(No Model.)

E. P. CLARK.

ELECTRIC ARC LAMP.

No. 509,842. Patented Nov. 28, 1893.

Fig. 1.

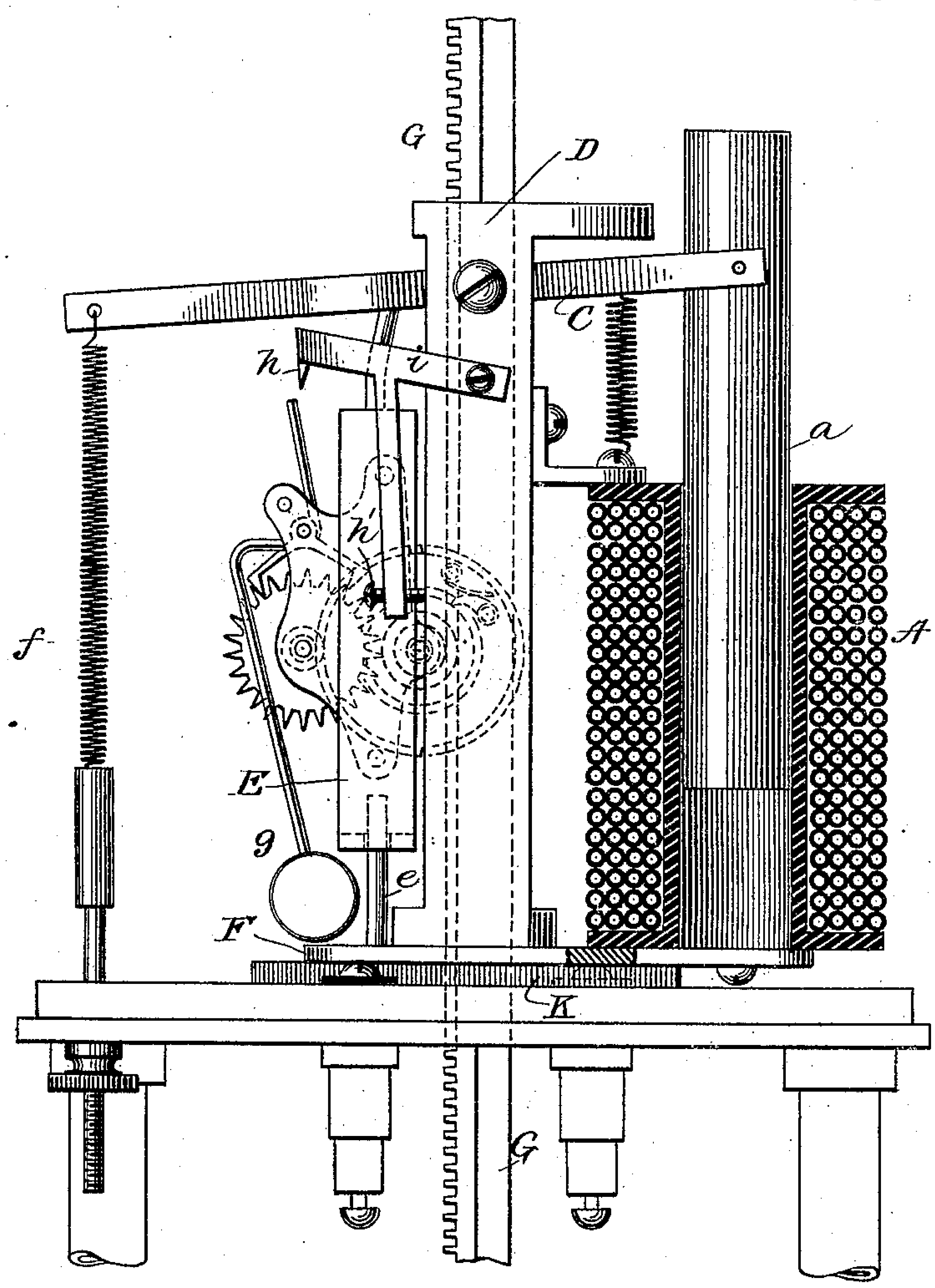


Fig. 2.

