No. 647,874. Patented Apr. 17, 1900.

C. A. PFLUGER.

ELECTRIC ARC LAMP.

(Application filed Aug. 7, 1895.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

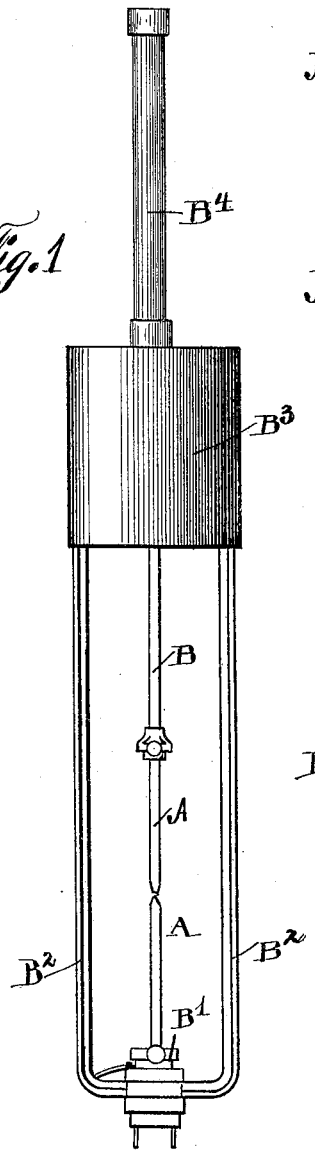
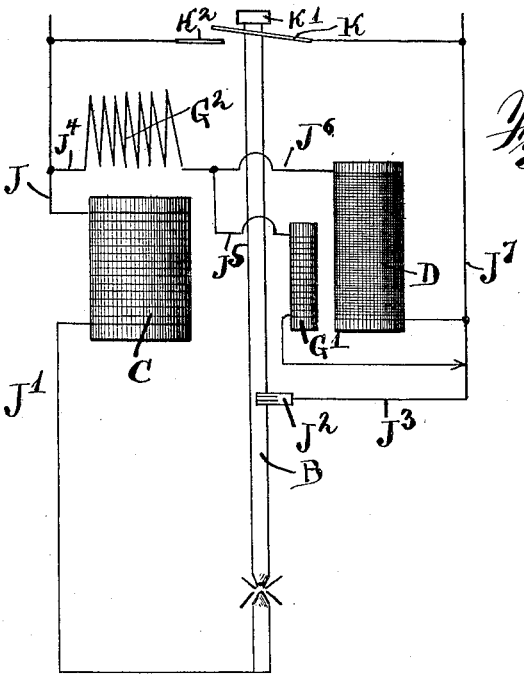


Fig. 2.



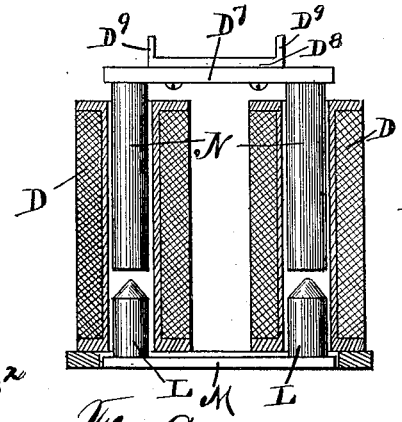


Fig. 6.

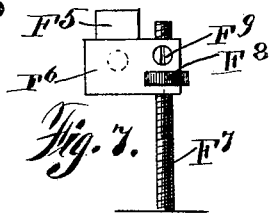


Fig. 7.

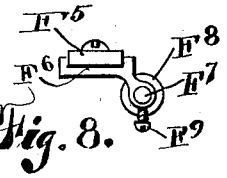


Fig. 8.

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No. 647,874. Patented Apr. 17, 1900.

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ELECTRIC ARC LAMP.

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(No Model.) 2 Sheets--Sheet 2.

