(No Model.) 3 Sheets—Sheet 1.

H. PIEPER, FILS.

ELECTRIC ARC LAMP.

No. 362,312. Patented May 3, 1887.

Fig. 1.

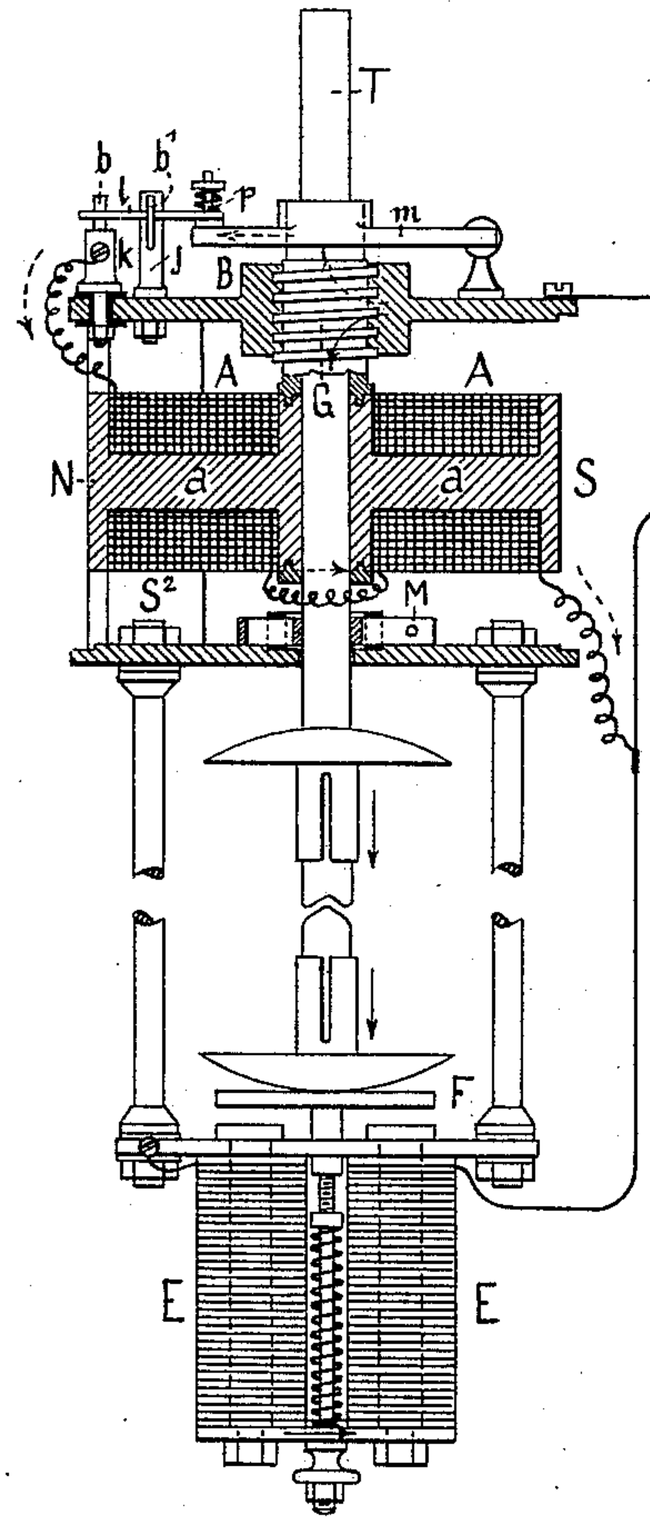


Fig. 2.