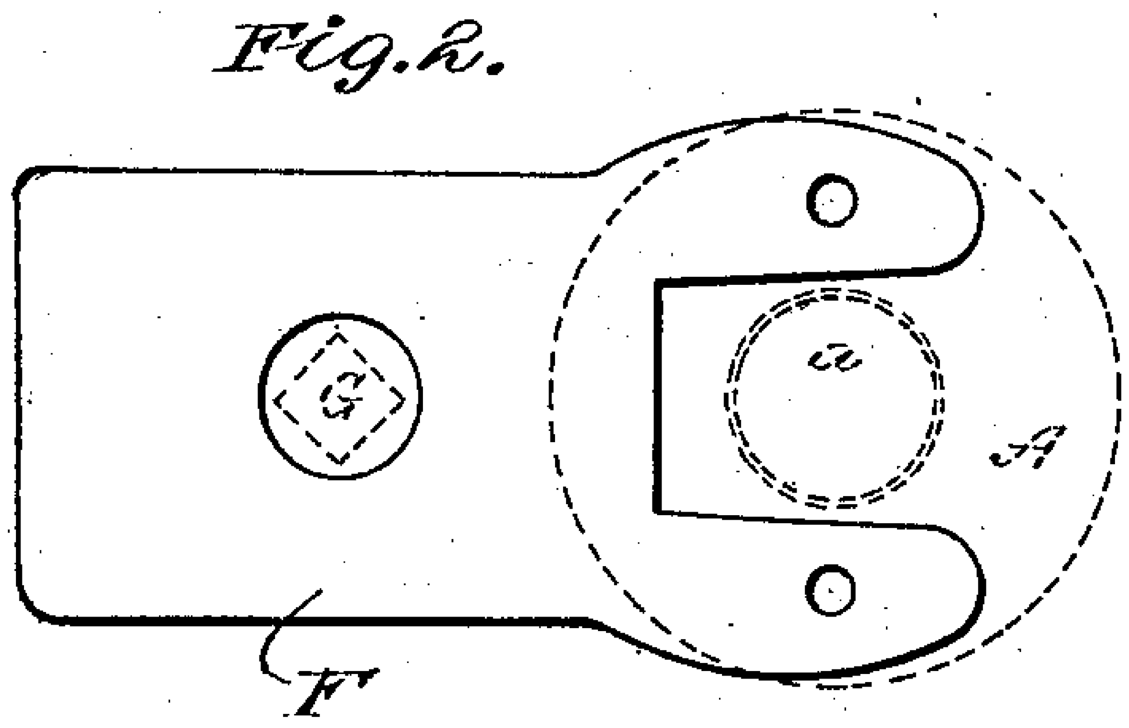
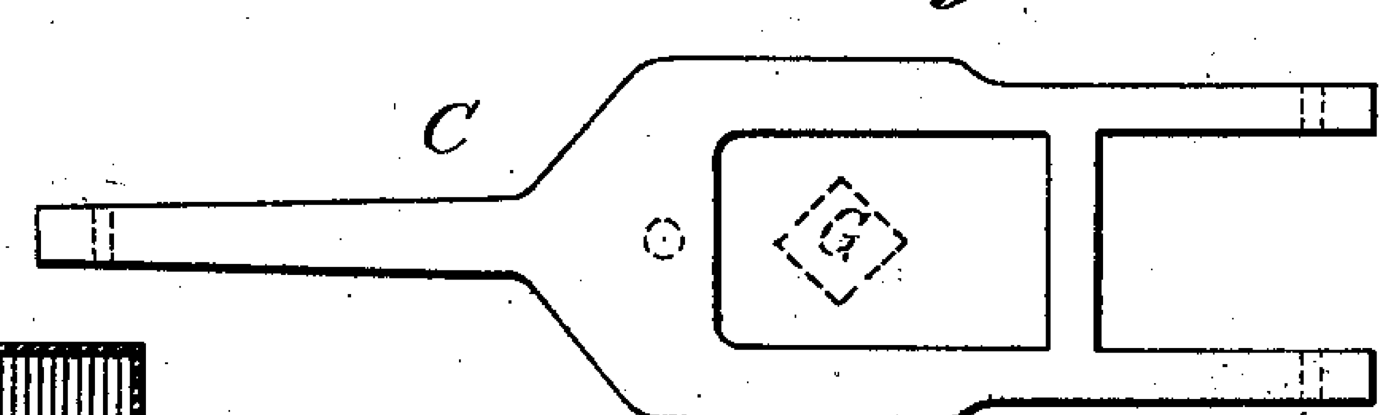