Fig. 3

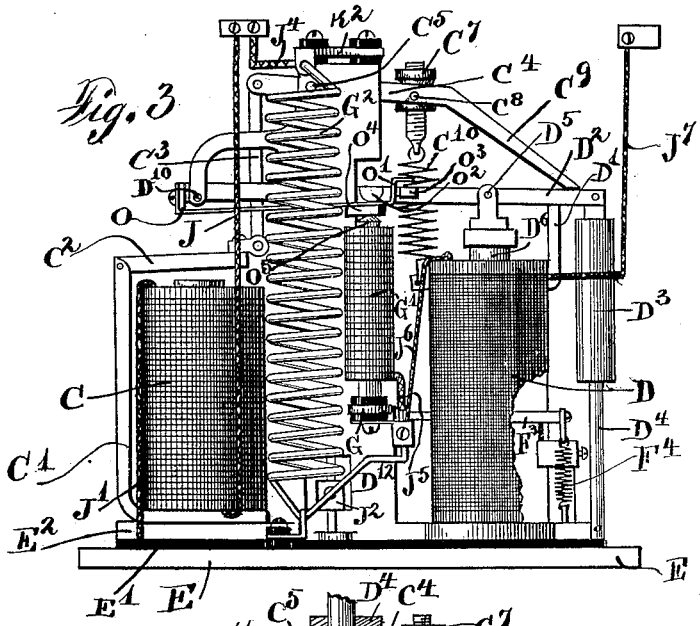


Fig. 4.

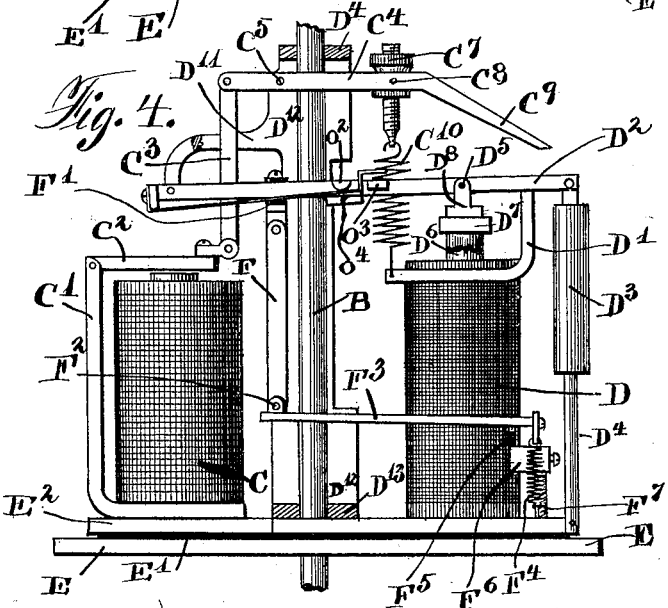
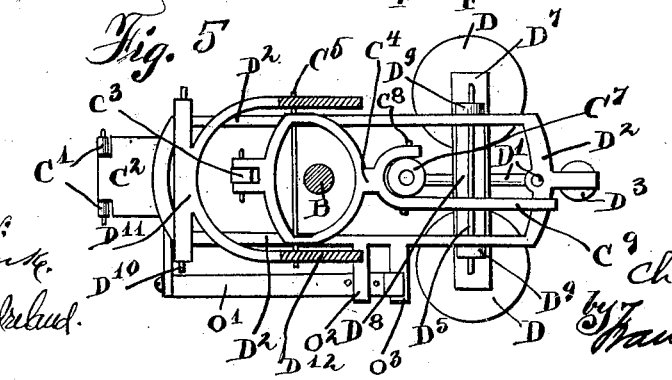


Fig. 5



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UNITED STATES PATENT OFFICE.

CHARLES A. PFLUGER, OF CHICAGO, ILLINOIS.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 647,874, dated April 17, 1900.

Application filed August 7, 1895. Serial No. 558,562. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. PFLUGER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Arc-Lamps, of which the following is a specification.

My invention relates to arc-lamps, and has for its object to provide certain new and useful improvements which I will more specifically set forth. I have shown it as applied to a series lamp; but I have also applied my invention to constant-potential arc-lamps and do not wish to be limited, therefore, to any particular application of it.

The invention really consists of several features, and they may be combined together in a single lamp or may be separated and used with other constructions. Thus the feature which I have shown touching the shunt-magnet could be used alone and apart from the other mechanism or with some other mechanism.

My illustration of the invention and its several features in connection with a series lamp should be taken as illustrative in a general way without being such as to limit me to its use or the use of any particular feature in connection with other features not essential to its operation.

I have illustrated the series lamp in the drawings, wherein—

Figure 1 is a side elevation of a complete lamp. Fig. 2 is a diagrammatic view of the circuits. Fig. 3 is a side elevation of the lamp mechanism with the parts at rest and the carbons in contact with each other. Fig. 4 is a view of the similar parts with the lamp in operation. Fig. 5 is a plan view of the lamp mechanism. Fig. 6 is a cross-section through the shunt-magnet. Figs. 7 and 8 are details.

