(No Model.)

2 Sheets—Sheet 1.

W. E. IRISH.

ELECTRIC ARC LAMP.

No. 479,510. Patented July 26, 1892.

Fig. 1.

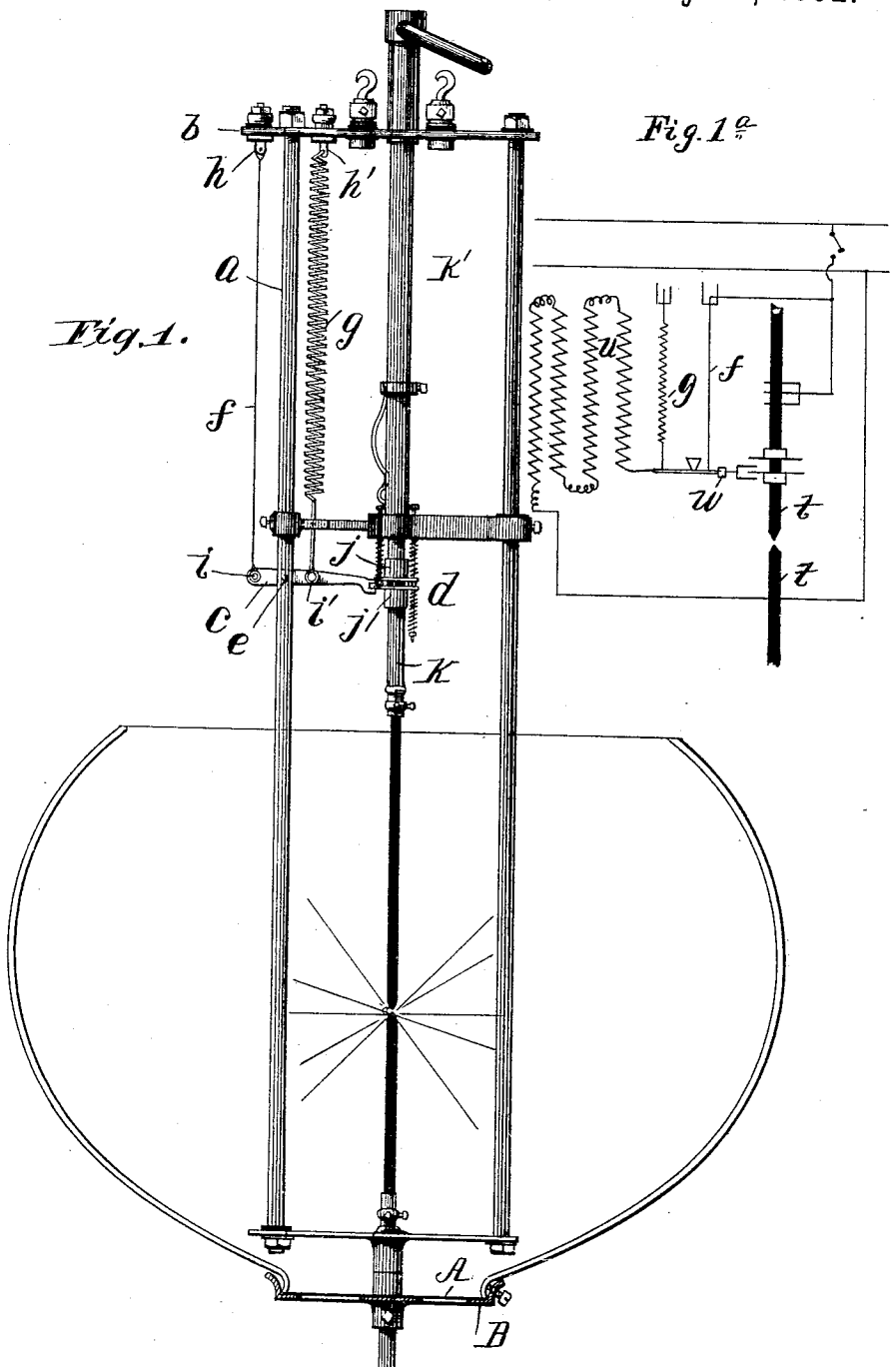

Fig. 1a.

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(No Model.) 2 Sheets—Sheet 2.

