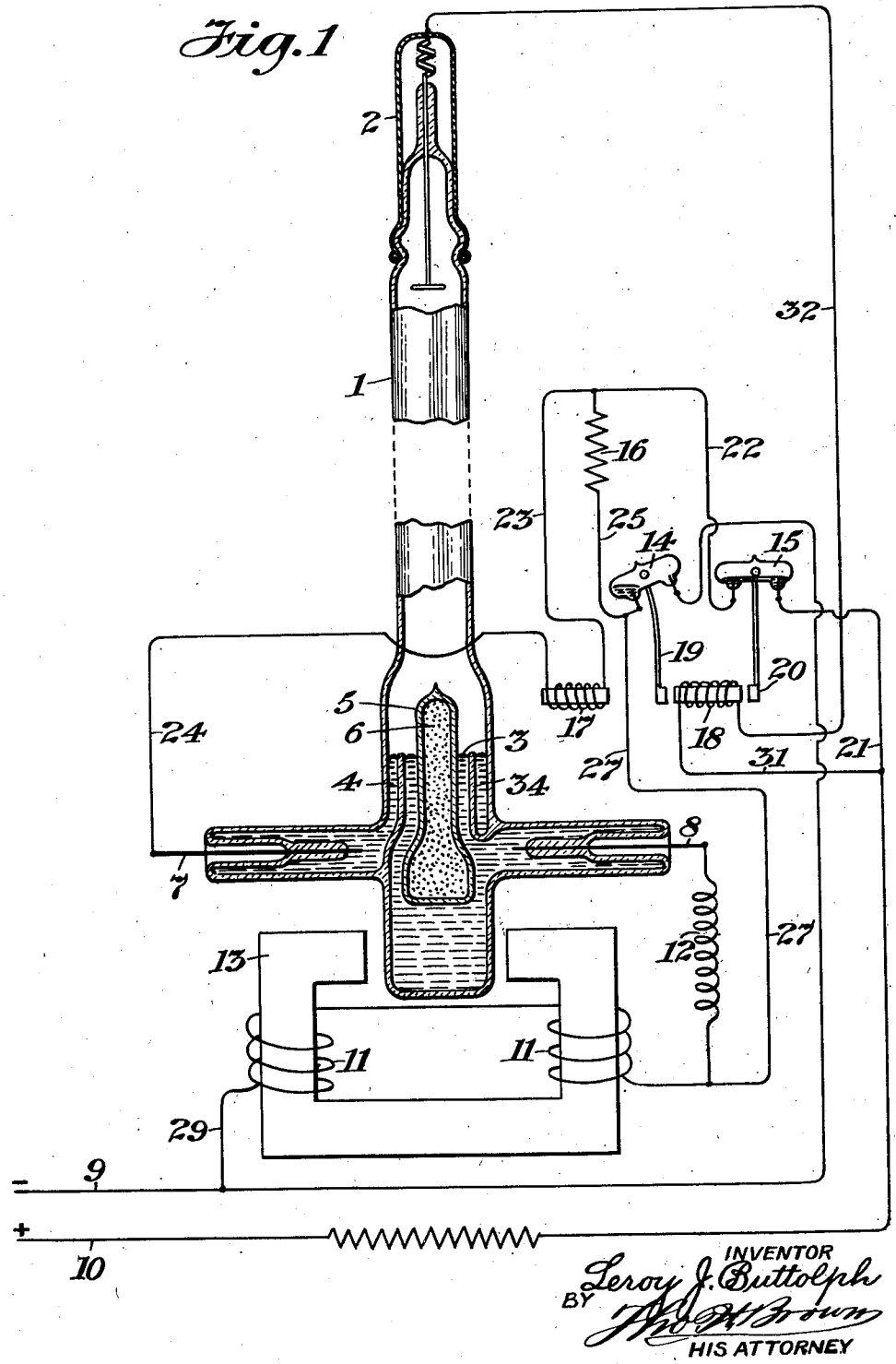
July 6, 1926. 1,591,112

L. J. BUTTOLPH

STARTING APPARATUS FOR VAPOR LAMPS

Filed Nov. 14, 1923 2 Sheets-Sheet 1

Fig. 1



INVENTOR
Leroy J. Buttolph
BY
HIS ATTORNEY

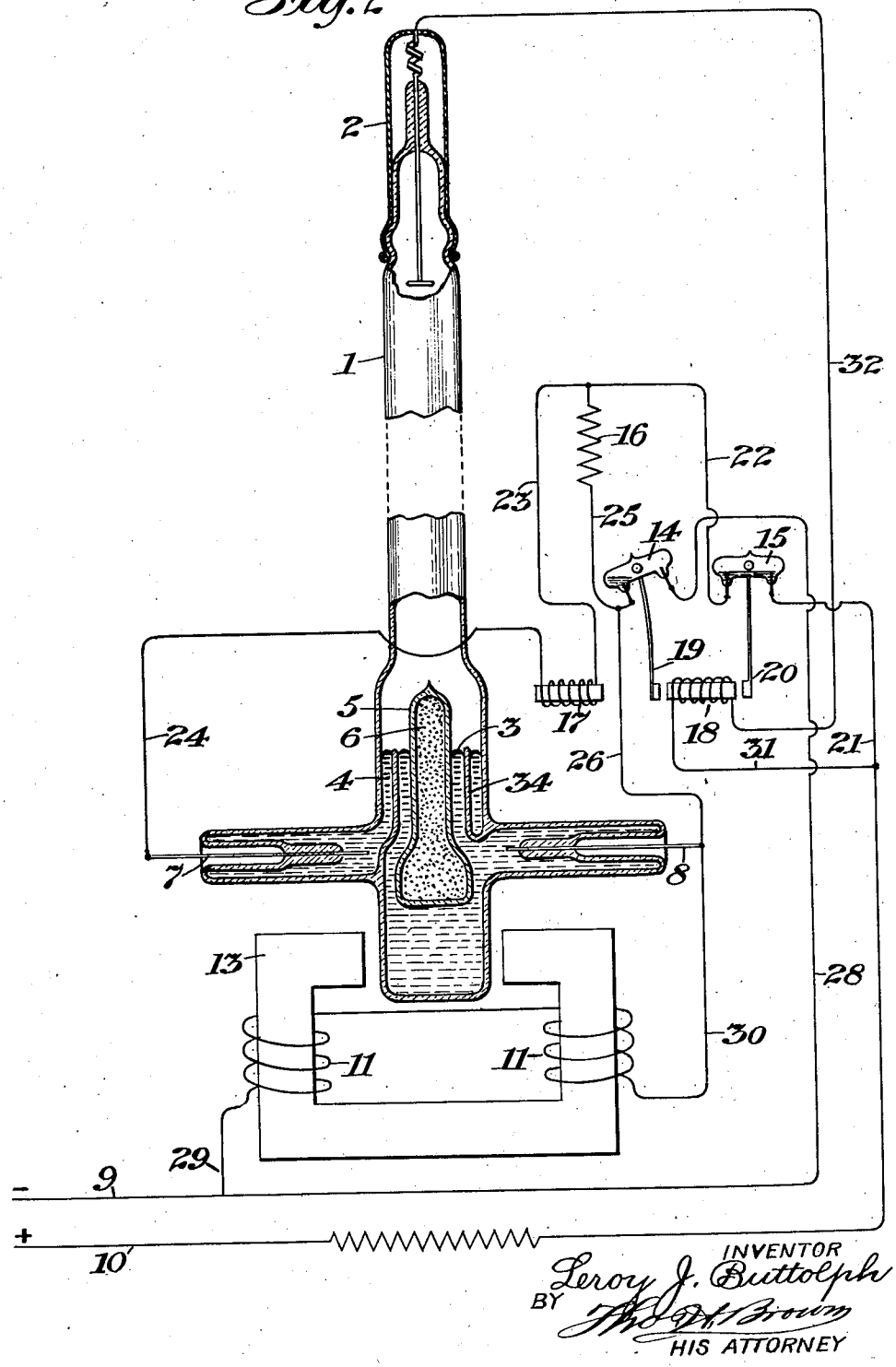
July 6, 1926. 1,591,112

L. J. BUTTOLPH

STARTING APPARATUS FOR VAPOR LAMPS

Filed Nov. 14, 1923 2 Sheets-Sheet 2

Fig. 2



INVENTOR
Leroy J. Buttolph
BY
Thos. D. Wm. Brown
HIS ATTORNEY

Patented July 6, 1926. 1,591,112

UNITED STATES PATENT OFFICE.

