(No Model.)

G. KIRKEGAARD.

ELECTRIC ARC LAMP.

No. 485,744. Patented Nov. 8, 1892.

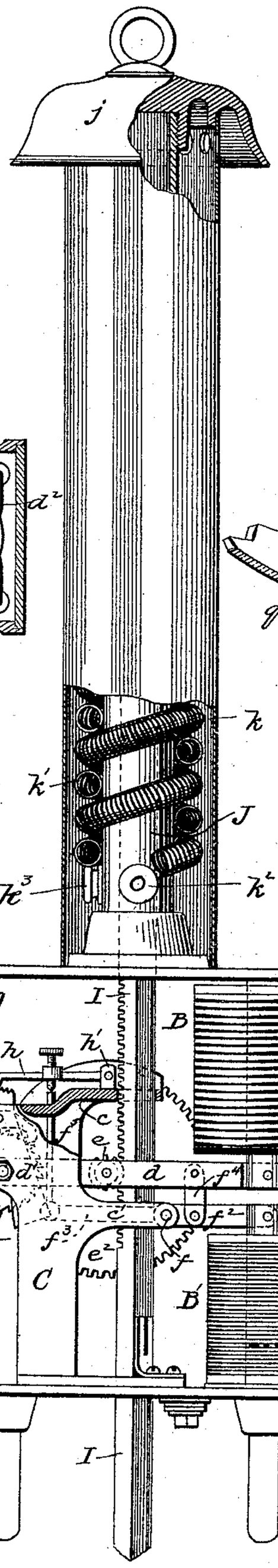

Fig. 1.

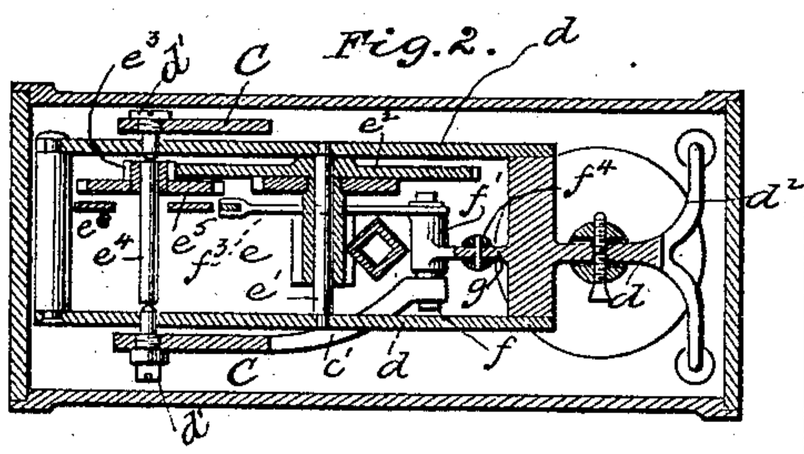

Fig. 2.

