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STARTING APPARATUS FOR VAPOR ELECTRIC LAMPS.

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Fig. 1

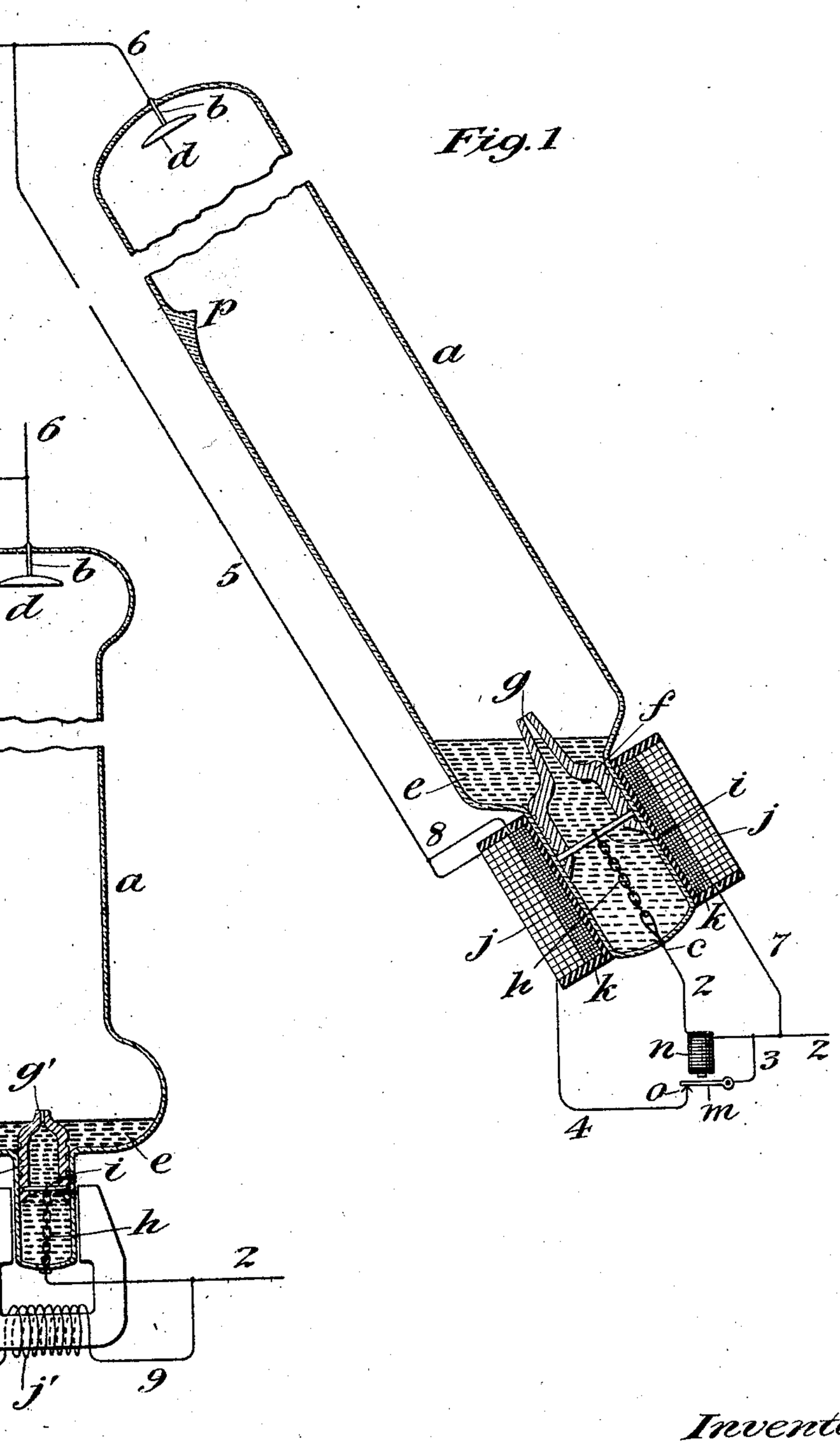

Fig. 2

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UNITED STATES PATENT OFFICE.