Like parts are indicated by the same letter in all the figures.

A A are the carbons, the upper suspended from the carbon-rod B and the lower rising from the carbon-holder B′, which is supported by the side bars B^2.

B^3 is the case or frame which contains the mechanism, and B^4 the tube above for the movement of the carbon-rod.

C is the series magnet in the series with the carbons A A.

D is the shunt-magnet.

X is the resistance, and X′ the cut-out magnet, which are placed together in a shunt circle.

E is the bottom of the case containing the mechanism. On it is placed the insulation-strip E′, and on this is secured the bed-plate E^2, to which the several parts of the lamp mechanism are secured. The series magnet C is secured to the lower end of an angle-plate C′, to the upper end of which is pivoted the armature C^2, and to this armature is pivoted the link C^3, pivoted to the end of the lever C^4, which lever is yoke-shaped at C^5 and pivoted on the cross-rod C^5 and provided with a thumb-screw C^7, pivotally supported on the pin C^8 and with the tail C^9. At the lower end of the thumb-screw C^7 is a spring C^{10}, the lower end of which is attached to the arm D′, depending from the shunt-magnet lever D^2. This lever is formed with parallel bars and is attached at one extremity to the dash-pot D^3, opposed to the rod D^4, and carries the pin D^5, on which the cores D^6 of the shunt magnet or solenoids D D are suspended. They are preferably secured with the keeper D^7, on which is mounted the bearing-plate D^8, with the lugs D^9 D^9 to receive the pivoted pin. This lever is pivoted by the pin D^{10} to the rigid frame-piece D^{11}. This frame-piece is attached to and forms part of the vertical bars D^{12}, which, together with the bottom piece D^{13} and top piece D^{14}, constitute the vertical frame of the lamp. This vertical frame is secured to the bottom cross-piece E^2, and thus the frame for supporting the operating mechanism is formed.

Returning to the shunt-magnet lever, we find that a link F is secured thereto, but insulated therefrom, by the insulation-blocks F′. This link is pivoted at F^2 to one end of the clutch F^3, which surrounds the carbon-rod. At the other end of the clutch is the downwardly-pulling spring F^4, which tends to pull the clutch down in opposition to the upward pull of the link F on the opposite side of the carbon-rod. Interposed in the path of the clutch is the insulation-block F^5,

supported on the block F^6, which is supported on the adjustable rod F^7. The block F^6 is adjustable along the screw by means of the thumb-nut F^8 and is secured in position by means of the set-screw F^9.

G is a bracket on the side of the frame-piece D^{12}, and secured thereto, but insulated therefrom, is the cut-out magnet G′ in series with the resistance G^2, as indicated in Figs. 2 and 3.

J is a main conductor which leads into the series magnet C, J′ leading thence down through the plate E to the lower carbon.

J^3 is a brush mechanism engaging the upper carbon, and J^3 the conductor leading thence to the opposite main wire.

J^4 is a conductor leading to the resistance G^2, J^5 a conductor leading from the resistance to the cut-out coil G′, and J^6 a conductor leading from the resistance-coil to the shunt-magnet. Thence a conductor J^7 leads to the opposite binding-post.

Mounted on the frame of the lamp is a spring contact-plate K, having a hole through which the carbon-rod B passes.

K′ is an enlarged head on the carbon-rod too large to pass through such hole.

K^2 is a contact-plate secured on, but insulated from, the frame and adapted to engage the spring-plate K when the latter is forced down.

Referring to the shunt magnet or solenoids D, I have provided them with upper cores N N, which are shorter than the solenoids, and I have provided in the bottom of each coil separate short lower cores L L on the plate M, which is received into an aperture in the lower part of the solenoid-frame and is capable of a slight vertical motion with the other cores. Secured to the frame of the lamp is a spring O, which is shaped at O′ as shown and passes up between the lugs O^2 O^3 on the side bars of the shunt-magnet lever D^2. The spring O has a downwardly-depending block O^4, which is opposed to the core O^5 of the cut-out magnet. There is a certain amount of play between the end of the spring and the lug O^3, as indicated in Fig. 3.