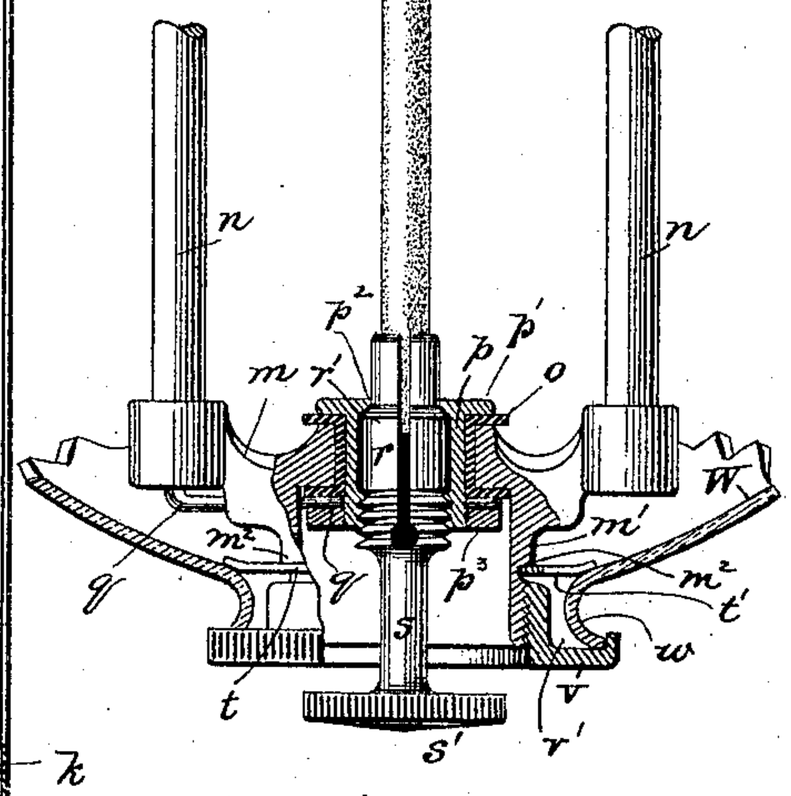

Fig. 3.

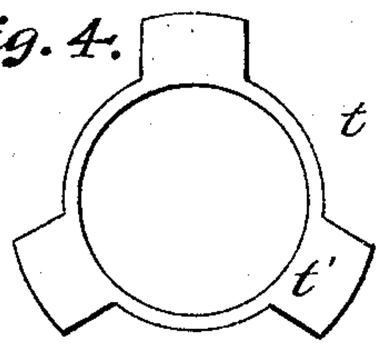

Fig. 4.

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ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 485,744, dated November 8, 1892.

Application filed May 13, 1892. Serial No. 432,831. (No model.)

To all whom it may concern:

Be it known that I, GEORG KIRKEGAARD, a subject of the King of Denmark, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

This invention relates to electric-arc lamps; and its object is to produce a lamp which shall be simple in construction, adapted for incandescent circuits, and very delicate and sensitive in its operation.

The invention has special reference to that class of arc lamp in which a clockwork moved by the weight of the carbon-rod is controlled by the electro-magnetic apparatus.

Besides improvements in the feeding mechanism, the invention comprehends improvements in the globe and carbon holders, and also improvements in the construction and location of a rheostat, which may be used in connection with the lamp when it is working on incandescent circuits.

The invention will be described in detail with reference to the accompanying drawings, in which—

Figure 1 represents a vertical section through the upper portions of the lamp, parts being shown in elevation. Fig. 2 represents a horizontal section of the lamp, taken on line $x\,x$ of Fig. 1. Fig. 3 represents a vertical section of the lower end of the lamp, showing the carbon and globe holders. Fig. 4 is a detail of the annular spring-plate.

Referring to the drawings by letter, A represents the case containing the feeding mechanism of the lamp. In one side of this case the main and shunt electro-magnetic solenoids B B′, respectively, are mounted, the former being connected to the roof of the casing and the latter to the floor of the casing and with coincident axes.

b b' respectively represent the movable cores of these solenoids. They project out of their respective coils toward each other and move in opposite directions when drawn into their coils.

C represents a frame mounted upon the floor of the case, and consists of two upright side pieces connected across the top by a horizontal piece c. In this frame is pivoted a second frame d, which supports a clockwork. The pivotal point of this frame is on two screw-studs projecting through the opposite sides of the frame C, and upon these studs the frame turns. The frame is rectangular in shape, the cross-piece at the forward end carrying an arm d^2, which spreads at its outer end, forming a T or cross head, to the extremities of which are fastened springs d^3, tending to lift the end of the frame and counterbalance the suspended parts. To this extension d^2 the end of the core b is loosely attached. The clockwork carried by this frame consists of a pinion e on the shaft e', a large wheel e^2 on the same shaft gearing into a small pinion e^3 on shaft e^4. This last-mentioned shaft has no connection whatever with the clockwork-frame d; but, as shown in Fig. 2, it is mounted on the ends of the screw-studs d'. Ratchet-wheel e^5 is also carried by this shaft, and it is operated by the anchor e^6 on shaft e^7, which has its bearings in the main frame C, and therefore is also independent of the frame d. Shaft e^7 also carries a balancing-weight e^8, which regulates the movement of the anchor. The escapement mechanism of the clockwork is therefore mounted entirely independent of the remainder of the train and the frame supporting it, so that any movement which may be imparted to the clockwork and frame d will not be communicated to the escapement, and consequently the latter will always remain in adjustment and will work with the greatest uniformity. One side of the frame C has an inwardly-bent arm c', projecting underneath the frame d and carrying in its end a stud f, upon which there is a sleeve f', carrying two arms f^2 and f^3, respectively. These arms, with the sleeve, constitute a single lever pivoted about midway of its extremities. The arm f^2 is loosely connected at its forward end with the outer end of core b'. It also has attached to it at a point near its pivot f a link f^4. This link is also connected with a short arm g on the frame d, so that said frame and lever are positively connected. The end of the arm f^3 carries a vertical push-rod f^5, projecting through the cross-piece at the top of the main frame C. h is a detent pivoted at one end in a post h' on the top of the frame and provided at its other end with a sharp toe, which is adapted to engage with a segment of teeth e^9, car-