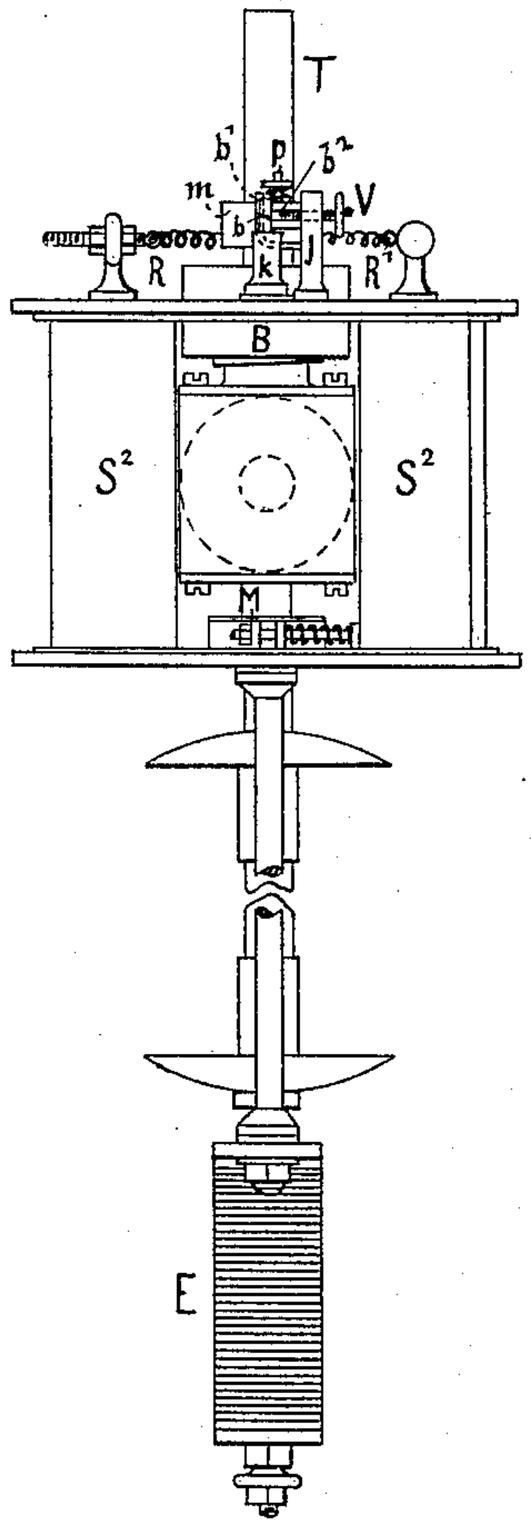


Fig. 3.

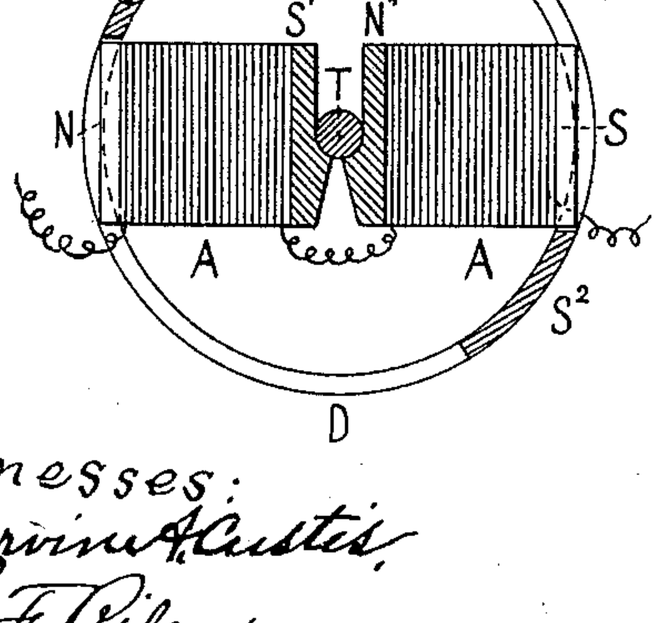
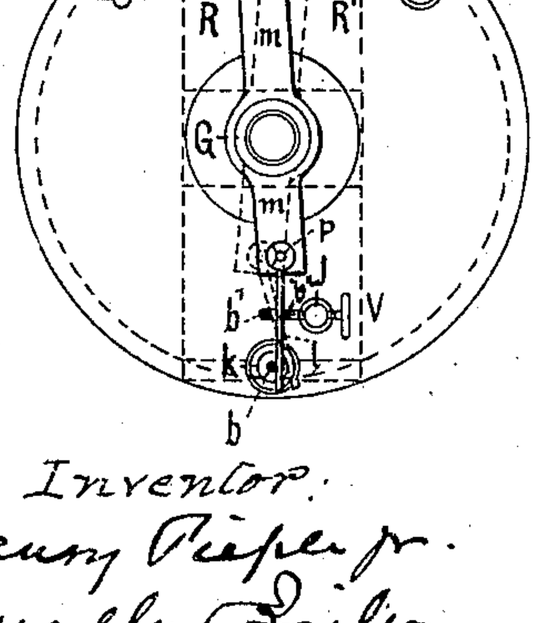


Fig. 4.



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B. F. Riley

Inventor:
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his attorney

(No Model.) 3 Sheets—Sheet 2.

H. PIEPER, FILS.

ELECTRIC ARC LAMP.

No. 362,312. Patented May 3, 1887.

Fig. 10.