LEROY J. BUTTOLPH, OF EAST ORANGE, NEW JERSEY, ASSIGNOR TO COOPER HEWITT ELECTRIC COMPANY, OF HOBOKEN, NEW JERSEY, A CORPORATION OF NEW JERSEY.

STARTING APPARATUS FOR VAPOR LAMPS.

Application filed November 14, 1923. Serial No. 674,626.

This invention relates to high voltage fused quartz lamps and especially to adaptations and apparatus for starting them.

In the starting of vapor electric arc apparatus such as rectifiers, lamps, etc., it is generally known that if there is sufficient electron emission from the cathode that an arc will be struck on the application of voltage across the terminals of the apparatus. In this device it is proposed to have voltage impressed across the terminals of the lamp from the beginning of the starting period on, and to have an auxiliary anode of mercury close to the cathode with means for striking an arc therebetween whereby an electron is produced to enable an arc to be struck between the main terminals of the lamp. An inductance in series with the cathode can be used to produce an inductive kick which will assist the auxiliary arc in starting an arc between the main terminals of the lamp.

The purpose of this invention is to provide a mercury arc lamp and apparatus therefor which will function to start the lamp quickly and efficiently and which apparatus will automatically reset itself after functioning to be in readiness to function again.

Another purpose of this invention is to provide an auxiliary anode for the lamp between which and the cathode a spark is drawn for the purpose of establishing an arc between the main electrodes of the lamp.

Another purpose of this invention is to provide an inductance in the lamp circuit to produce an inductive kick across the terminals of the lamp to supplement the arcing between the cathode and the auxiliary anode to start the lamp as above cited.

In the drawing Fig. 1 is a diagrammatic view of an embodiment of this device in which a spark between 3 and 4 in conjunction with an inductance in series with the cathode is used to start the arc between the main terminals of the lamp. Fig. 2 shows a form of this invention in which a spark between 3 and 4 is used to start the arc of the lamp.

In Fig. 1 part 1 is a silica tube having a cathode chamber a part of which is surrounded by a supplemental chamber substantially annular in form, the two chambers being separated by the partition 34. In the cathode chamber is an armature of iron filings 6 jacketed in a casing 5 of fused quartz. Normally this armature floats in the mercury 3 of the cathode. Parts 9 and 10 are respectively negative and positive feed mains, the latter being connected through the solenoid 18 to the anode of the lamp and the latter through the electro-magnets 11, inductance 12, and electrode 8 to the cathode 3. From a point between magnets 11 and inductance 12 a connection is made through conductors 27 and 25, resistance 16, conductor 23, solenoid 17, conductor 24 to the electrode 7 and auxiliary anode 4. From a point between conductors 25 and 27 a connection is made to one side of mercury switch 14 the other side of which is connected to the negative supply main. From a point between resistance 16 and auxiliary anode 4 a connection is made through mercury switch 15 to the positive supply main. An armature 19 is connected to switch 14 and is operatively positioned with respect to solenoid 17 and may be operatively positioned with respect to solenoid 18. Armature 20 connected to switch 15 is operatively positioned with respect to solenoid 18. Switch 14 when not acted upon by solenoid 17 normally assumes the open position. This action may be obtained by means of a spring or by mounting the switch so that it will be operated by gravity to move into the open position. The normal position of switch 15 is the closed position.

