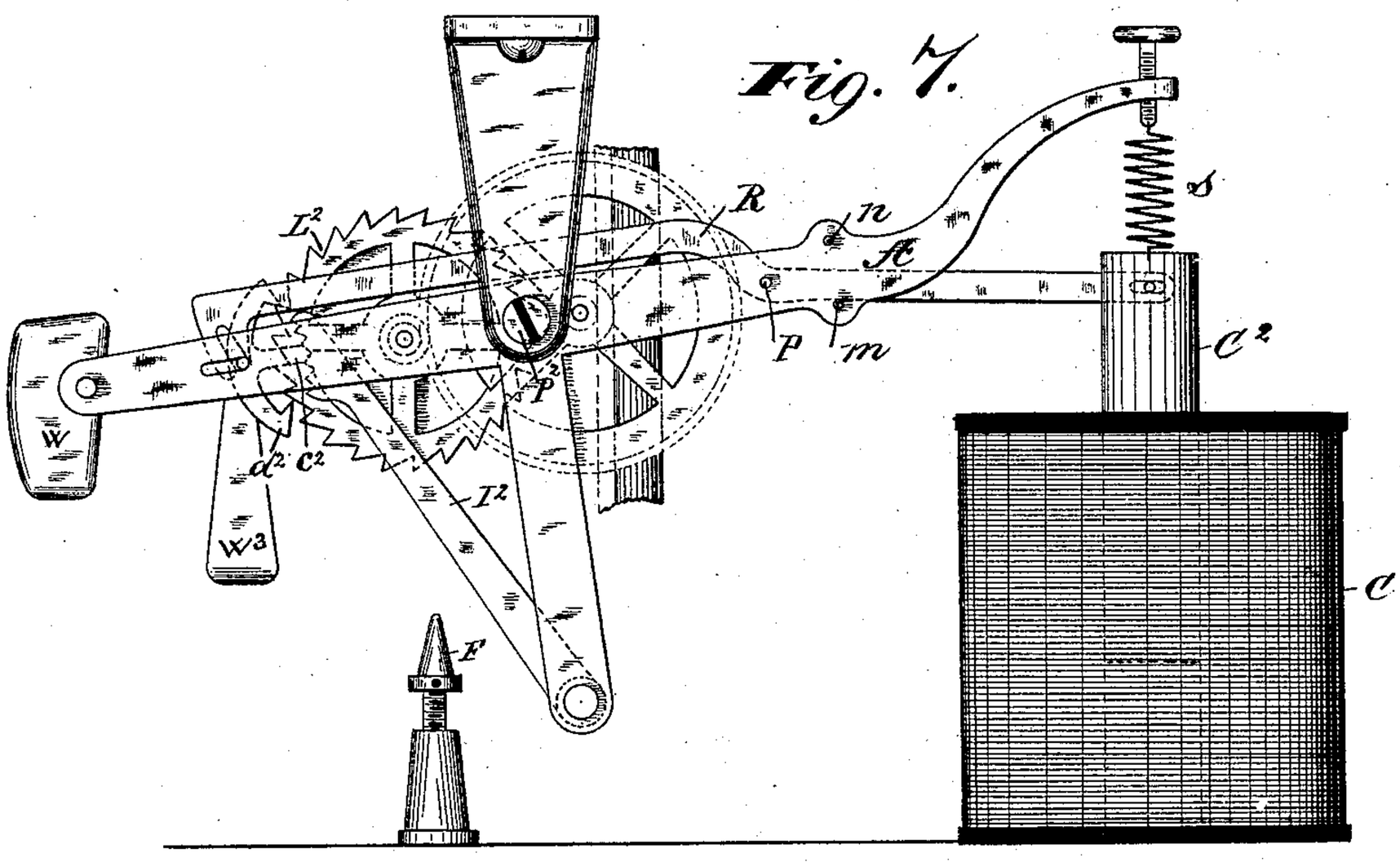