The use and operation of my invention are as follows: The form in which I have shown my invention is that of a series lamp, with the carbons in contact when the lamp is out of use. If now the current be applied, it is evident that a considerable current will pass through the series magnet and through the two carbons, which are together. This will energize the series magnet C and draw down its armature C^2 and also draw down the link C^3, thus tilting the lever C^4 on its pivoted pin C^5 and raising the thumb-screw C^7 and spring C^{10}. Since this spring is attached to the frame D′ on the lever D^2, from which lever is suspended by the link F the clutch F^3, it is evident that the clutch will be raised, and since upon being slightly raised it is cramped upon the carbon-rod by the action of the spring F^4 it is plain that this action will separate the carbons and establish the arc. The lamp now proceeds in somewhat the usual manner. The current shunted in the shunt magnet or solenoids D by the increased resistance at the arc, the parts being properly adjusted, will tend to draw down the lever D^2, and thus lower the parts, including the clutch and carbon-rod, until the clutch, having engaged the block F^5, is caused to slightly release its grip upon the carbon-rod B and permit such rod to move slightly downward. One of the difficulties which arises in this process of feeding is incident to the fact that the spring or other elastic or yielding medium against which the lever which supports the clutch is caused to move is variable. Thus it happens that when the arc is established—as, for example, on a potential of forty-five volts, when the resistance is slightly increased at the arc and the voltage is raised slightly—a sufficient current will be shunted to the shunt magnet and solenoid to cause it to draw down its armature against the action of the spring which holds it up. This will of course gradually increase the tension of the spring and in a greater ratio than the increased energizing effect of the shunt magnets or solenoids incident to the increasing current passed through them. The tendency, therefore, is to make the lamp feed at a higher voltage than its normal or proper voltage. At the end of the stroke, so to speak, or just when it is ready to feed there is an additional resistance to the action of the magnet incident to the fact that it must release the clutch from the rod and in so doing must force the clutch downwardly against the action of the spring which holds it upon its support. There is therefore need of an increased force or action in the shunt magnet or solenoid at the moment when it is about to feed, and this increased force in order to produce satisfactory results and cause the lamp to feed at substantially its normal voltage must be greater than the increase incident to the increase of current passing through the shunt. As one means of effecting this object I have introduced into the lower part of the shunt magnets or solenoids two short cores on an armature, which cores extend into the lower ends of the coils or helices and which, together with their armature, are capable of a slight upward motion. They are adjusted with reference to the coils so as to be drawn up against the lower end of the magnets when the latter are traversed by a current of the normal voltage of the lamp—as, for instance, forty-five. Under these conditions the feeding operation last-above described will be modified as follows: As soon as the current is materially above forty-five volts it will not only draw down the shunt-magnet lever in opposition to this supporting-spring responsive to the variations in the current flowing through the shunt-magnet, but the cores L L will be drawn up quickly into the magnets and will create an additional field of force and apply a considerable additional upward

tendency to the shunt-magnet armature, causing the feed to take place earlier than it otherwise would do—in other words, causing it to take place before the current has risen materially above the normal, or, say, forty-five volts.

Of course the particular mechanism which I have shown for increasing the action of the shunt magnets or solenoids or for accelerating the motion of the clutch-supporting mechanism may be greatly varied and the desired result may be attained in other ways than by the particular means which I have described. This constitutes one of the important features of my invention.

If the lamp fails to feed by reason of the sticking of the carbon-rod or other such difficulty, so that the current through the shunt is greatly increased, the parts will ultimately be brought down into the position indicated in Fig. 4; but the lug or armature O^4 on the spring O is in contact with the core of the cut-out magnet G′, which core is itself the terminal of the coil of said magnet. These parts would be as indicated in Fig. 3. In other words, at the moment of contact between the armature O^4 and the core of the magnet G′ their parts would be in the position indicated in Fig. 4. Under the conditions assumed the current would pass from one terminal of the lamp to the other through the cut-out magnet, which would practically divert the current from both the series and shunt magnets. The effect of this action would be such as to release the burden of the spring C^{10} at both ends, so to speak; but in experience it is found that this spring or such similar spring as is employed will at least momentarily interrupt the circuit of the cut-out magnet, causing the formation of an arc. I avoid this effect by putting the contact for the cut-out magnet on a spring which has a slight play between the two lugs O^2 and O^3 on the side bar of the shunt-magnet lever. The establishment, therefore, of a cut-out circuit takes place without arcing, and the parts assume practically the position shown in Fig. 3. If the carbons are then readjusted, so as to establish the original conditions, the current when applied will cause the same action as before. The peculiar manner in which I have effected these various connections between the levers and magnets need not be very fully described. The main-circuit magnet draws down on its link C^3 and tilts the lever C^4, thus drawing upwardly on the spring C^{10}, and since it is connected by the armature D′ with a lever D^2 the same is drawn upwardly. The two levers are therefore connected by one and the same spring, which thus when extended acts in opposition to both magnets. When the spring is extended by the magnets, its operation is satisfactory; but when the magnets release their respective armatures the two levers would go into inoperative positions were it not for the tailpiece on the lever C^4. In other words, there must be a stop to limit the action of the two levers toward each other and resist the spring. The stop for the clutch is illustrated more fully in Figs. 7 and 8. It is easily adjustable by simply turning the thumb-nut F^8 and then setting the screw F^9.