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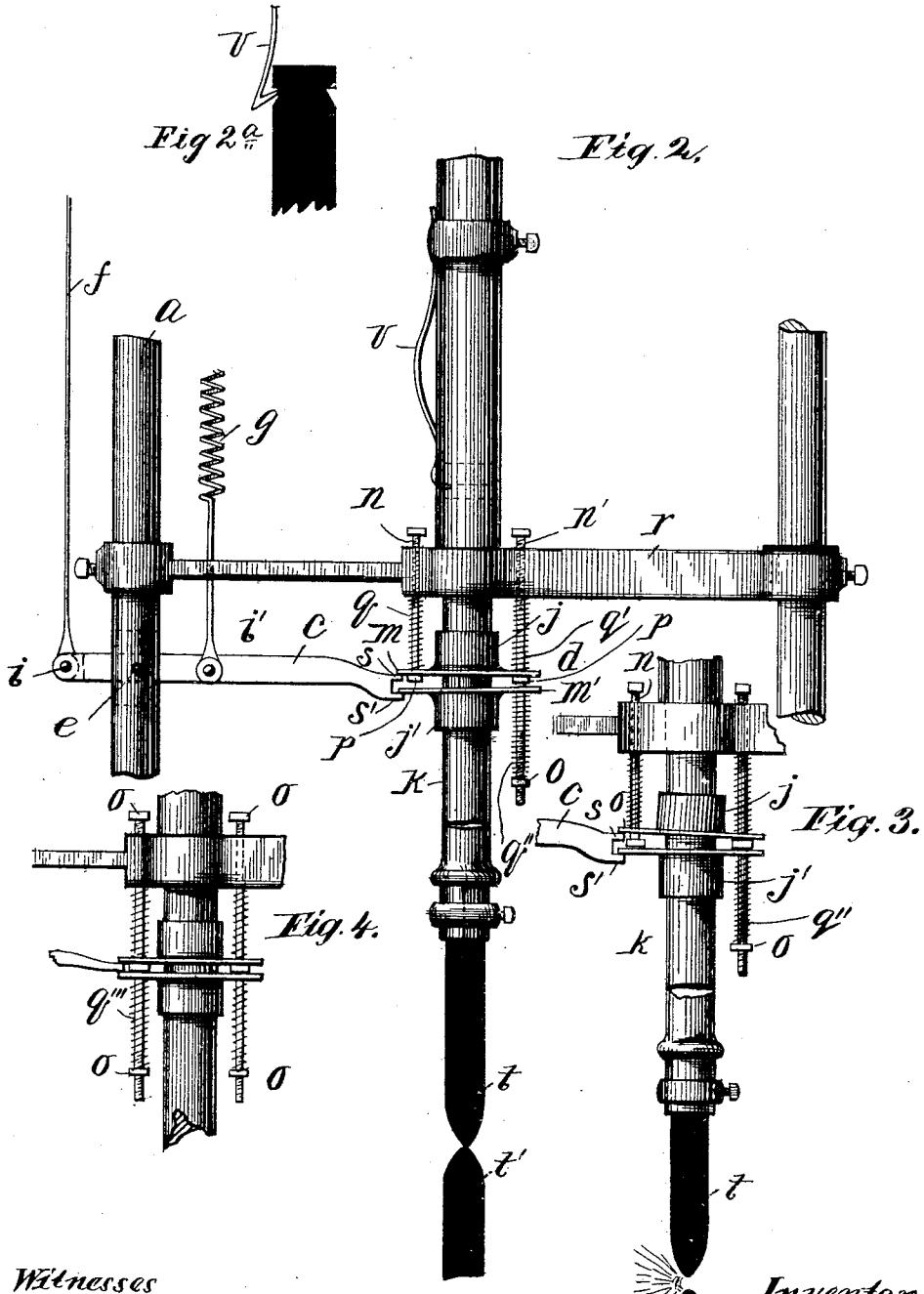

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UNITED STATES PATENT OFFICE.

WILLIAM E. IRISH, OF CLEVELAND, OHIO.

ELECTRIC-ARC LAMP.

SPECIFICATION forming part of Letters Patent No. 479,510, dated July 26, 1892.

Application filed May 4, 1892. Serial No. 431,795. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. IRISH, a citizen of the United States, and a resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Electric-Arc Lamps, of which the following is a specification.