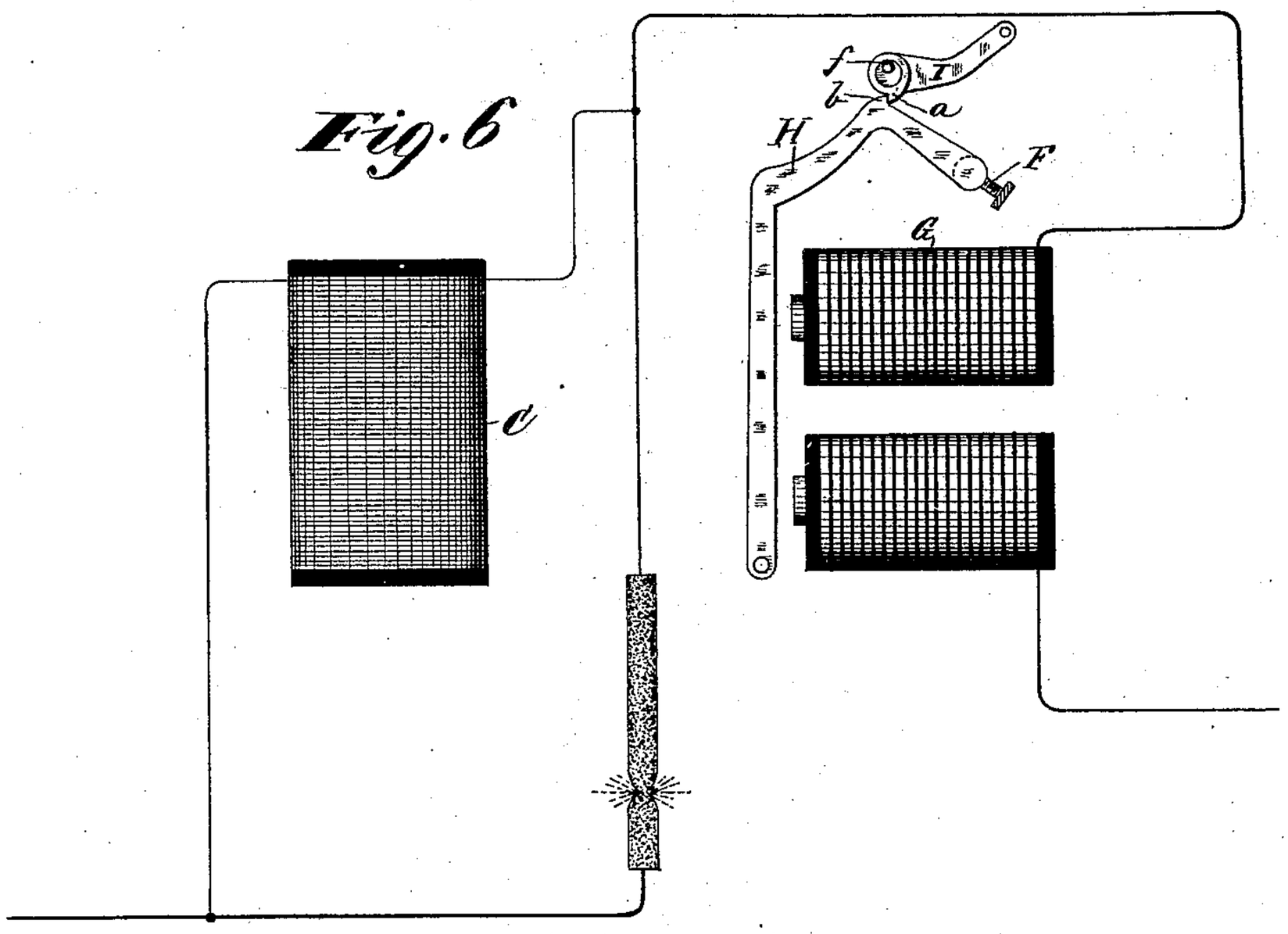