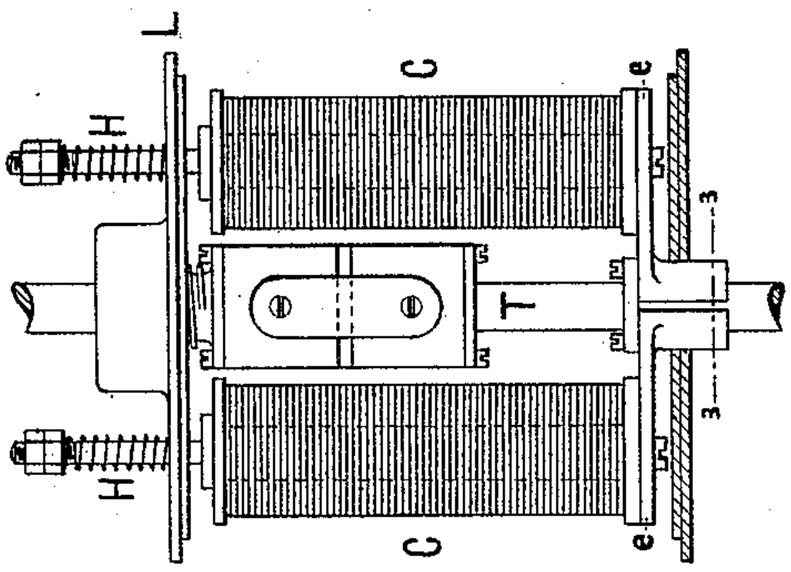


Fig. 10a.

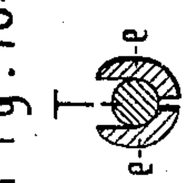


Fig. 8.

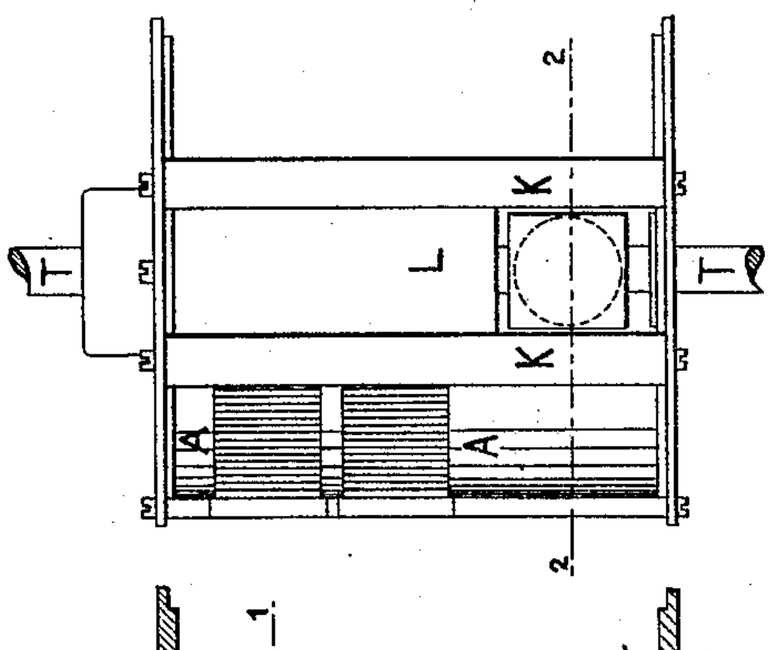


Fig. 9.

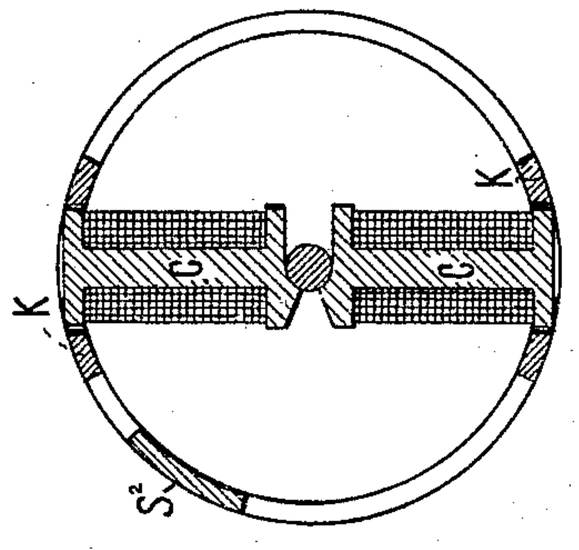


Fig. 6.

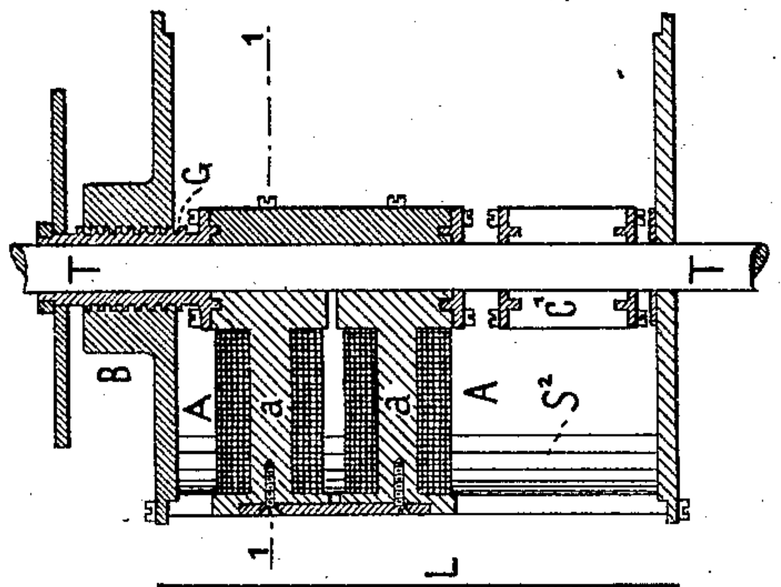


Fig. 7.