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STARTING APPARATUS FOR VAPOR ELECTRIC LAMPS.

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To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Rockaway, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Starting Apparatus for Vapor Electric Lamps, of which the following is a specification, reference being had therein to the accompanying drawings, forming a part thereof.

My invention relates to starting apparatus for vapor electric lamps, and has for its objects simplicity of construction, economy in construction and operation, and reliability and effectiveness of operation.

My invention includes the provision of jet-projecting means located within the sealed tube or casing wherein the light is produced by the incandescence of the vaporized illuminant combined with exteriorly-located electrically-controlled power-developing means and with auxiliary power-developing means and controlling means therefor, so that when the lighting-circuit of the lamp is established the energization of the power means will be discontinued, but the energization of the auxiliary power means will be continued, and more specifically my invention includes the provision of exteriorly-located coils of low and high resistance controlling interior projecting means and controlling means for deënergizing the low-resistance coils by the establishment of the lighting-circuit.

My invention also includes deflecting means for the illuminant coöperative with starting means for projecting the illuminant.

Other advantageous features and objects of my invention will appear from the following description.

I will now describe the apparatus embodying my invention illustrated in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is a vertical central section of the end portions of an electric vapor-lamp having an inclined tube and provided with starting means. Fig. 2 is a similar view of an electric vapor-lamp having a vertical tube and provided with a starting device of modified construction.

The lamps shown are of the mercury-vapor type. The tube *a* is, as usual, of considerable length and contains a charge of mercury, which rests in liquid form at the lower end of the tube. The electric current enters the tube through platinum wires *b* and *c*, sealed into the tube, the lower leading-in wire *c* entering the liquid mercury *e* at the bottom of the tube and the upper leading-in wire *b* entering the top of the tube and having a contact plate or enlargement *d* to increase its area of conductive contact with the vapor.

When the lamp is in use, the glowing mercury-vapor filling the tube conductively connects the upper electrode *d* and the body of liquid mercury *e*, which forms the lower electrode; but when the electric current is shut off the greater part of this vapor condenses to liquid form, and the resistance between the electrodes becomes very great. It is therefore necessary in starting the lamp to in some manner lead the electric current across an intervening space in which the condition is very nearly that of a vacuum and which may be from two to five feet or more in length. According to my invention I project the liquid mercury upward through the tube, so as to conductively lead the electric current from the lower to the upper electrode, and thereby to diminish or bridge the gap between the electrodes, so that a closed circuit will be established through the lamp and the lighting operation will be effectively started. I provide within the tube projecting means comprising a piston *f*, of iron or suitable magnetic material, and having a jet-orifice *g* and having a chamber formed within the piston and open at its lower end and closed at its upper end except at the jet-orifice. The lower end of the lamp-tube *a* is of uniform reduced diameter to provide a cylinder for the piston *f*, and the piston *f* is provided with sealing-grooves on its outer periphery. The piston is buoyantly sustained by the liquid mercury and is restrained as to upward movement by a chain *h*, which is secured at its lower end to the lower platinum leading-in wire *c*, a loop being formed therein to engage the lower end link of the chain, and is secured at its upper end to a cross-bar *i* near the lower end of the piston *f*.

The exterior power-developing means in the construction shown in Fig. 1 comprise a solenoid having coils of low resistance *j* and coils of high resistance *k*, this solenoid fitting closely the exterior of the cylinder formed at the lower end of the lamp-tube, so that the piston *f* is the core of the solenoid and is attracted downward within the tube when the coils are energized.

The low-resistance coils *j* are connected in a circuit flowing from one of the lamp-supplying conductors 2 through a wire 3, armature *m*, contact *o*, wire 4, low-resistance coil *j*, and wire 5 to the other lamp-supplying conductor 6. This circuit is normally closed, but is controlled by the electromagnet *n* of the armature *m* and will be opened by the attraction of the armature *m* when the electromagnet *n* is energized. This circuit-opening electromagnet *n* is in the lighting-circuit, being directly connected in the lamp-supplying conductor 2, which runs to the lower leading-in wire *c*. The high-resistance coils are connected in another branch circuit having no circuit-breaker therein and flowing from the conductor 2 through wire 7, high-resistance coils *k*, and wire 8 to the wire 5 of the conductors of the circuit of the low-resistance coils.