Fig. 6



WITNESSES:

Gabriel J. W. Galster.
Thos. L. Casteel

INVENTORS'
Hermann Lemp
Merle J. Wightman
BY
Townsend & MacRitter
ATTORNEYS'

UNITED STATES PATENT OFFICE

MERLE J. WIGHTMAN AND HERMANN LEMP, OF HARTFORD, CONNECTICUT, ASSIGNORS TO THE SCHUYLER ELECTRIC MANUFACTURING COMPANY, OF CONNECTICUT.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 367,568, dated August 2, 1887.

Application filed October 26, 1886. Serial No. 217,239. (No model.)

To all whom it may concern:

Be it known that we, MERLE J. WIGHTMAN and HERMANN LEMP, citizens of the United States, and residents of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Electric-Arc Lamps, of which the following is a specification.

Our invention relates to electric-arc lamps of the class in which the carbon-feed mechanism engaging with the carbon or carbon-carrier is sustained on a suitable support that is subjected, while the lamp is burning normally, to the sole action of a derived-circuit magnet acting in opposition to a suitable retractor. In lamps of this character the carbon-feed mechanism is controlled in its action by a suitable detent mechanism which releases the feed mechanism when the support is moved through increase in the length of arc and consequent increase in the pull of the derived-circuit magnet, a movement in the opposite direction by the action of the retractor serving to bring the feed-controlling mechanism to rest. With this organization of lamp some additional means must ordinarily be employed to move the support for the feed mechanism, so as to cause the formation of the arc and to leave the support of the feed mechanism in proper position to permit the operation of the lamp to go on under the sole control of the derived-circuit magnet.

Our invention consists in an improved combination and novel organization of apparatus whereby this result may be effected.

Our invention consists, also, in certain details of construction, that will be set out in the following description, and will then be specifically recited in the claims.

Our invention comprises the following general combination of apparatus: The carbon or carbon-carrier is sustained while the lamp is in action on a suitable lever or other support carrying a feed-controlling mechanism which engages with the carbon or carbon-carrier and holds the same from feeding downward while the arc is normal. Acting on said support in opposite directions are a derived-circuit magnet and a retractor, the magnet acting in a direction to lower the support, and with it the feed-controlling mechanism engaging with the carbon, while the retractor, if unopposed by the magnet to a sufficient degree, will raise the support. The detent or releasing devices may be of any suitable character for permitting the feed-controlling mechanism to free the carbon or carrier, so that the same may feed whenever the support, acted upon by the derived-circuit magnet and retractor, is moved by the magnet through an increase of its power produced by increase of the normal length of arc.

Combined with the lamp is any suitable device for freeing the carbon or carrier when the lamp is out of action, so that the apparatus may start with the carbons in contact.

The organization is completed in all the essentials necessary to full operation by an electro-magnet whose coils are in the branch or circuit passing through the carbons, and which, when excited, acts on the lever or other support for the feed-controlling mechanism through suitable intermediate mechanism properly arranged and constructed to permit the main magnet to depress the support, and with it the feed-controlling mechanism, and then to free said support after the same has been depressed to a suitable extent, the retractor then coming into play to lift the support and form the arc. The main-circuit magnet remains in circuit; but on turning off the current its parts resume their original position.

The devices which free the carbon when the lamp is out of action are thrown in operative position when the current is first turned on, so that the subsequent operations of the lamp's mechanism may proceed without interference from them.

In the accompanying drawings, Figure 1 is a side elevation of a lamp embodying our invention, showing the position of the parts when the lamp is out of action. Fig. 2 is a side elevation looking from the opposite side of the lamp. Fig. 3 is a view showing the position of the parts when the intermediate catch or latch between the main-circuit magnet's armature and the derived-circuit magnet's armature is about to free the latter from the influ-

ence of the main-circuit magnet. Fig. 4 shows the position of the parts during normal operation of the lamp. Fig. 5 is a cross-section on the line *x x* of Fig. 1. Fig. 6 is a diagram of circuits, showing the connections of the magnets employed. Fig. 7 shows, in side elevation, a modified construction of apparatus whereby the carbon-carrier may be freed when the lamp is out of action.

A indicates a lever or other suitable support mounted in proper bearings in the lamp-frame, and C indicates an electro-magnet of any kind in a derived circuit around the lamp, said magnet being employed for the purpose of moving the lever or other support A when the feed of the carbon is to take place, and in opposition to a suitable retractor, consisting, in the present instance, of a weight, W, supported from the opposite end of the lever A. An additional adjustable retractor is indicated at W^4, Fig. 2. Electro-magnet C is connected with the lever or support A by hanging the movable core C^2 of said magnet to the lever in any proper manner. It is obvious that any other construction of electro-magnet might be employed for the purpose of actuating said lever.