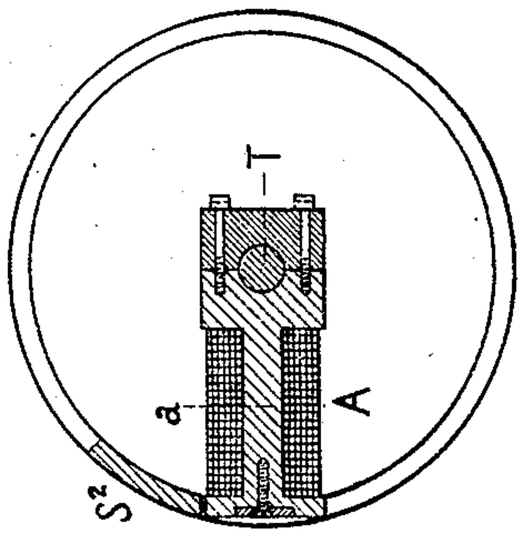
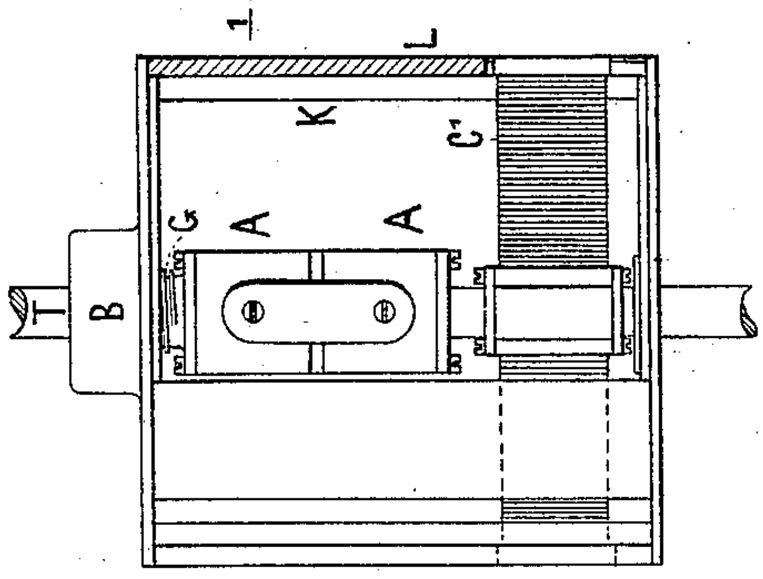


Fig. 5.



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his attorney

(No Model.)

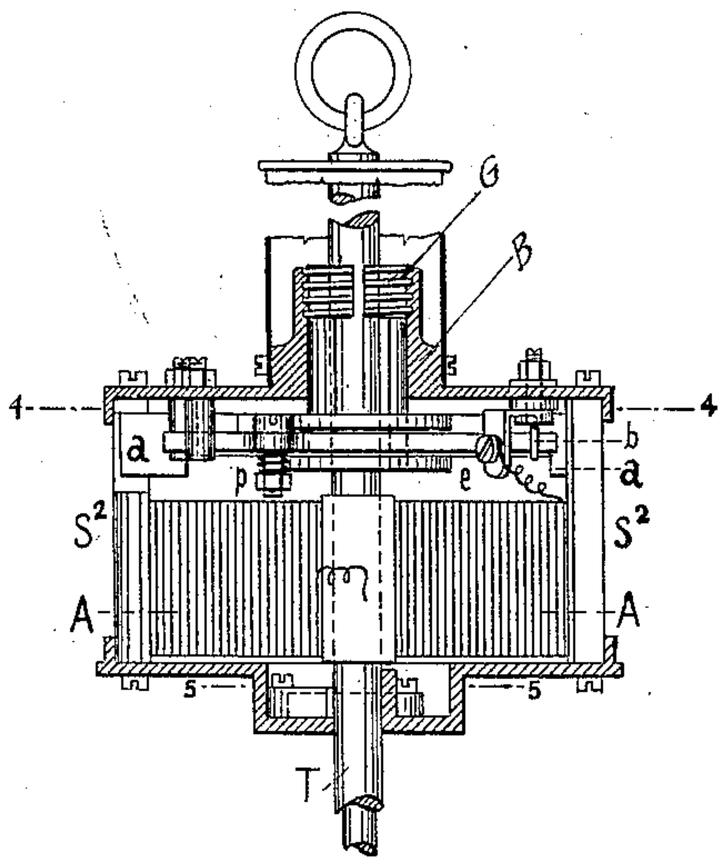
3 Sheets—Sheet 3.