As previously stated, I do not desire to be limited to the particular mechanism shown nor to the employment of all these various details in one and the same lamp, as they may be fully utilized alone. Moreover, as previously pointed out, the effects or results which I seek can be undoubtedly substantially accomplished by mechanism differing in form considerably from what I have illustrated while still possessing the same general features and operating in the same manner.

The method of acceleration as applied to the shunt-magnet I propose to apply equally to constant-potential arc-lamps.

I use the terms "magnet" and "solenoid" interchangeably where one is capable of being substituted for the other.

I claim—

1. In an arc-lamp, the combination of a movable carbon-carrier with a magnet or solenoid which controls the same and a movable accelerating device associated with said magnet to increase its action beyond the increase resulting from the normal increased current flowing therethrough.

2. In an arc-lamp the combination of a movable carbon-carrier with a magnet or solenoid which controls the same and an accelerating device associated with said magnet comprising means for increasing the strength of the effective magnetic field of such magnet or solenoid beyond the increase due to the normal increase of the current flowing therethrough, said accelerating device consisting of a secondary core independent of the carbon-carrier and adapted to be moved by the magnetic action of the solenoid.

3. In an arc-lamp, the combination with a movable carbon-carrier of a magnet or solenoid which controls the same responsive to variations in the arc, said solenoid provided at one end with a movable core connected with the carbon-carrier and at the other end with an independent movable core, said latter core acting to change the strength of the solenoid at a predetermined point by varying its position therein.

4. In an arc-lamp the combination of a movable carbon-carrier with a shunt magnet or solenoid to control the same, means for increasing the effective action of the magnet or solenoid beyond its increased action due to the normal increase of current flowing therethrough comprising a secondary core movably mounted in proximity to one end of said solenoid and adapted to be moved so as to vary its position with relation to the solenoid.

5. In an arc-lamp the combination of a movable carbon-carrier with a solenoid to control the same and secondary movable cores in such solenoid adapted to be moved by the magnetic action of said solenoid so as to vary the length

extending into the solenoid whereby the power of the solenoid is increased toward the end of its action beyond the increase due to the normal increase of current flowing therethrough.

6. An arc-lamp, comprising a solenoid, a movable carbon-carrier connected with the core of said solenoid so as to be controlled thereby, responsive to variations in the arc, a movable secondary core associated with one end of said solenoid and adapted to be moved by the magnetic attraction of the solenoid so as to vary its position to increase the action of the solenoid beyond the increase resulting from the normal increase of current flowing therethrough, and a limiting device associated with said secondary core and adapted to limit its movement in either direction.

7. In an arc-lamp the combination of a series magnet with a shunt-magnet, two pivoted levers controlled one by each of said magnets, a spring which connects the two levers together and acts in opposition to both magnets and a clutch suspended from one of said levers, and a stop device to prevent the spring from drawing the two levers too closely together.

8. In an arc-lamp the combination of a series magnet with a shunt-magnet, two pivoted levers controlled one by each of said magnets, a spring which connects the two levers together and acts in opposition to both magnets and a clutch suspended from one of said levers, and a stop device to prevent the spring from drawing the two levers too closely together, said stop consisting of a tailpiece on one of the levers to engage the other.

9. In an arc-lamp the combination of a cut-out magnet with a spring-suspended armature therefor attached to a spring-support and lugs on the shunt-magnet lever between which said spring-support has a small play.

10. In an arc-lamp the combination of a shunt-magnet with a movable part controlled thereby to feed the carbons, a cut-out magnet and a circuit-closer carried by such movable part suspended so as to have a slight movement thereon and provided with a spring-support contact to engage the opposed cut-out contact.

11. In an arc-lamp the combination of a movable carbon-carrier with a solenoid to control the same, and means for varying the strength of said solenoid toward the end of its action beyond the increase due to the normal increase of current flowing therethrough, said means comprising a movable core independent of the carbon-carrier and so positioned as to be automatically moved by the solenoid, substantially as described.

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Witnesses:

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