Fig. 3.



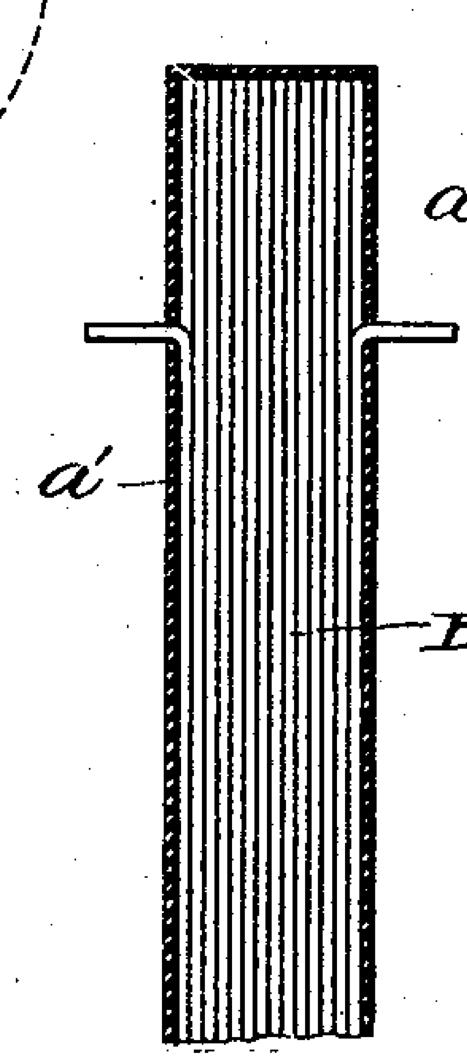


Fig. 4.

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ERNEST P. CLARK, OF NEW YORK, N. Y., ASSIGNOR TO THE CLARK ELECTRIC COMPANY, OF NEW YORK.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 509,842, dated November 28, 1893.

Application filed January 28, 1893. Serial No. 460,141. (No model.)

To all whom it may concern:

Be it known that I, ERNEST P. CLARK, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Arc Lamps, of which the following is a full, clear, and exact description.

The object of this invention is to provide an efficient arc lamp for alternating currents of a frequency or rate of alternation such as is usual at the present time in American alternating incandescent systems and consists of novel devices to that end, of which the following is a description.