H. PIEPER, FILS.

ELECTRIC ARC LAMP.

No. 362,312. Patented May 3, 1887.

Fig. 11.



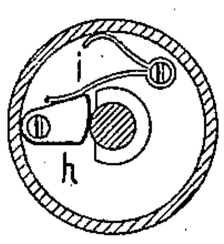


Fig. 14.

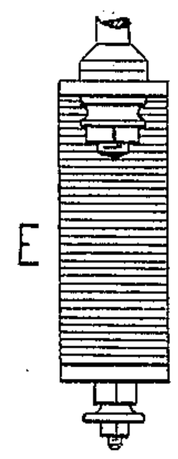


Fig. 11a.

Fig. 12.

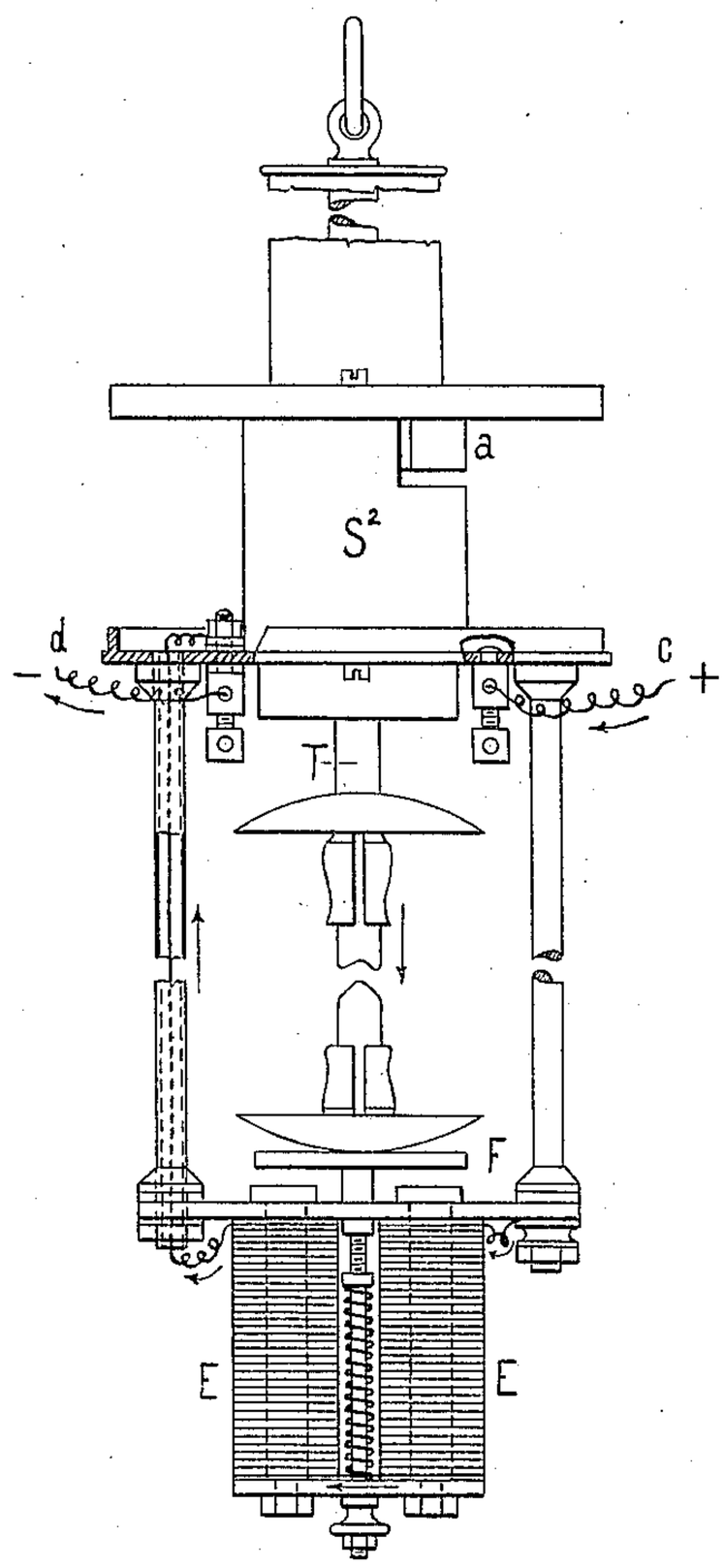


Fig. 13.