ried by the escapement-weight e^8. The push-rod f^5 bears against the under side of the detent and raises and lowers it out of and into engagement with the segment of teeth e^9, and thus releases or locks the clockwork. The detent has a set-screw against which the push-rod bears and by which the effective thrust of the push-rod may be adjusted. I is the upper carbon-carrying rod, having teeth i cut in one side nearly its entire length, which are engaged by the pinion e. The solenoid B is supposed to be connected in the shunt-circuit thereto in the ordinary manner.

The operation of the mechanism so far described is as follows: The carbons when not burning are supposed to be together. When the current is turned on, the solenoid B, becoming energized, pulls up its core b and swings the clockwork bodily on its pivot d'. This movement also withdraws the rod f^5 from the detent which, as its movement is much longer than that of the frame, immediately locks the clockwork, and, the pinion e being in engagement with the carbon-rod, the latter is lifted and the arc is formed between the carbons. When the resistance of the arc increases and the shunt-magnet B′ becomes energized, it pulls down on its core b' and thrusts the rod f^5 upward against the detent, lifting it and releasing the clockwork, which then begins to move by the weight of the upper carbon-rod and permits said rod to feed downward until the detent is permitted to engage the escapement through the weakening of the shunt-magnet. It will be observed that when the solenoid acts to form the arc the rod f^5 partakes of a movement several times longer than the arc-space between the carbons. This is due to the position of the point of attachment of the link f^4, and results in insuring that the clockwork shall be locked simultaneously with the slightest upward movement of the carbon-rod, thus making the operation of the apparatus in establishing the arc very positive. In feeding the carbon-rod it will also be observed that any variation of the current in the shunt-magnet moves the push-rod f^5 a long distance in comparison to the distance it moves the clockwork. This is due to the fact that the lever carrying the push-rod is pivoted in the middle, while the lever or frame carrying the clockwork is pivoted at its end, and to the additional fact that the link f^4, connecting the lever and frame, is located near to the pivot of the lever, but very remote from the pivot of the frame. As a matter of fact, while the lamp is in operation the movement of the frame during the feeding operation is hardly perceptible, while the movement of the push-rod is distinct. This arrangement of the levers results in a very delicate, sensitive apparatus, and the slightest variation of the current in the shunt-magnet will be followed by immediate response by the carbon-rod. The carbon-rod extends upward through the top of the casing into a tube J, which carries at the top a screw-cap j and ring for supporting the lamp. This tube is surrounded by another sheet-metal tube of larger diameter, so that a space will be left between the tubes. In this space and coiled around the inner tube are two coils of German-silver wire k k' or other high-resistance metal. The lower ends of these coils are connected, respectively, to insulators k^2 k^3, and the upper ends are connected in any desired manner with the mains. This is a convenient way of disposing of the lamp-resistance, and provides for the largest amount of resistance in the smallest space.