My invention relates to the combination of a thermo-expansive electric conductor, a clutch, an operating-lever, and spring or similar devices for communicating the motions of the said conductor to the said clutch, and carbon electrodes engaged with said clutch.

The object of the invention is to obtain an effective lamp at unusual cheapness of construction, to provide a clutch which will give exceptional constancy and durability of arc, and to furnish a construction suitable for any kind of commercial currents.

Briefly stated, the invention involves the following organization: A lever capable of an up-and-down movement and controlled by the current operating the lamp, independent clutches adapted to be engaged by the lever, one to support and raise the carbon, the other to support and lower the carbon, a fork at the extremity of the lever, adapted to release the hold upon the second clutch as the lever ascends, and a thermo-expansive electric conductor and spring jointly operating said lever at each variation of current passing through the arc.

The lamp is adapted to any circuit—as, for example, series or parallel—and to any current—as, for example, direct or alternating, polyphase, intermittent, &c.

The drawings are made from successful and full-working lamps.

Figure 1 is an elevation of the complete lamp; Fig. 1ª, a diagram of circuits in a shunt-lamp; Fig. 2, an enlarged elevation of the clutch; Fig. 2ª, a detail modification; Fig. 3, a view of a portion of that shown in Fig. 2 in a different phase; Fig. 4, a view similar to that in Fig. 3, except that a modification is involved.

The device for operating the clutch consists of the combination of the rod *a*, forming part of the frame of the lamp, a top plate *b* of the lamp, a lever *c*, engaged with the clutch *d* and fulcrumed at *e* to the rod *a*, and a thermo-expansive electric conductor *f* and actuating-spring *g*, fastened, respectively, to the said top plate *b* and to the adjustable screws *h h'*, and pivoted to the lever, respectively, at the joints *i i'*.

The clutch consists of tubes *j j'*, located the one above the other and surrounding the carbon or carbon-holder *k* loosely when their axes coincide with that of the carbon-holder, but with a drag or grip when tipped to the least extent. The tube *j* has a flange *m* on its lower edge, and the tube *j'* has a flange *m'* on its upper end. When the axes of the tubes *j j'* and holder *k* coincide, the flanges *m m'* are parallel.

n n' are stationary rods parallel to each other and to the carbon-holder and pass loosely through holes in the flanges *m m'*. They are threaded and provided with nuts *o*, so that the tension of the helical springs surrounding the same may be varied. At or near their centers are shoulders *p*. The several helical springs *q q' q'' q'''* abut against the respective shoulders *p* and nuts *o* or the frame cross-piece *r* of the lamp. The rods *n n'* are suspended rigidly from the cross-piece *r*.

In Figs. 2 and 3 one of the springs *q'''* is omitted and the corresponding rod *n* terminates between the flanges *m m'*. The springs *q q' q'' q'''* are normally under compression, tending to lengthen. In Fig. 2 the lower tubular clutch *j'* is tipped. In Fig. 3 the upper one is tipped, and in Fig. 4 neither is tipped. The supports of the clutches are such that they are capable of independent motions, and each may be tipped as if about a flexible and elastic hinge. In Fig. 3 the position of the upper tube is shown as tipped. Any adjustments may be made, as desired, by means of the nuts *o* and rods *n n'*. For example, the compression or tension of the spring *q''* may be made greater than that of spring *q'* by adjusting the lower nut *o* on the rod *n'*.

In Figs. 2 and 3 the lever *c* has a fork of two tines, the upper one *s* being between the flanges *m m'* and the lower one *s'* below the flange *m'*. In Fig. 4 the lower one *s'* is omitted—*i. e.*, there is no fork, and the lever *c* simply terminates between the clutches.

In general the clutch is controlled by the

arc, so that any tendency to variation immediately affects the clutch, so that to the eye the arc is without fluctuation. The carbons t t' normally touch and the current passes through them and the thermo-expansive-electric conductor f, which expands, and the spring g, which is first placed under the proper tension by the screw h', lifts the forked end of the lever, as shown in Fig. 3, and the upper carbon t is raised, forming the arc. At the same time the tubular clutch j' is placed in a vertical position, as shown in Fig. 3. As the arc grows longer the current becomes less and the conductor f contracts, and, in joint action with the spring g and lever c, releases the grip of the tubular clutch j and simultaneously tightens that of the clutch j', whereby the carbon t is lowered. These operations are continually repeated. The clutch is delicately responsive to the least movement of the lever, as it should be, because the expansions and contractions of the conductor f are very small to permit of current. The least expansion elevates the carbon t, the least contraction lowers it. The upper tube clutches and raises the carbon, while the grip of the lower one is lessened, and the lower tube clutches and lowers the carbon, while the grip of the upper one j is lessened.