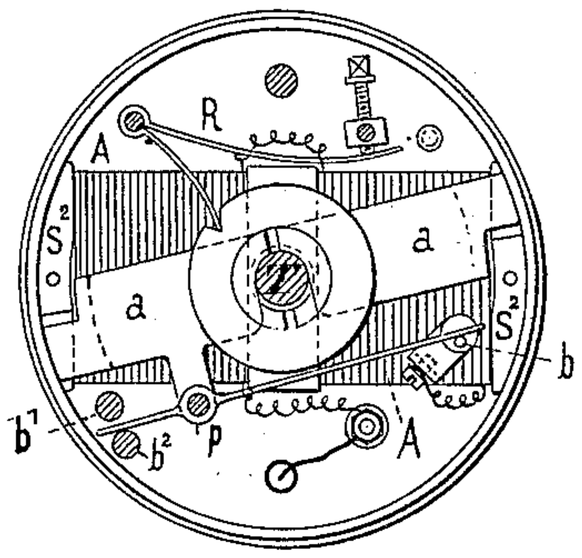
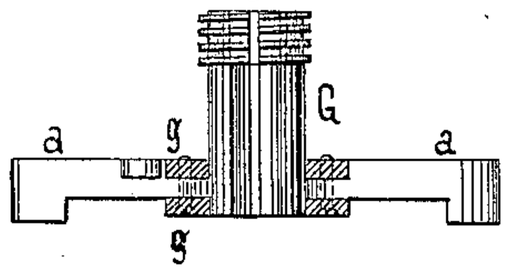


Fig. 15.



Witnesses:
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Marvin A. Curtis,

Inventor:
Henri Pieper jr.
by Marcellus Bailey
his attorney.

UNITED STATES PATENT OFFICE.

HENRI PIEPER, FILS, OF LIEGE, BELGIUM.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 362,312, dated May 3, 1887.

Application filed April 14, 1886. Serial No. 198,831. (No model.) Patented in Belgium June 22, 1885, No. 69,367, and September 5, 1885, No. 70,136.

To all whom it may concern:

Be it known that I, HENRI PIEPER, Fils, electrician, a subject of the King of Belgium, and residing at Liege, in the Kingdom of Belgium, have invented new and useful Improvements in Electric-Arc Lamps, (for which I have obtained Letters Patent in Belgium, June 22, 1885, No. 69,367, and September 5, 1885, No. 70,136,) of which the following is a specification.

My invention relates to electric-arc lamps, and more particularly to the means for automatically advancing one of the carbons toward the other in the measure as the said carbons are consumed, and for breaking the contact of the carbons at the moment an electric current is sent through the same.

The improvements consist in the combination, with the holder of one of the carbons, (the said holder being made of soft iron,) of an electro-magnetic grip composed of a movable portion or bar of soft iron placed close to the holder, a stationary portion or piece of like iron fixed at some distance from the said bar, and an electric coil, the said parts being so arranged that an electric current passed through the said coil will on one hand produce magnetic attraction, and in consequence thereof friction, between the bar and the holder, while on the other hand it creates attraction between the bar and the stationary piece of iron, whereby the bar is caused to move toward the latter and to impart, through the medium of the said friction, motion to the holder, either for the purpose of breaking contact of the carbons or in view of producing feed-motion.

Moreover, the improvements consist in means for causing the bar after having attracted the holder to move together with the same in a helical line in one direction, and thereupon to release the holder and to move in opposite direction, while the holder is retained by a friction-brake, a feeding-motion of the carbon secured to the holder being thus obtained.

The improvements also comprise particular means for breaking and re-establishing the circuit of the electro-magnet of the feeding device.

In the annexed three sheets of drawings a lamp provided with my improved feeding device is shown by Figure 1 in a sectional front elevation, by Fig. 2 in side elevation, by Fig. 3 in a sectional plan, and by Fig. 4 in top view. Fig. 5 is an outside view with a part in section, and Fig. 6 a sectional elevation at a right angle to Fig. 5, of a portion of a lamp with modified arrangement of feed-motion and an electro-magnetic device for breaking contact of the carbons. Fig. 7 is a sectional plan on line 1 1 of Fig. 6. Fig. 8 is an outside view corresponding to Fig. 6, and Fig. 9 a plan on line 2 2 of Fig. 8. Fig. 10 is an elevation of a portion of a lamp with modified arrangement of electro-magnets for breaking contact of the carbons, and Fig. 10^a a section thereof on line 3 3. Fig. 11 shows in sectional front elevation the upper portion of a lamp with another modification of feeding mechanism. Fig. 11^a is the lower portion thereof. Fig. 12 represents the same lamp in side elevation, and Fig. 13 in sectional plan on line 4 4 of Fig. 11. Fig. 14 is a section on line 5 5 of Fig. 11, and Fig. 15 a part in detail.

