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ELECTROMAGNETIC STARTER FOR MERCURY ARC DISCHARGE DEVICES

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Fig. 1.

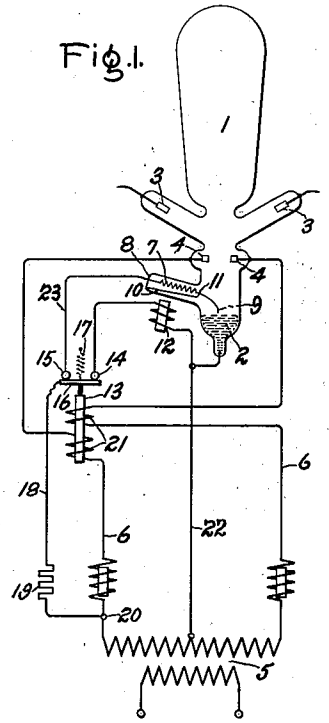
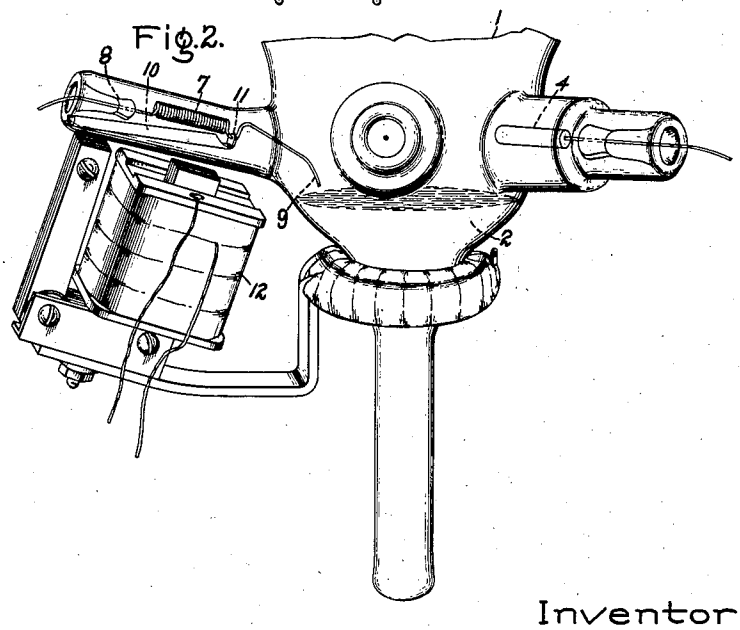


Fig. 2.



Inventors:
Elmo E. Moyer,
Rolland C. Griffith,
by Charles V. Mulla
Their Attorney.

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ELECTROMAGNETIC STARTER FOR MERCURY ARC DISCHARGE DEVICES

Elmo E. Moyer and Rolland C. Griffith, Schenectady, N. Y., assignors to General Electric Company, a corporation of New York

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7 Claims. (Cl. 250—27.5)

Our invention relates to starting means for arc discharge devices, particularly to electromagnetic starting means for the holding anodes of mercury arc rectifiers and the like, and its object is the provision of an improved means of this character which is of simple construction and which is positive and reliable in operation.

In the operation of electromagnetic starters for the holding anodes of arc discharge devices of the glass walled type difficulties have been encountered heretofore due to complication of the apparatus, inertia of moving parts thereof, inadequate sealing means and other causes. In accordance with our invention these difficulties are overcome by the provision of a simple and effective starting device comprising a spring member which is sealed into the tube of the arc discharge device adjacent the mercury pool constituting the cathode and which is arranged to cooperate with an armature member operated by an electromagnet mounted outside the tube.

Our invention will be better understood by reference to the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Referring to the drawing, Figure 1 is a diagrammatic view of a portion of a rectifier or similar system comprising an arc discharge device embodying our invention, and Figure 2 is a fragmentary perspective view of certain parts thereof.