I am aware that there have been many devices invented for this purpose, but all of them have proved more or less unsatisfactory, because it is difficult to obtain a satisfactory operating power for an arc lamp with alternating currents of this high frequency, without making the solenoids or magnets of larger dimensions and of many more turns than would be required for a lamp working from a continuous current. It is also found that when the coils are constructed of sufficient power to operate the lamp, there is so much impedence or apparent resistance—as distinguished from the actual ohmic resistance—in them, owing to the high frequency of the current employed, that the available electro-motive force is not sufficient to maintain a good arc between the carbons. This difficulty has been met in two ways; first, by raising the electro-motive force at the terminals of the lamp to a point which will allow of the large drop in the coils, and still be able to maintain the arc; or second, by counter balancing the weight of the upper carbon and its rod, to such a degree, that a much smaller magnet or solenoid may be able to operate it, and so by reason of the smaller magnet employed, reducing the impedence enough to allow the lamp to work with a reasonable electro-motive force. The objection to the first plan lies in the excessive power required, and to the second plan, in the lack of certainty of action, as the effective weight of carbon and rod—which is the feeding power of all lamps—being so far reduced by the counter-balancing, a slight impediment as dust or dirt, may stop the feed altogether and thus disable the lamp. The purpose of my invention is to provide a solenoid of sufficient power to lift and operate the upper carbon and its rod without the aid of counter-balance weights of any description, and to do this without introducing an objectionable impedence into the circuit, and to this end consists of the novel arrangements and combination of parts, hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a side elevation of the feeding mechanism of the lamp, showing the magnet in section. Fig. 2 is a plan of the base plate. Fig. 3 is a plan of the main lever; and Fig. 4 is a section of the magnet core.

Referring to the drawings by letter, A represents the solenoid, or working coil, whose purpose is to separate the carbons when the current is first turned on, and to keep them separate while the current flows, and to allow the upper carbon to descend as required to compensate for the consumption of the carbons. This solenoid consists of ordinary copper magnet wire, wound upon a spool composed entirely of some solid insulating material, as for instance, hard rubber. The core of the said solenoid is shown at a, and is made very long as shown, in order to obtain a powerful effort and a long range of stroke. This core is composed of a bundle of iron wires incased in, and securely held in shape, by a sheath or case of insulating material a', as for instance, hard rubber. In former lamps of this character, the spool of solenoid A, has usually been formed of metal and slit vertically to avoid currents which would otherwise be induced in it by the alternations of the current in the coil, but such slitting does not entirely avoid these currents; consequently a metal spool of any description must necessarily be an absorber of power and must cause more or less impedence in the coil of wire surrounding it. On the contrary, a spool composed entirely of insulating material can have no currents induced in its substance and causes no additional impedence in the coil. The core a, has always been made of a number of iron wires for the purpose of preventing induced currents within it, but in all previous lamps of this character, the bundle of wires constituting the core has been held or bound together by means of wire or metal bands tightly about it at intervals, and while the core itself, if made of fine wires, is reasonably free from local induced currents, the metal bands by which it is held together, become the seat of powerful induced currents and are consequently absorbers of energy whose presence adds materially to the impedence or apparent resistance of the solenoid coil. In my lamp on the contrary, the wires of the core B, are inclosed in, and held by, a sheath of insulating material in which no currents can be induced and which will at the same time afford the necessary rigidity to the core. It is only by strict attention to these points and avoiding all possible opportunities for the generation of induced currents in other parts as described hereinafter, that I have been able to use a solenoid large enough to do effective work in the lamp and still keep the impedence down to so small a point that it offers no obstacle to the effective working of the lamp.