In the lamp shown by Figs. 1 to 4 each of the cores *a* of two electro-magnets, A, constitutes the aforesaid movable bar of iron, and each of the two plates S^2, fixed to the lamp-frame, the said stationary piece of iron. The cores *a* have at both ends heads of which those marked with the letters S′ and N′, and formed as is shown by Fig. 3, embrace the carbon-holder T upon one side, so that when magnetism is induced in the cores they will both attract the holder, which is made of iron, in a direction transverse to their axes. At the same time attraction is produced between the outer heads, N and S, of the cores and the plates S^2. The two cores are fixed to each other by two plates of brass or other metal not susceptible of being affected by magnetism. The upper one of these plates has a cylindrical extension, G, provided with screw-threads that work in like threads cut into a boss, B, formed on the upper disk portion of the lamp-frame. The electro-magnets are thus guided partly by the said screw-threads, partly by the holder T.

To the upper end of the extension G, projecting above the boss B, is secured a lever, *m*, connected by a spring, R, to a post on the lamp-frame, the said spring being so arranged

that it tends to draw the electro-magnets away from the plates S^2. Another spring, R', serves to limit the amount of motion produced by R. The lever *m* carries on a pivot, *p*, a small lever, *l*, pressed against a shoulder of *p* by a spring, so that a certain amount of friction is caused thereby. By the sides of this lever there are two stops, *b'* and b^2, carried by a post, J, that may be insulated or not, and near its end is placed on an insulated post, *k*, a pin, *b*, and the said parts *l*, *b*, *b'*, and b^2 are so arranged that when the spring R draws the electro-magnets away from the plates S^2 the lever *l* is brought in contact with the pin *b* by being pressed against the stop b^2, whereas, when the electro-magnets during their motion toward the plates S^2 have come near the same, the lever will be drawn away from b^2 and caused to strike against *b'*, in consequence whereof it is turned on its center *p* and separated from the pin *b*, as is shown by dotted lines. The wire of the combined coils of the electro-magnets A is attached with its ends respectively to the main conducting-wire *d* and the insulated post *k*, and the latter is in electric communication with the conducting-wire *c* by the lamp-frame, the screw G, the lever *m*, and the lever *l*, provided the latter be in contact with the pin *b*. A shunt-circuit is thus formed which is established or broken by the lever *l*, according as it is in contact with the pin *b* or not.

The holder T is placed under the control of a brake, M, arranged to prevent the holder from sliding down, but which allows it to be rotated and gradually pushed downward by the action of the feeding device. A brake adapted for this purpose will be more fully described hereinafter with reference to Figs. 11 and 14. The electro-magnets E, connected to the main circuit and the armature F thereof, pressed upward by a spring and carrying the lower carbon, serve to withdraw the latter from the upper carbon when a current is sent into the lamp, and thereby to produce the luminous arc. These parts, however, do not form any portion of my invention.

The operation of the feeding device is as follows: As long as the carbons are at the proper distance from each other the current passing through the shunt-circuit is too weak to put the feeding device into operation; but in the measure as the carbons are consumed and the resistance in the luminous arc becomes greater the strength of the shunt-current increases, until the magnetism induced by the same in the cores *a* produces sufficient attraction between the outer heads, S N, and the plates S^2 as that the electro-magnets revolve in the direction of the arrows *f*, Fig. 3. At the same time the friction due to the attraction between the inner heads, S' N', and the holder T causes the holder to be rotated together with the electro-magnets; but as these are guided by the threads of the screw G and the boss B their rotative motion will produce an axial motion of the holder, the incline of the screw-threads being such that the direction of the said axial motion will be downward. When the electro-magnets are about to strike against the plates S^2, the shunt-circuit is broken by the lever or circuit-breaker *l*, the cores are demagnetized, and the electro-magnets are drawn away from the plates S^2. The device thus continues to work until the proper length of arc has been re-established.

The arrangement of the electro-magnets A (shown in combination with the holder T of Figs. 5 to 9) differs from the foregoing in this, that they are both placed on one side of the holder, and that they consequently both attract the same in like direction parallel to their axes. Their cores are therefore arranged to embrace the holder upon that portion of its periphery which is directed centrally toward them, and they are maintained in contact with the holder by a brass cap. If preferred, a single electro-magnet may be used in this case, instead of the two shown in the drawings.