The carbon-carrier which supports one of the carbons of the lamp—as, for instance, the upper carbon—is indicated by the letter B.

Mounted on the lever A is a feed-controlling mechanism, of any suitable kind, which normally engages with the carrier B, so as to prevent the same from feeding while the arc remains at normal length.

The feed-controlling mechanism we have shown is of the type which comprises as its essential features a wheel gearing with the carbon-carrier by any suitable mechanical devices, and provided with a detent arrangement connected directly or indirectly with the wheel, and of such construction that when the lever A is moved by the derived-circuit magnet, in obedience to an increase in the length of arc, the wheel will be free to rotate, and thus permit the carbon-carrier to move downward. Under normal conditions the wheel is locked from rotation and the carbon remains stationary.

In the present case we have shown a form of clock-work mechanism sometimes employed in electric lamps, and consisting of a train of wheels mounted in the lever or frame A and connected with a wheel, D, with which the detent devices engage.

The wheel D is here shown as a brake-wheel, with which a brake, E, mounted in a downward extension from the frame A, tends normally to engage, so as to hold the wheel D from movement until the brake-lever is thrown off of the brake-wheel by engaging with a releasing-stop—such, for instance, as indicated at F.

The clock-work mechanism is provided with the usual pawl-and-ratchet connection between the wheel D and the carrier B, so that the carrier B may be raised without rotating the wheel D, or vice versa. The wheel or pinion engaging with the carrier might rotate when the end of the lever A on which said pinion is supported is depressed.

In the present embodiment of our invention the carbon-carrier B is mounted on the side of the fulcrum of A, opposite the weight or retractor W, and nearest the end of the lever to which the derived-circuit magnet is attached or connected, so that, as will be obvious, if the lever or support for the carbon-carrier be depressed by any suitable means and then released, the weight W, if at the same time the wheel D be held from rotation, will pick up the carbon-carrier and form the arc.

An electro-magnet whose coils are of low resistance and are placed in the circuit to the carbons, as indicated in the diagram, is shown at G. This electro-magnet is of any desired type, and is provided with an armature-lever or other movable device actuated by the electro-magnet, and indicated at H. Said lever or support is provided with a retractor, which in operating on said lever has no effect upon the lever or support A, being entirely independent thereof.

Between the lever H and the support A is a suitable latch, catch, or slipping connection of proper kind to permit the lever H to actuate the lever A when the former lever is drawn up by the power of the electro-magnet, but to become disengaged so as to free the lever A from the influence of the magnet G when the feed-controlling mechanism, consisting of the wheel or pinion engaging with the carbon-carrier B, has been lowered to the proper point for permitting the arc to be formed on a reverse movement of the support or lever A by the operation of the retractor W. A form of catch or latch suitable for this purpose is indicated at I, and is shown as consisting of a lever pivoted on the lever A and having a catch or pawl-tooth at *a*, with which a projection or catch, indicated at *b* and formed on or attached to lever H, may engage. The lever I is given a free movement to a limited extent, so that the catch *b* may slip back under the pawl or nose *a* when the armature-lever H is retracted from the position indicated at Fig. 4. The lever I is limited in its movements by a pin, *f*, which projects into an opening formed in the end of the lever I, as clearly shown in the drawings.

In the form of our invention shown in Figs. 1 to 5 of the drawings the releasing stop or detent *f* is also carried by the lever H. When said lever is fully retracted and the weight W is down, which is the position that the parts assume when the lamp is out of action, the brake-lever is held out of engagement with the brake-wheel by resting against the detent or stop F. When the lever H is drawn up by the magnet G, the detent-stop F is moved to one side and the brake-wheel D is locked, because the brake engages with the same.

