(No Model.) 2 Sheets—Sheet 1.

L. PIETTE & F. KRIZIK.

ELECTRIC ARC LAMP.

No. 273,888. Patented Mar. 13, 1883.

Fig. 1.

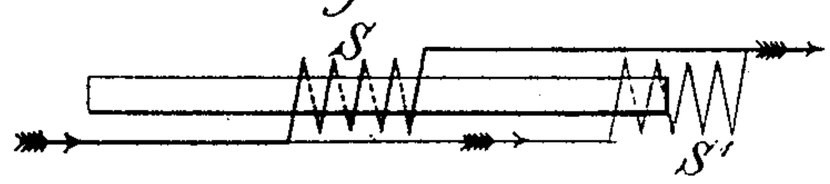


Fig. 2.

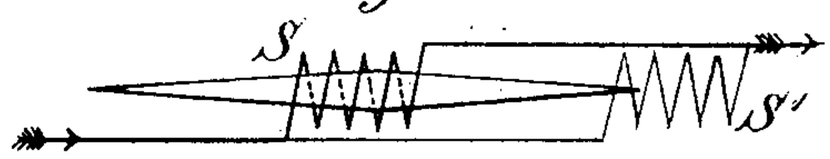


Fig. 3.

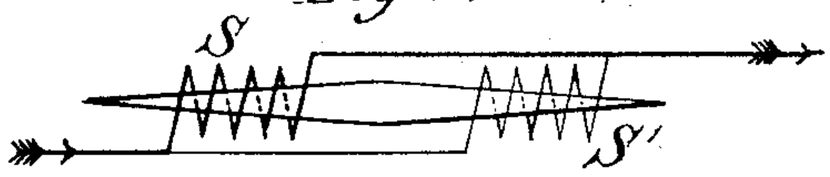


Fig. 4.

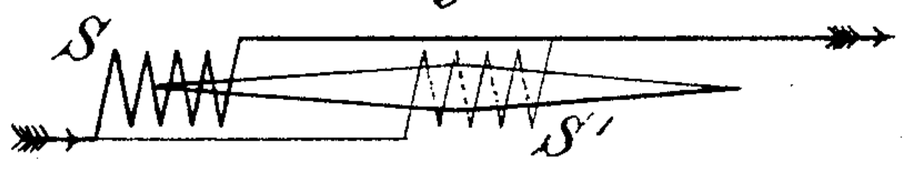


Fig. 5.

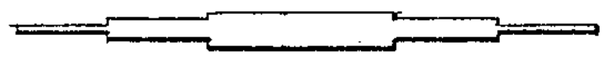


Fig. 6.

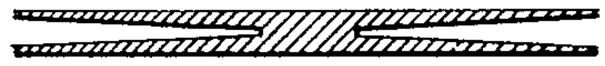
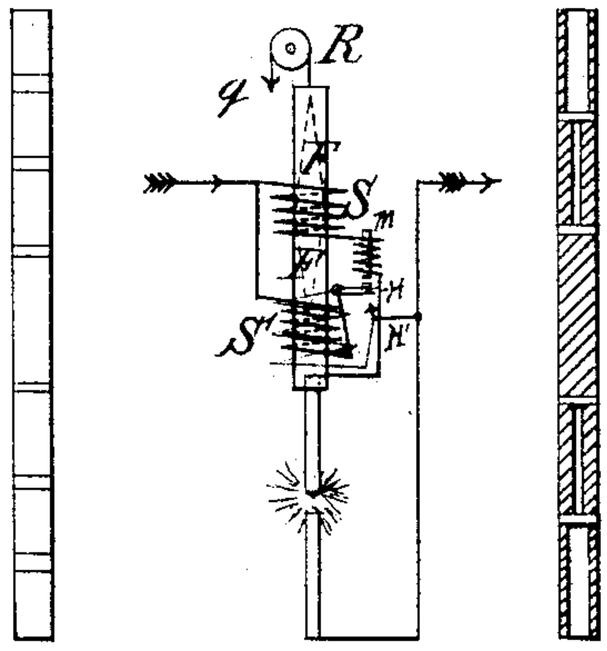