The electro-magnets arranged in respect to the holder T, as described with reference to Figs. 1 and 3, and having stationary pieces of iron transversely opposite to their outer heads, may with advantage be employed for allowing the carbons to come in contact with each other when the lamp is extinguished, for producing the arc when it is lighted, and for serving as a friction-brake to the holder while the lamp is burning. For this purpose the two electro-magnets C, Figs. 5 to 9, are arranged to move between guides K, parallel to the holder T, and made of brass or other material that is not affected by magnetism; and above the outer heads of their cores the iron plates L, forming the said stationary pieces of iron, are fixed to the frame of the lamp. The coils of the said electro-magnets being connected to the main circuit of the lamp, magnetism will be induced in the cores of the same as soon as a current is passed into this circuit, and in consequence of the attraction resulting therefrom on one hand between the cores and the holder, and on the other hand between the cores and the plates L, the electro-magnets will be raised, together with the upper carbon. In this state the electro-magnets remain as long as the lamp is burning, their cores meanwhile preventing the holder T from sliding by its weight, whereas they allow the feeding device to push it downward slowly. When the lamp is disconnected from the source of electricity and magnetic induction ceases, the electro-magnets separate from the plates L and drop down as far as any suitably-arranged stop permits them, while the holder drops until the upper carbon settles on the lower one.

Fig. 10 shows the electro-magnets C arranged in vertical position and the upper plate, L, of the lamp-frame constituting the stationary piece of iron. The cores of the electro-magnets embrace the holder T in the manner shown by Fig. 10^a by means of their extensions *e*. H H are two springs adapted to

partly balance the weight of the electro-magnets.

In the lamp represented by Figs. 11 to 15 the electro-magnets A are formed by a stationary core, S^2, corresponding to the pieces S^2 of Figs. 1 to 3, and a coil placed thereon, while the movable bars *a*, forming the cores in the lamps described, constitute in this case armatures. The said armatures embrace the holder T in like manner, as set forth, in respect to the bars *a* of Figs. 1 and 3. They are suitably connected together—for instance, by the brass plates *g*—and they are provided with the screw-threaded cylindrical piece G, which may be integral with one of the plates *g*, and which works in inside threads of the boss B. The alternate magnetization and demagnetization of the core S^2, and thereby of the armature-bars *a*, will consequently produce the same effect upon the holder T as in the preceding arrangements. The circuit-breaker is substantially the same as in Figs. 2 and 4, only its form is somewhat different.

The brake shown by Figs. 11 and 14, and acting on the holder T, consists of a friction-pawl, *h*, having an eccentric face, and pressed with the said face against the holder by a spring, *i*. This brake not only prevents the holder from sliding by its weight, but also hinders the rotation of the same in the wrong direction by the feeding device, if such action should take place. The electro-magnets E E shown in Figs. 11[a] and 12 are the same as those of Figs. 1 and 2.

I claim as my invention—

1. In an electric-arc lamp, the combination, with an iron carbon-holder, T, of an oscillatory intermittent electro-magnetic grip included in a shunt to the main circuit, and means, substantially as described, whereby said grip is operated to effect the feed of said holder at the times and in the manner substantially as hereinbefore set forth.

2. The combination, in an electric-arc lamp, of an electro-magnetic grip composed of an electro-magnet and an armature, one of which is movable while the other is stationary, with an iron carbon-holder which is acted on by said movable portion of the grip, substantially as and for the purposes hereinbefore set forth.

3. In an electric-arc lamp, the combination, with an iron carbon-holder, of an oscillatory intermittently-operating electro-magnetic feed-grip and a friction-brake, substantially as and for the purposes hereinbefore set forth.

4. In an electric lamp, the combination, with the iron carbon-holder T, of an electro-magnetic feed-grip comprising an oscillatory portion, *a*, placed transversely to and with one end close to the holder, and a stationary portion, S^2, placed to one side of the other end of the said portion *a*, an electric coil included in a shunt of the main circuit of the lamp and arranged to induce magnetic attraction both between the two parts of the grip and also between the movable part of the grip and said carbon-holder T, a screw, G, fast to the movable part of the grip and working in screw-threads in the lamp-frame, a circuit-breaker whereby the shunt-circuit is broken when the movable portion *a* has traveled a predetermined distance toward the stationary portion S^2, a spring adapted to move the part *a* in a direction opposite to that in which it is drawn by the magnetic attraction, and a friction-brake for said holder T, substantially as and for the purpose hereinbefore set forth.

5. The combination, with the iron carbon-holder T, the stationary portion S^2, and movable portion *a*, of the electro-magnetic feed-grip, an electric coil included in a shunt of the main lamp-circuit and arranged to induce magnetic attraction between the parts of the grip and also between the movable part of the grip and the carbon-holder, the feed-screw G, fast to the part *a* and working in screw-threads in the lamp-frame, the spring R, and the friction-brake, all substantially as described, of a circuit-breaker consisting of the lever *l*, pivoted to portion *a*, or some part moving in unison therewith, the pin *b*, connected to the shunt-circuit, and the two stops b' b^2, all combined substantially as hereinbefore set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HENRI PIEPER, FILS.

Witnesses:
C. MENFFELS,
JACQUES CROTTY.