The operation of the devices as thus far described would be as follows: When no current flows on the circuit, the parts are in the posi-

tion shown in Fig. 1, the left-hand end of lever A being depressed by the weight W and resting upon the supports W^2, attached to the frame of the lamp. The armature-lever H is in position to engage with the latch or catch, as shown, and the carbon-carrier B is free from the restraint of the feed-controlling mechanism, because the stop *f* holds the brake I away from the wheel D, and the wheels are free to rotate. The carbons are therefore in contact, and there is a free path for the current in the lamp through the carbons and through the main-circuit magnet G. When the current is turned on, the electro-magnet C is but weakly excited, while the electro-magnet G acts with full power and draws up its lever H, which, through the catch, moves the support for the feed-controlling mechanism into the position shown in Fig. 3, where, as will be seen, the catch is about to be disengaged, owing to the movement of the two parts of the same in diverging paths. On a little farther movement the parts are freed, and the lever A, which has, by the power of the main-circuit magnet G, been thrown to the position indicated in Fig. 3, is now moved in the opposite direction by the weight W. Inasmuch as the stop F has been moved over to the right in a direction away from the brake-lever, the latter during the reverse movement just mentioned engages with the brake-wheel D and holds the feed-controlling mechanism from movement, so that the carbon-carrier B is by such reverse movement lifted, thus forming the arc. In this operation the derived-circuit magnet gradually acquires greater power by reason of the diversion of current through it, until finally the balance between its pull and the pull of the retractor is established, so that the parts come to rest in about the position shown in Fig. 4. By suitable adjustment of the retractor this position of rest may be made one at which a normal arc may exist. The electro-magnet G, being still in circuit and excited, holds the lever H in the position shown in Fig. 4, and the stop F is, as will be seen, slightly removed from contact with the brake-lever. If now the arc increase in length by burning away of the carbon, the derived-circuit magnet will tilt the lever and will bring the brake-lever against the stop F, so as to release the brake-wheel and permit the carbon to feed, in obvious way.

When the current is turned off, the armature-lever H falls back to the position shown in Fig. 1, the lever I of the latch rising slightly to permit the projection *b* to pass the nose *a*. If, for any reason, the carbon should overfeed, the derived-circuit magnet will lose its power, and the weight W will lift the carbon so as to re-establish an arc.

We do not limit ourselves to any particular form of catch or latch, since any mechanism by which the lever H may be temporarily connected with the lever A and may then, after the lever A has been moved by the operation of the magnet G or depressed to a proper extent, disconnect levers H and A, will answer the purposes of our invention.

When the lamp goes out of action, it will be obvious that the stop F returns to position, where it will release the feed-controlling mechanism, so that the carbon-carrier may feed downward. It will be apparent that by thus supporting stop F and operating it by the magnet G said stop is made to do double duty—that is to say, it acts as a means for permitting the carbon to come into contact with the opposite carbon, when the lamp is out of action, and also, when moved into a new position by the operation of the magnet C, to act as the normal feed-releasing stop or detent which frees the feed-controlling mechanism when a feed of the carbon is desirable.

It will be apparent that in any lamp organized as above described the retractor for the armature-lever H has no influence in determining the position or condition of the support for the feed-controlling mechanism, as is the case in some previously-patented inventions, but that the levers A and H and their retractors act independently of one another in all respects excepting at the instant the lamp comes into operation, when the levers A and H are temporarily connected through mechanical devices by which the power of the magnet G may be exerted for starting the lamp by moving the support for the feed-controlling mechanism.

In the drawings, Fig. 7, I have shown another way in which the carbon may be freed from the control of the feed mechanism when the lamp is out of operation. In this figure, also, I have shown another form of detent mechanism, such as is sometimes employed in the art.

The main-circuit magnet G and its lever H, with the devices for connecting the same temporarily to the lever A, are omitted for the sake of simplicity.

The lever A is pivoted at the point P^2, and the feed-controlling mechanism consists of a wheel gearing with the carbon-carrier, which wheel connects with and turns an escapement-wheel, L^2, of any usual form, with which engages an anchor-escapement, d^2, pivoted in suitable supports and provided with a retarding vibrating weight, W^3.

The wheel L^2 is locked from movement by the locking of the anchor-escapement d^2, through engagement of an arm, c^2, projecting from the anchor-escapement, with teeth or serations on the pivoted lever I^2, which takes the place of the brake-lever in the previous form of lamp, and is pivoted on an arm extending downward from the lever A.