Fig. 7. *Fig. 9.* *Fig. 8.*



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 10

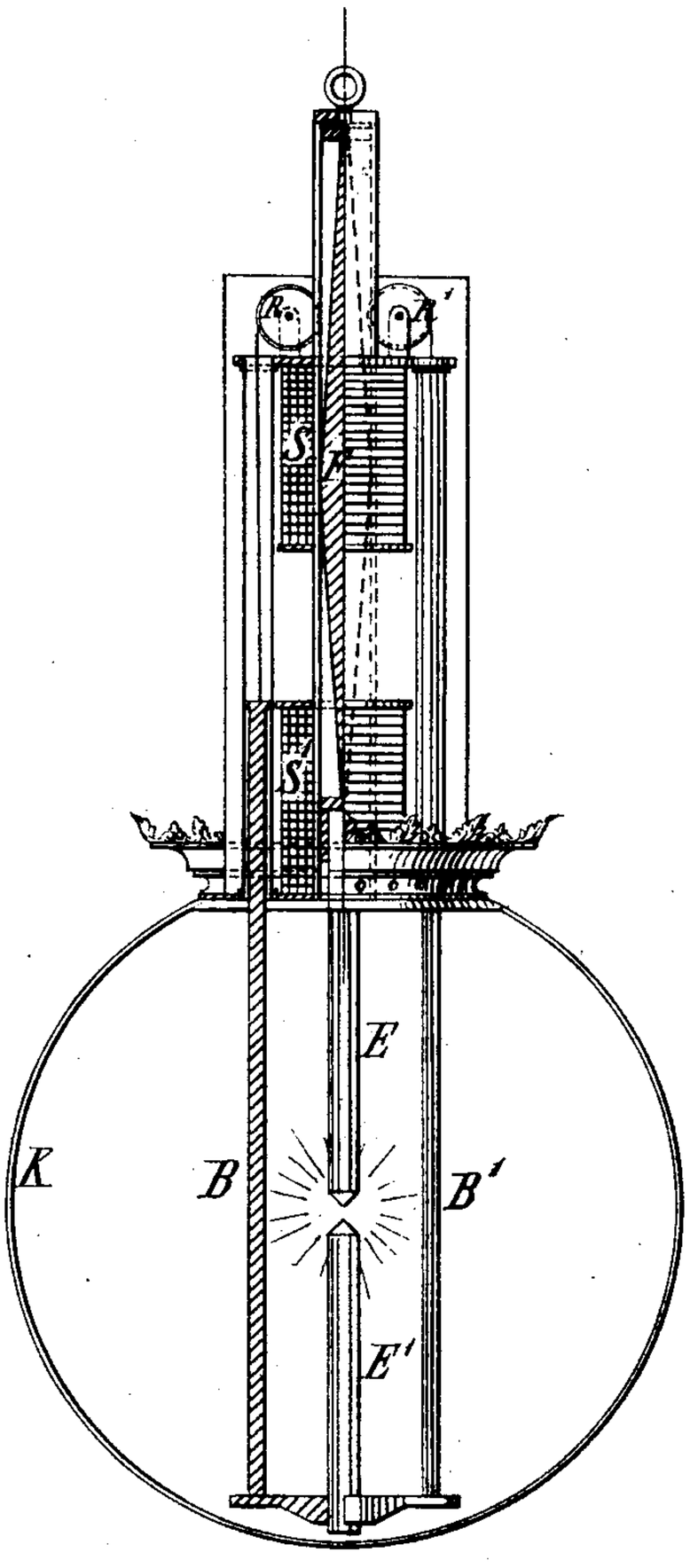
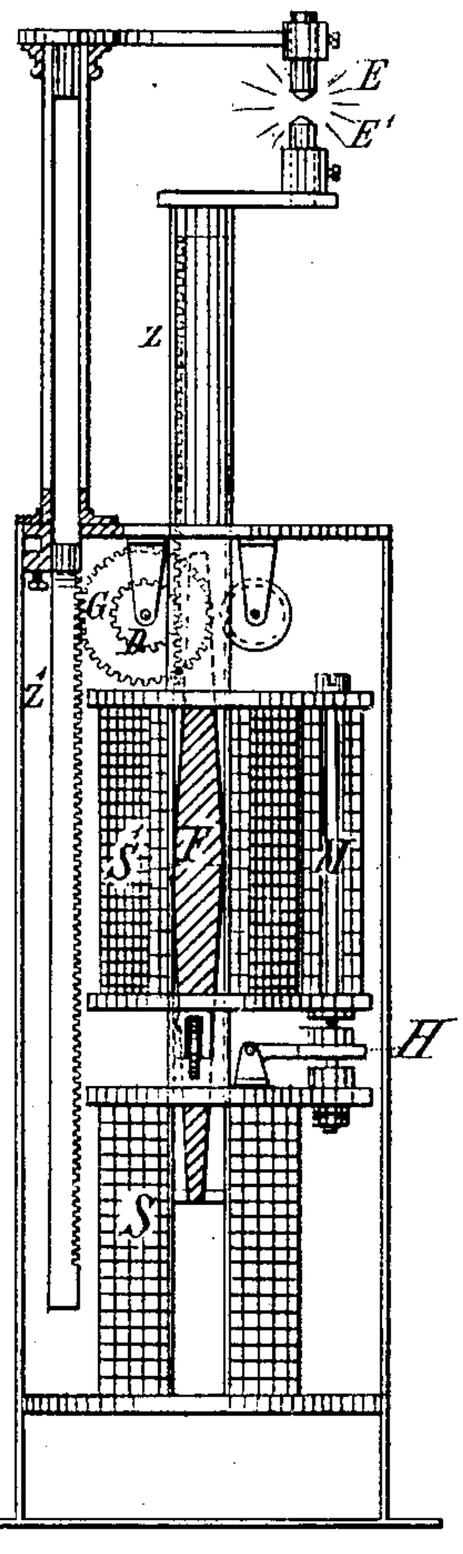