In the operation of the embodiment of this invention shown in Figure 1 of the drawings when a switch is closed in the main circuit current passes through main 10 to conductor 21, through switch 15, conductor 22, resistance 16, conductors 25 and 27 through electro-magnets 11 to the other main 9; the electro-magnets 11 being energized by this current the armature 6 is drawn down raising the level of 3 whereby the two masses of mercury 3 and 4 are united, whereupon current flows from 22 through conductor 23, solenoid 17, conductor 24, electrode 7, through mercury masses 4 and 3, electrode 8, inductance 12, and through coils 11 to main 9. The current passing through solenoid 17 actuates armature 19 which closes switch 14, whereby coils 11 being short circuited armature 6 rises in the mercury 3. Upon the floating of 6 in 3 the level of the latter drops and its connection with 4 is broken and a spark is produced between them. If there is sufficient vapor in the tube at this time

the spark will start an arc between the cathode 3 and the anode 2. Of course, at this time, the inductive kick of the coil 12 assists in striking the arc between the terminals of the lamp through an action well known in the vapor lamp art by which a reactive current surge is set up in said coil 12 due to the sudden change from zero current passage through said coils to a passage of current of a considerable value.. If not, the parts of the apparatus resume the positions in which they were at the closing of a switch in the main line and the foregoing cycle of operations is again gone through. When an arc is struck in the lamp current flowing through the main 10 goes through solenoid 18 which actuates armature 20 through which 15 is opened. Solenoid 17 now being de-energized, switch 14 opens and connection to the cathode is entirely through the coils 11 which become active in connection with coil 12 as the usual stabilizing inductances. Switch 14 and solenoid 18 may be so positioned with respect to each other that the latter when energized holds the former open or aids in keeping it open.

The embodiment of this invention as shown diagrammatically in Fig. 2 is similar to that shown in Fig. 1 excepting that there is no inductance between the magnets 11 and the cathode 3. In the operation of this form the momentary arc between 3 and 4 is relied upon alone to start an arc between the main electrodes of the lamp and during the operation of the lamp as such the coils 11 function alone as the stabilizing inductance in series with the cathode.

I claim as my invention:

1. In an electric vapor lamp circuit including a vapor lamp, an anode and a liquid cathode therefor, and feed mains, in combination, an auxiliary liquid anode adjacent said cathode and separated therefrom by an insulating partition, said liquid cathode and said auxiliary liquid anode having levels normally just below the top of said partition, a float containing magnetic material in said cathode, said float being adapted when moved downwardly in the liquid of the cathode to cause the level of the mercury forming the cathode to rise and cross the partition and join the liquid of the said auxiliary anode, an electro-magnet positioned near the cathode, one side of said magnet being connected to the negative supply main and the other side being connected to the cathode, a connection between the cathode and the auxiliary anode with a resistance and a solenoid in series therein, a switch connected on one side to the cathode and on the other side to the negative supply main, an armature connected thereto and operatively positioned with respect to said solenoid, a second solenoid in the main anode supply lead, a second switch connected on one side to a point between the auxiliary and said resistance and on the other side to the positive supply main, an armature connected to said second switch and operatively positioned with respect to said second solenoid.

2. In an electric vapor lamp circuit including a vapor lamp, an anode and a liquid cathode therefor, and feed mains, in combination, an auxiliary liquid anode adjacent said cathode and separated therefrom by an insulating partition, said liquid cathode and said auxiliary liquid anode having levels normally just below the top of said partition, a float containing magnetic material in said cathode, said float being adapted when moved downwardly in the liquid of the cathode to cause the level of the mercury forming the cathode to rise and cross the partition and join the liquid of the said auxiliary anode, an electro-magnet positioned near the cathode, one side of said magnet being connected to the negative supply main and the other side being connected to the cathode, a connection between the cathode and the auxiliary anode with a resistance and a solenoid in series therein, a switch connected on one side to the cathode and on the other side to the negative supply main, an armature connected thereto and operatively positioned with respect to said solenoid, a second solenoid in the main anode supply lead, a second switch connected on one side to a point between the auxiliary anode and said resistance and on the other side to the positive supply main, an armature connected to said second switch and operatively positioned with respect to said second solenoid.

Signed at Hoboken, in the county of Hudson and State of New Jersey, this 13th day of October A. D. 1923.

LEROY J. BUTTOLPH.