A stop, F, serves to release the anchor-escapement, so that the carbon may feed by moving the lever I^2 away from engagement with the arm c^2. The stop F, instead of being mounted on a movable support, as in Fig. 1, is mounted on a fixed support.

In order that the carbon-carrier may be free

when the lamp is out of action, I mount the core C^2 of the derived-circuit magnet on a lever, R, which is in turn pivoted on the support A and is limited in its movements by two stops, *m n*.

A comparatively-light spring, *s*, connected at one end to the lever A and at the other to the core C^2, serves when the lamp is out of operation to lift the core and move the opposite end of the lever R, so that an incline cam-surface, *k*, will disengage the anchor from the escape-wheel.

The pivots of the anchor are suitably mounted so that they may have a slight play to and from the escape-wheel, and to a sufficient extent to permit the anchor and escape-wheel to be disengaged or to be brought into engagement. When the lever R is drawn down into the position shown in the drawings, the anchor is drawn into engagement with the escape-wheel by the cam-surface, and the wheel can therefore turn with a retarded movement only.

When the lamp is out of action, core C^2 is raised by the spring *s* and the lever R rests against stop *n*. On turning on the current the whole frame or support A will be dipped in the manner described in connection with the previous figures, and will then be suddenly released, whereupon the weight W, which is sufficient to raise the carbon-holder and core C^2, will throw the lever or support A in the reverse direction with a sudden quick movement. On this action the inertia of the core C^2, being opposed only by the light spring *s*, will cause the lever A to bring stop *m* against lever R, thus putting the parts into the position indicated, so that the anchor will engage with the escapement-wheel and retard its movement. An arc is therefore formed through the raising of the carbon-carrier, and the derived-circuit magnet C, gradually acquiring power, will hold the core C^2 down. The lever R, being now engaged with lever A by stop *m*, can move said lever so as to produce a feed of the carbon by causing the detent-lever I^2 to release the escape-wheel.

Other plans might be employed without departing from our invention for releasing the carbon-carrier when the lamp is out of action.

The special construction of lamp shown in Fig. 7 will be made the subject of a separate application.

What we claim as our invention is—

1. The combination, in an electric-arc lamp, of a derived-circuit magnet, a lever supported or actuated thereby and carrying feed-controlling mechanism engaging with the carbon-carrier, detent devices for freeing said mechanism when the lever is retracted so as to permit the carbons to feed together, a main-circuit-starting magnet continually in circuit while the lamp is in operation and having an armature mounted independently of the lever, and intermediate mechanism whereby the said magnet may first engage with and tilt the lever from its fully-retracted position and then release the same to permit the retractor of the lever to lift the carbon and form the arc.

2. The combination, in an electric-arc lamp, of a carbon or carbon-carrier supported on a lever actuated in opposite directions by a derived-circuit magnet, and a retractor tending to pull the lever in a direction to lift the carbon-carrier, a feed-controlling device engaging with the carrier and also supported by the lever-detent devices for freeing the carbon-carrier when the lever is fully retracted, and a main-circuit-starting magnet and a catch operated thereby for depressing that end of the lever which supports the carbon-carrier, so that on the disengagement of the catch the retractor may act to raise the carbon and establish the arc.

3. The combination, in an electric-arc lamp, of a carbon-supporting lever, a derived-circuit magnet, a retractor therefor tending to raise the carbon-carrier, detent devices for freeing the carbon when the lever is fully retracted, a main-circuit-starting magnet and catch operated thereby for temporarily depressing the end of the lever carrying the carbon, and means for simultaneously withdrawing or moving the detent devices out of operative position, so that when the lever is freed the carbon will be prevented from feeding as the retractor raises the same to form the arc.

4. The combination, in an electric-arc lamp, of a carbon-supporting lever carrying the feed-controlling devices, a derived-circuit magnet acting on the lever in a direction to lower the carbon, a retractor acting on said lever in a direction to raise the carbon, detent devices supported on the armature of a main-circuit magnet, and an intermediate catch between said main-circuit magnet and the lever, whereby the lever may be tilted so that the retractor may, on reversing the movement of the lever, raise the carbon and form the arc.