In Fig. 3 I have illustrated my improved carbon and globe holders. m is a casting supporting the side rods n n of the lamp. It is provided with a central circular opening, the walls of which are lined with suitable insulating material o. In this opening is placed a short cylinder p, provided with an annular flange p' around its upper edge resting upon the edge of the opening and with an internal conical surface p^2, for a purpose which will hereinafter appear. The cylinder projects through the opening at the bottom and is secured in placed by a ring p^3, screwed onto it and drawing the flange p' down onto the edge of the opening. This ring also clamps the end of one of the conductors q, which leads down through one of the side rods. The cylinder is also provided internally at its lower end with a screw-thread. The carbon-clamp consists of a tubular body r, split longitudinally into several sections, forming spring-jaws. A conical shoulder r' is formed around the outside of the tube and is adapted to engage with the conical surface p^2 on the cylinder, before described. The lower portion of the tubular clamp has an external screw-thread, which engages with the internal thread at the lower end of the cylinder. The lower end of the tube has a solid extension s in the form of a stem and carries a hand-wheel or cross-head s', by means of which the clamp may be rotated. The main casting m has a downward cylindrical projection m', externally threaded, as shown, and open at its lower end to admit the carbon-clamp. Above the external thread is a shoulder m^2, against which a spring-plate t is adapted to rest. This plate is confined between the shoulder and a ring v, which screws onto the external threads of the cylinder. This ring has an annular gutter v', in which the flange w on the bottom of the lamp-globe W rests. When the globe is in position, the spring-plate t, which is provided with spring-arms t', bears upon the inner surface of the globe with a yielding pressure and holds the same in place. To remove the globe, the ring is simply unscrewed and the globe then lowered from its position. This globe-holder does away with screws or other positive fastenings, which are a great objection on account of the liability of breaking the globe through expansion and contraction of the metallic parts caused by variations in temperature. The globe may be held in place

as rigidly as desired by screwing the ring up or down, as the case may be. To replenish the lower carbon, the clamp is removed by turning the cross-head s' and screwing the clamp free of the threads in the cylinder p, then drawing it downward until it is entirely free from the lamp. When the clamp is removed from the base of the lamp, the spring-segments of the tube spring out and free the pencil, which may be removed and another one put in its place. The clamp is then readjusted to its seat and screwed up until the conical surfaces come together and grip the pencil. It will be observed that this operation is performed without removing the lamp-globe and without the necessity of reaching through the upper open end of the globe.

Although I have shown and described solenoids as the operating magnetic apparatus, it is obvious that electro-magnets with fixed cores may be utilized, in which case the armatures would be carried by the levers.

Having thus described my invention, I claim—

1. In an arc lamp, a train of wheels for feeding the carbon-rod and a bodily movable frame in which the same is mounted, in combination with an escapement and escapement-wheel mounted in a separate stationary frame, the movable frame being pivoted concentrically with the escapement-wheel, whereby the center of gravity of the escapement-wheel will remain constant or stationary, while that of the train is shifting, substantially as described.

2. In an arc lamp, the combination of a pivoted frame carrying a clockwork geared to the carbon-rod, an electro-magnet in the main circuit adapted to swing said frame on its pivot, a detent for said clockwork, an electro-magnet in a shunt-circuit to the arc, a lever moved by the shunt-circuit magnet and operating the detent, and a link or other device connecting the frame and the lever at points to one side of the pivots of said frame and lever, whereby a movement of the frame and levers by either of the magnets will cause a longer movement of the detent than of the clock-movement, substantially as described.

3. In an arc lamp, the combination of the main magnet B, the pivoted frame d, carrying a train of wheels provided with a detent, the carbon-rod geared to the train of wheels, said frame connected to or operated by the core of magnet B, the lever $f^2 f^3$, carrying at one end push-rod f^5, operating said detent, and at the other end connected to or operated by shunt-magnet B', said lever $f^2 f^3$ and said frame d being connected together by link f^4, substantially as and for the purpose set forth.

4. The combination, with the casting m, provided with a circular opening, of the cylinder p, located in said opening, but insulated from the casting, said cylinder provided with a flange p' and with the conical surface p^2 and also internally and externally threaded, the ring p^3, fitted onto the lower end of said cylinder and clamping an electric conductor q, and the carbon-holder $v\,s$, located in said cylinder and having a corresponding conical surface and a corresponding screw-thread, for the purpose set forth.

5. The combination of the lower carbon-support of an arc lamp, a detachable and adjustable ring connected thereto, said ring provided with a gutter or support for a globe, and an annular spring-plate located above the gutter and adapted to bear against the inside of the globe with a yielding pressure to hold it in place.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEORG KIRKEGAARD.

Witnesses:
JAMES F. KAVANAGH,
FRANK S. OBER.