Fig. 11.



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UNITED STATES PATENT OFFICE.

LUDWIG PIETTE AND FRANZ KRIZIK, OF PILSEN, AUSTRIA-HUNGARY.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 273,888, dated March 13, 1883.

Application filed June 19, 1882. (No model.) Patented in England April 6, 1880; in Germany April 7, 1880; in Austria Hungary April 16, 1880; in France June 8, 1880, and in Belgium June 11, 1880.

To all whom it may concern:

Be it known that we, LUDWIG PIETTE and FRANZ KRIZIK, subjects of the Emperor of Austria, and residents of Pilsen, in the Empire of Austria, have invented a certain Improvement in Electric Lamps, of which the following is a specification.

This invention relates to a method of effecting automatically the regulation of the distance of the carbons in an electric lamp, without the aid of clock-work or other like mechanism, by the use of solenoids having special cores, such solenoids and cores being applicable where, as in electric lamps, uniformity of attractive force has to be maintained throughout a considerable length of stroke. In an electric lamp according to this invention there are two solenoid coils placed end to end, with their axes in the same straight line, and with one iron core free to slide lengthwise within both, this core carrying at its end one of the carbons of the lamp and being balanced when it is vertical or running on rollers when it is horizontal. The one solenoid coil, of low resistance, is in the lamp-circuit. The other, of high resistance, is in a branch circuit connecting the conductors to and from the lamp. The core is so shaped that so long as the two solenoids exert equal attractive forces it remains stationary, notwithstanding that it may have been previously moved lengthwise so as to extend farther into or through the one coil than the other; and in order that it may have this property it is made with the mass of its metal reduced toward the ends. This may be done either by tapering it from the middle of its length to a less diameter at each end, or by boring it from each end with a tapering bore; or, instead of giving the metal a regular taper externally or internally, its diameter or thickness may be reduced by steps from the middle each way; or it may be made of a number of pieces of iron rod or tube united end to end, with pieces of non-magnetic material of different lengths intervening between the lengths of iron. The core so constructed carrying one of the carbons, will then adjust itself, moving the one carbon to or from the other, until the attractive forces exerted on the core by the two solenoids in opposite directions become balanced. When the carbons are too near the resistance of the arc is so far lessened that the solenoid in the circuit of the carbons becomes the more powerful of the two, and the core thereupon moves so as to separate the carbons. When, on the other hand, the carbons are too far apart the resistance of the arc is so much augmented that the solenoid in the circuit of the carbons becomes the weaker, and the core thereupon moves so as to bring the carbons nearer together. It is of advantage to combine with the lamp an automatic shunt of any known construction, so that when the lamp is extinguished the current is shunted into the general circuit.