In the figures an arc discharge device of the glass walled type is shown comprising tube 1, mercury pool 2 constituting a cathode, main anodes 3 which may be connected to any usual circuits (not shown), and holding anodes 4 which are supplied with current from a transformer 5 through leads 6. In order that the arc discharge between the cathode and the holding anodes 4 may be established when voltage is applied to transformer 5, it is necessary that a cathode spot be formed on the surface of the mercury pool 2 constituting the cathode. In accordance with our invention this result is accomplished by the provision of a resilient member, as a coiled spring 7, of molybdenum or other suitable material, which is sealed at one extremity 8 into the tube 1 and adjacent the cathode and which is so mounted that the inner extremity or tip 9 thereof extends to a point above and closely adjacent to the surface of the mercury in pool 2, thus forming a contact means therewith. The resilient member or spring 7 is preferably of sufficient stiffness to hold the contact element, spring tip 9, normally out of contact with the mercury in pool 2. In order to cause the tip 9 to dip into the mercury pool upon initiation of the starting operation, an armature member 10 comprising magnetic material and preferably formed of a thin strip of iron is connected to spring 7 as at a point 11 remote from the extremity 8 thereof which is sealed to the tube. The armature strip 10 extends from its point of attachment on spring 7 toward the closed end of the tube arm in which the spring and armature are mounted, the outer end of the strip preferably resting upon the lower wall of the arm. Thus the thin strip forming the armature is arranged substantially parallel to the resilient portion of the spring and to the lower arm of the wall, and is so positioned in the relatively narrow space between spring 7 and the lower wall of the arm that the spring at its point of attachment to the armature is free to move downwardly a short distance. It will be noted that if the downward movement of the armature is continued more than necessary for the operation of the starter, armature strip 10 then merely comes into contact throughout its entire length with the glass wall of the arm. For the purpose of operating the armature 10 an electromagnet 12 is mounted adjacent thereto and outside the tube. Since the armature strip 10 is of thin material, preferably convex in form toward the lower wall of the glass arm and since the armature extends a considerable distance relatively closely adjacent to this wall, therefore breakage of the glass by the armature 10 when the latter is drawn down by the electromagnet 12, or when the apparatus is subjected to shock or undue movement, is avoided.

Circuit connections for the starting means above described comprise a relay 13 which includes contacts 14 and 15 connected respectively to electromagnet 12 and to the extremity 8 of spring 7. A contact member 16 mounted on the armature of this relay is normally maintained in closed position with respect to contacts 14 and 15 by a spring 17 and is connected through a lead 18 and resistance 19 to a terminal 20 of transformer 5. Relay 13 further includes two windings 21 connected in series respectively in the holding anode leads 6.

In operation, when voltage is applied to transformer 5 electromagnet 12 is energized by current flowing in the circuit including the transformer terminal 20, resistance 19, lead 18, contacts 16 and 14 of relay 13, and lead 22. Armature 10 is then drawn down by electromagnet 12 and depresses the free end 11 of spring 7, thereby causing the contact means or tip 9 of spring 7 to dip into the mercury pool 2. The

instant that tip 9 of spring 7 touches the mercury, electromagnet 12 is short-circuited through the current path including contacts 14, 16 and 15, lead 23, spring 7, spring tip 9 and mercury pool 2, and spring 7 is therefore free to return to its normal nonoperating position shown in the figures. At the moment that tip 9 of spring 7 breaks contact with the mercury in pool 2, the current flowing through the spring tip and the mercury is interrupted at the surface of the mercury pool and a cathode spot is formed on this surface. Holding arcs thereupon form between the cathode and the holding anodes 4. Current then flows in the holding anode circuits including coils 21 and these coils are energized, thereby opening the relay 13 against the pressure of spring 17 and disconnecting the circuits of starting spring 7 and electromagnet 12. If the holding arcs do not form the first time that the tip 9 of spring 7 leaves the surface of the mercury, the operation will be repeated until the arcs form.