In the shunt-lamp the conductor f is in circuit with the resistance or rheostat u in shunt around the carbons t t'. The operation of the clutch after starting is substantially the same as already described. The carbons are normally out of contact. When the current is turned on, the conductor f expands and, being connected in this case to a point between the fulcrum and the clutch, allows the spring to cause the clutch to lower the carbon t, whereby the circuit is closed through the carbons and the current through the conductor f weakened, whereby the conductor f and spring g cause the carbon to be raised in the manner similar to that described with reference to former figures.

It should be noticed that the tubes not only tip, but also move bodily, the springs q' q'' being properly compressed. In this manner the carbon is raised or lowered through as long a range as necessary for great fluctuations of current, which sometimes occur even with the best dynamos. As soon as the upper carbon is too short for further operation the spring v falls into the notch v' and holds the carbon t. This spring continually presses upon the carbon or carbon-holder through the guiding-tube k', and may form one of the paths of the current, if desirable.

In Fig. 2[a] the carbon is without a carbon-holder. I have used carbons thus twenty-four inches in length successfully. By the use of the spring b the carbon ends are prevented from falling to the ground or against the glass globe and breaking it.

In Fig. 1[a] the fork having the tines s s' is separated electrically from the lever c by the insulator w.

A is a disk of mica, located in the globe-holding ring B, to collect particles of hot carbon and at the same time to allow light to be transmitted, thereby obtaining as little shadow as possible beneath the lamp.

When the electrode is held with or without the holder k, the current can get to the arc by going through the carbon only to that distance between the clutch and the carbons located below said clutch.

The nuts p serve as stops to limit the downward motion of the upper clutch and the upward motion of the lower clutch.

I claim as my invention—

1. In an arc lamp, the combination, with the movable electrode, of separate clutches thereon and independently movable to positions parallel or inclined to each other, a thermo-expansive electric conductor, and means for communicating the motions of said conductor to the said clutches.

2. In an arc lamp, a single expansible conductor capable of expansion under the passage of the current and acting with a spring to control two independent clutches, one of which tends to raise and support the carbon and the other to lower the carbon while partially supporting it against falling by gravity.

3. In an arc lamp, the combination of a movable electrode, tubes loose thereon, springs partially resisting the motion of the tubes in a direction parallel to the electrode, a fulcrumed lever engaged with the upper end of the lower tube and with the lower end of the upper tube, and a thermo-expansive electric conductor and spring both under tension and engaged with and acting upon the arms of said lever.

4. In an arc lamp, the combination of a thermo-expansive electric conductor, a longitudinally extensible and compressible spring, a rod a, forming a part of the frame of the lamp, a lever fulcrumed thereon and pivoted at different points to said conductor and spring, adjusting-screws fastened to said rod and to said conductor and spring, a movable carbon or carbon-holder, and a clutch for said carbon or carbon-holder engaged with said lever.

5. In an arc lamp, the combination of a thermo-expansive electric conductor normally under tension, a spring under tension and reacting against the tension of said conductor, a lever whose arms are pivoted to said conductor and spring and forked at one end, a movable electrode, flanged and movable tubes upon the electrode and so engaged with said fork that the lower tine thereof is below the lower flange and the upper tine between the two flanges, and springs resisting the action of said tubes.

6. In an arc lamp, the combination of a thermo-expansive electric conductor, a movable carbon or carbon-holder, tubes loose upon the carbon or carbon-holder, flanges respectively on the lower end of the upper tube and on the upper end of the lower tube, rods par-

allel to the carbon and passing loosely through said flanges, springs on said rods and pressing up on said flanges, and means engaged with said conductor and with said flanges for communicating motion from said conductor to said tubes.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 2d day of May, 1892.

WILLIAM E. IRISH.

Witnesses:
C. L. SHAW,
EDWARD P. THOMPSON.