In the drawings, Figures 1, 2, 3, and 4 are diagrams illustrating the principles on which this invention is founded. If an iron core of uniform section, as shown in Fig. 1, be placed within two solenoid coils, S and S′, of equal magnetic force, the attraction on the core will depend on its position relatively to the coils. It is strongest when one end of the core is in the middle of the coil and weakest when the middle of the core is in the middle of the coil. Hence, when the core is in the position shown in Fig. 1 it will be more strongly attracted by S′ than by S. When, however, the mass of the core at different parts of its length varies the attraction of the two coils upon it may be equalized. Thus by making the core in the form of a double cone, as shown in Figs. 2, 3, and 4, notwithstanding the different positions occupied by the core, it remains equally attracted by the two coils S S′, Figs. 2 and 4 showing its extreme positions each way and Fig. 3 its middle position. The core, instead of being truly tapered toward each end, may be reduced by steps, as indicated in Fig. 5; or it may be hollowed out by tapering holes, as in Fig. 4; or it may be made up of a number of separate lengths of iron connected together by non-magnetic material, as indicated in Fig. 7, and these lengths may be bored through with holes of different diameter, as indicated in Fig. 8. By thus constructing the cores they may be made to move over considerable distances without undergoing change of attraction, and they are therefore suitable for regulating the distance of the carbons in electric lamps.

Figs. 9, 10, and 11 show various constructions of lamps in which they are so applied. In Fig. 9 the double-coned core F is attached to the socket of the upper carbon, the whole being balanced by a weight, *q*, attached to a cord passing over a pulley, R, and free to move within the two solenoid coils S and S′. The coil S, of large wire, presenting small resistance, is in the circuit of the carbons, and S′, in a shunt-circuit, consists of fine wire in many convolutions, so as to get with a weak current magnetic force equivalent to that of S with a strong current, and to present considerable resistance. When the carbons are too near, the attractive power of S being increased, while that of S′ is diminished, the core F is attracted upward, separating the carbons. When, on the other hand, the carbons are too far apart, S loses force and S′ gains force, so that the core F is attracted downward, causing the carbons to approach. In Fig. 10, showing a pendent lamp partly in elevation and partly in section, the core F and upper carbon, E, with its socket, are balanced by the lower carbon, E′, and the rods B B′, which carry it, the pulleys R R′, over which the balancing-cords pass, serving as guides to the socket-tube of the upper carbon. In this lamp the connections and action of the two solenoid coils S S′ are as described with reference to Fig. 9. A standard lamp arranged to maintain a constant focal position of the arc produced by a continuous current is arranged as shown at Fig. 11, the racks *s s′* of two carbon-sockets being connected by insulated gear G D, proportioning their movements to their respective rates of consumption. The shunt-coil S′ may consist of two or more layers of thick insulated copper wire, furnishing the convolutions required with several layers of thin copper and German-silver wire to provide the required resistance. An electro-magnet, M, in the main circuit, acting on an armature contact-lever, H, serves to short-circuit the coil S′ in case of interruption of the lamp-circuit. When such interruption occurs the passage of current through S and M fails and the armature H falls, making contact with branch H′. The current then passes out directly from the coarse-wire portion of solenoid S′, thus short-circuiting the fine-wire portion.

We claim—

1. A solenoid core for an electric lamp, composed of a mass of metal varying in quantity in the direction of its length, substantially as described.

2. A solenoid core for an electric lamp, consisting of a body of metal whose mass diminishes toward each end, substantially as and for the purpose described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

LUDWIG PIETTE.
FRANZ KRIZIK.

Witnesses:
C. O. PAGET,
E. G. S. MOELLER.