The core a, is pivoted and suspended from a lever C. This lever is of the form shown in Fig. 3 and as will be observed does not entirely encircle the core, the effect of which would be to make the lever the seat of induced currents. It is also important that the core be suspended upon pins which enter it, a short distance only on each side, and not by a pin passing through both core and lever, which would also cause loss by induced currents. The plan I make use of to suspend the core, is to bend two of the wires of which it is composed into the form of the letter L and let one end of each wire project through a hole in the side of the shell or sheath, thus forming pins to suspend the core from; this is shown in Fig. 4. Lever C, is pivoted in two uprights D, as shown, and from a point near its center of motion, the frame E, containing a clock work and escapement, is suspended. The frame E, moves vertically and is guided by pins e, one of which is shown in Fig. 1. These pins are secured to the base plate F, of the lamp and pass freely through holes in the lower cross piece of frame E. The carbon holding rod G, made of square brass with rack teeth cut in one corner, as shown, gears with the first wheel of the clockwork train held in frame E, and an ordinary verge is applied to the last wheel, said verge carrying a vibrating piece g. With the parts in the position shown, the descent of the carbon-holding rod G, by gravity causes the gears of the clockwork to revolve and piece g, to vibrate. If now the core a, is drawn by the solenoid A, the frame E, with the clockwork will be raised and the vibrating piece g, will strike lug h, and stop vibrating until the frame is once more restored to its former position. The action is, then, to first raise frame E, which brings vibrator g, into contact with lug h, which arrests the motion of the gears and the descent of the carbon holding rod; and next by continued upward movement of frame E, which now carries the rod with it, to separate the carbons and form the arc. When by the consumption of the carbons, the arc is lengthened beyond a certain degree, the current in the solenoid being weakened by the increased resistance of the arc, allows the core a, to ascend slightly by gravity and the tension of the spring f, which lowers frame E, its clockwork and the rod C, thus shortening the arc until finally the frame E, reaches a position where vibrating piece g, slips past lug h, and allows the rod G, to feed downward, shortening the arc and restoring the strength of the current. Core a, is again drawn into the solenoid, raising frame E, and its attached parts and causing vibrator g, to once more strike lug h. Vibrator g, usually strikes one side or the other of the lug, but occasionally it may be raised at an instant when its top will come fairly into contact with the under edge of the lug. When this abnormal contact between the two parts takes place, the lug being carried by a yoke i, which is pivoted freely to upright D, simply lifts with the vibrator and the vibrator slips from under the lug and strikes its side, as before, while the lug drops back into its former position. The object of this is to allow the rod to fall the full distance before the clockwork is stopped, otherwise the pull of the magnet would injure the working parts and render the lamp inoperative. The solenoid A, and upright D, are mounted upon a metal base plate, which is shown in Fig. 2, the position of A, on the plate being shown by the dotted circle. It will be observed that the plate is cut away at the part which comes under the solenoid, for the purpose of avoiding the currents which would be induced in it if it were left full under the solenoid. The plate with all the parts of the lamp mechanism is mounted upon a block of insulating material K, which effectually insulates it from the case.

I have not shown a diagram of the circuit of the lamp, as it is essentially the same as in other lamps of its class.

The position of the lug h, is adjusted by means of the screw h', which is carried in an angular extension from the yoke, and which bears upon the frame D. The yoke is a semicircle pivoted at its extremities to the two sides of the frame D. The object of moving the clock frame in a direction parallel to the carbon rod, is to maintain at all times the same depth of mesh between the pinion and rod.

Having thus described my invention, I claim—

1. In an electric arc lamp, a solenoid through which alternating currents flow, whose spool or shell is composed entirely of non-conducting material and whose core is composed of iron wires inclosed in a shell or sheathing of non-conducting material.

2. In an arc lamp, the combination of a clockwork provided with an escapement and

having a vibrating finger controlling said escapement, of a detent consisting of a single point or finger carried by a yoke pivoted at its extremities, the yoke being provided with an angular extension carrying an adjusting screw, said detent adapted to lift when its engagement with the escapement is abnormal, in the manner set forth.

3. In an arc lamp, a solenoid core consisting of a bunch of iron wires, in combination with a lever pivoted to said core, the pivots being formed by two of said iron wires bent at right angles to the core and engaging with the lever, substantially as described.

4. In an alternating current arc lamp, a solenoid having a core consisting of a solid bunch of iron wires inclosed in a case or sheathing of non-conducting material, in combination with a lever pivoted to said core at a point intermediate of its extremities, the pivots being formed by two of said iron wires bent at right angles and passing through the said sheathing, substantially as described.

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

ERNEST P. CLARK.

Witnesses:
WM. A. ROSENBAUM,
FRANK S. OBER.