During the operation period of the arc discharge device, current continues to flow in the circuits of holding anodes 4, thereby maintaining the relay 13, which controls the circuits including spring 7 and electromagnet 12, in open position. When, however, the arc discharge device ceases to operate, current ceases to flow in the holding anode circuits including series coils 21; a spring 17 of relay 13, therefore, recloses the circuits including spring 7 and electromagnet 12 and the starting system is again in readiness for the initiation of the starting operation. If the current passing through the arc discharge device should fail, the holding arcs will be immediately reformed when the current is reestablished.

Resistance 19 limits the current flowing through spring 7 during the starting operation. This resistance is in series with electromagnet 12 also but as the current drawn by the electromagnet is small any voltage drop due to resistance 19 is negligible.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a starter for a mercury pool arc discharge device comprising an evacuated tube, a spring sealed into and projecting through a wall of said tube, and a relatively long armature connected at one extremity thereof to said spring, and extending substantially parallel to said wall and to a portion of said spring, the other end of said armature bearing against said wall.

2. In a starter for a mercury pool arc discharge device comprising an evacuated tube having an arm portion, a spring mounted on said arm portion at the outer end thereof, an armature connected to said spring and extending a substantial distance between said spring and a side wall of said arm portion, said armature having a free end in contact at its extremity with said side wall, and means to move said armature toward said side wall of said arm portion into a position substantially parallel to said wall, said armature when moved by said means tending to make contact through substantially its entire length with said wall.

3. In a starter for an arc discharge device including an evacuated tube and a mercury pool therein, a spring comprising a coiled section mounted on a wall of said tube and a second section connected to said first section and extending to a point adjacent said pool, an armature connected to said spring at a point thereof between said sections and extending between said wall and said coiled spring section to a point of said wall remote from said first-named point, and means to move said armature toward said wall into a position substantially parallel to said wall, said armature when moved by said means tending to make contact through substantially its entire length with said wall.

4. In a starter for an arc discharge device including an evacuated tube and a mercury pool therein, a spring having a highly resilient portion mounted at one end thereof in an arm of said tube, said spring including a portion connected to said resilient portion and having a tip adjacent said pool, an armature comprising a thin metallic strip connected to said spring and extending between the wall of said arm and said resilient portion of the spring, and electromagnetic means to move said armature toward said wall into a position substantially parallel thereto thereby to move said tip into contact with the mercury, said armature when moved by said means tending to make contact through substantially its entire length with said wall.

5. In a starter for an arc discharge device including an evacuated tube and a mercury pool, a conductive member comprising a resilient portion connected to a wall of said tube and a portion extending between said resilient portion and a point adjacent said mercury pool, an armature comprising a strip of magnetic material in engagement at one end thereof with said wall and at its other end with said conductive member at a point of said conductive member remote from the point of connection of said conductive member to said wall, and electromagnetic means to move said armature toward said wall into a position substantially parallel thereto thereby moving said second-named portion of said conductive member into contact with the mercury pool, said armature when moved by said means tending to make contact through substantially its entire length with said wall.

6. In a starter for an arc discharge device including an evacuated tube and a mercury pool therein, a spring of arc-resistant metallic material mounted on a wall of said tube and having a tip portion formed integrally with the main body of said spring extending to a point adjacent said pool, an armature connected to said spring and having a free end portion in contact with said wall and extending a substantial distance between said spring and said wall of the tube, and electromagnetic means to move said armature into a position substantially parallel to said wall thereby to move said tip portion into contact with said mercury.

7. In a starter for a mercury pool arc discharge device comprising an evacuated tube, a spring of metallic material highly resistant to heat having two sections of differing degrees of resiliency, the more resilient of said sections being mounted at one extremity thereof on a wall of said tube, the less resilient section of said spring including a tip portion integral therewith at the extremity thereof remote from said first section adapted to be moved into contact with said mercury pool, an armature connected to said spring and having a free end portion in contact at the extremity thereof with said wall and extending a substantial distance between said spring and said wall of the tube, and means to move said armature into a position substantially parallel to said wall.

ELMO E. MOYER.
ROLLAND C. GRIFFITH.