When the electric current is turned on, the circuits both of the high-resistance coils and low-resistance coils are closed, and the solenoid powerfully attracts the piston-core *f* and pulls it downward in its cylinder in the tube, and the liquid mercury below and within the cylinder is forcibly projected upward through the jet-orifice *g* toward the upper end of the tube. The force of this projection may be such as to carry the projected stream of mercury into contact with the upper electrode *d* of the lamp or in such proximity thereto as to effect a closure of the lamp-circuit. To control the direction of this projected stream, I provide a deflecting-surface *p* in the lower inclined inner wall of the tube, which will deflect the stream of liquid mercury upward to correct the tendency to fall toward the lower wall of the inclined tube and also to spread the stream to cover a greater cross-sectional area of the tube. The circuit having been once closed a sufficient vaporization of the mercury will be effected to establish and maintain a lighting-circuit through the lamp. The closure of the lighting-circuit will effect an energization of the circuit-opening electromagnet *n*, and this electromagnet will attract its armature *m* and open at the armature *m* and contact *o* the branch circuit of the low-resistance coils *j* of the solenoid; but the current of the high-resistance coils *k* will remain closed and will develop sufficient attractive force to hold the piston-core *f* down, so that its jet-orifice *g* will be immersed in and protected by the liquid mercury.

In the modified construction (shown in Fig. 2) the solenoid is replaced by an electromagnet *q*, the poles of which are located along the exterior surface of the lamp-tube in proximity to the piston *f'*, which is here the armature of the electromagnet. The coils *j''* of the electromagnet *q* are in a branch circuit flowing from the lamp-supplying conductor 2 through wire 9, coils *j''*, and wire 10 to the other lamp-supplying conductor 6. This circuit remains closed, and the electromagnet *q* remains energized so long as the lamp is supplied with electric current. The operation is here as above described, except that the lamp-tube is vertical and no deflecting-surface is provided within the tube.

It is obvious that various modifications may be made in the constructions shown and above particularly described within the spirit and scope of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. The combination, with a vapor electric lamp, of exteriorly-located electrically-controlled power-developing means, auxiliary power-developing means, interiorly-located projecting means controllable by the power means and the auxiliary power means, and means controllable by the circuit of the lamp for discontinuing the energization of the power means but not of the auxiliary power means by the establishment of the lighting-circuit.

2. The combination, with a vapor electric lamp, of exteriorly-located coils of low resistance and high resistance, respectively, interiorly-located projecting means controllable by the coils of low and high resistance and means controllable by the circuit of the lamp for deënergizing the low-resistance coils by the establishment of the lighting-circuit.

3. The combination, with a vapor electric lamp, of starting means for projecting a conductive liquid within the lamp, and a deflector for such liquid.

4. The combination, with a vapor electric lamp, of exteriorly-located power-developing means, an interiorly-located liquid-projecting piston having a jet-orifice and controllable by the exterior power means, and a deflector within the lamp in the path of the liquid projected by the piston.

5. The combination, with a vapor electric lamp having a sealed casing, of exteriorly-located power-developing means, an interiorly-located liquid-projecting piston having a jet-orifice and controllable by the exterior power means and buoyantly sustained in the liquid illuminant, and a flexible connection from the piston to the casing for limiting the buoyant movement of the piston.

6. The combination, with a vapor electric lamp, of exteriorly-located power-developing means, and an interiorly-located liquid-projecting hollow piston having a jet-orifice and an inner chamber of cross-sectional area considerably greater than the jet-orifice, such chamber opening upward into the jet-orifice and having a substantially unrestricted opening at its lower end.

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

CLYDE J. COLEMAN.

Witnesses:
EDWIN E. ZITTEL,
SIDNEY ARONSTEIN.