5. The combination, with the carbon-supporting lever A, a derived-circuit magnet connected with the lever, and a retractor tending to move the lever in a direction to tilt the carbon, of a main-circuit-starting magnet and an intermediate catch, as set forth, between said magnet and the carbon-supporting lever, as and for the purpose described.

6. The combination, with the lever supporting the carbon and carrying the feed-controlling mechanism therefor, of a retractor tending to raise the carbon, a main-circuit-starting magnet, and a device mounted independently of said lever for releasing the feed-controlling mechanism when the lever is retracted, said device being operated by the main-circuit magnet and moved thereby out of releasing position, so as to permit the retractor to lift the carbon.

7. The combination, with the lever A, the carbon-carrier supported thereby, a retractor tending to lift the carbon, a starting-magnet for depressing the end of the lever carrying the carbon, and a releasing-stop for the feed-controlling mechanism supported by the arma-

ture of the main-circuit magnet independently of lever A.

8. The combination, in an electric lamp, of a carbon-supporting lever operated in opposite directions by the derived-circuit magnet and by a retractor, a releasing-stop for freeing the carbon when the lever is fully retracted, and a magnet in the arc circuit for moving said releasing-stop into normal position when the lamp is started.

9. The combination, in an electric-arc lamp, of a support actuated by the derived-circuit magnet and sustaining the feed-controlling mechanism that engages with the carbon or carbon-carrier, a retractor whereby the support is lifted when the lamp is out of action, means for releasing the carbon-carrier when the support is thus lifted, and a starting-magnet continually in the arc circuit having temporary mechanical connection with the said support at the instant the current is turned on, as and for the purpose described.

10. The combination, in an electric-arc lamp, of a derived-circuit magnet and carbon-sustaining support actuated thereby in a direction to lower the carbon, a retractor by which the support is lifted, means for releasing the feed-controlling devices that engage with the carbon when the lamp is out of action, a main-circuit-starting magnet continually in circuit, which depresses the support to start the lamp, and means for disconnecting the armature of said magnet from the said support when the latter has been lowered to a predetermined extent.

11. The combination, in an electric-arc lamp, of a derived-circuit magnet and armature-lever therefor, a carbon-sustaining and feed-controlling device mounted on the lever in position to be lowered by the magnet and raised by the retractor, a releasing device for freeing the carbon when the lamp is out of action, a starting-magnet in the arc circuit of the lamp, an armature-lever therefor, intermediate mechanism connecting said lever with the lever of the derived-circuit magnet, and means for throwing the releasing device out of action when the lever is depressed preliminarily to the formation of the arc by the operation of the retractor for said lever.

12. The combination, in an electric-arc lamp, of the support for the carbon-supporting and feed-controlling device, a retractor by which the same is held lifted when the lamp is out of action, means for releasing the carbon-carrier when the lamp is out of action, a main-circuit-starting magnet, and an intermediate latch through which the starting-magnet depresses the lever, said latch being suitably arranged, as described, to permit free movement of the engaging devices in the opposite direction.

13. The combination, with the armature-support for the derived-circuit magnet, of a starting-magnet, and a feed-releasing device supported by said magnet independently of the support for the armature of the derived-circuit magnet and arranged in position to permit the carbon to feed when the lamp is out of action, as and for the purpose described.

14. The combination, with the derived-circuit magnet, lever actuated thereby and carrying the carbon feed-controlling mechanism, a retractor acting on said lever in a direction to form the arc, a brake carried by the lever and governing the action of the feed-controlling mechanism, and a releasing-stop for said brake mounted on a movable support, and a magnet in the arc branch for actuating said support, as and for the purpose described.

15. The combination, in an electric-arc lamp, of a feed-controlling mechanism engaging with the carbon-carrier and mounted on a support actuated in opposite directions by a derived-circuit magnet and a suitable retractor, an electro-magnet in a low-resistance circuit having a retractor operating on the armature-lever of said magnet solely, and a catch or latch, substantially such as described, between said lever and the said support, whereby the low-resistance magnet may actuate the support to start the lamp into operation.

Signed at Hartford, in the county of Hartford and State of Connecticut, this 27th day of September, A. D. 1886.

MERLE J. WIGHTMAN.
HERMANN LEMP.

Witnesses:
J. A. DALZELL,
A. C. KENDALL.