

Nov. 28, 1939.

O. H. BIGGS

2,181,294

ELECTRIC DISCHARGE LAMP

Filed Dec. 31, 1938

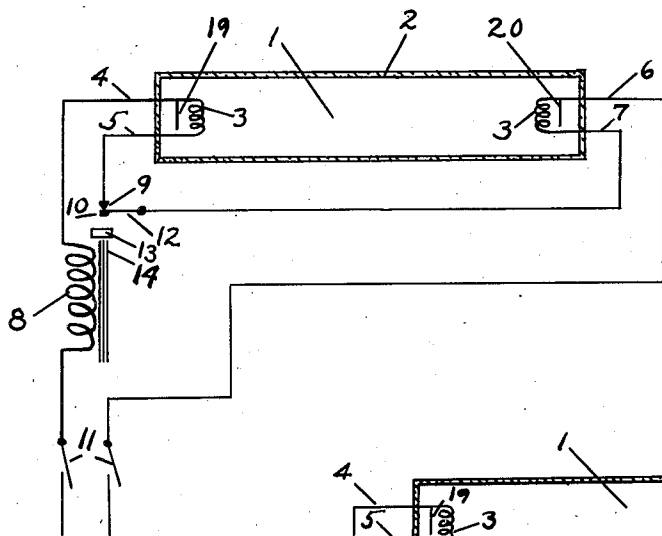


Fig. 1.

Fig. 2.

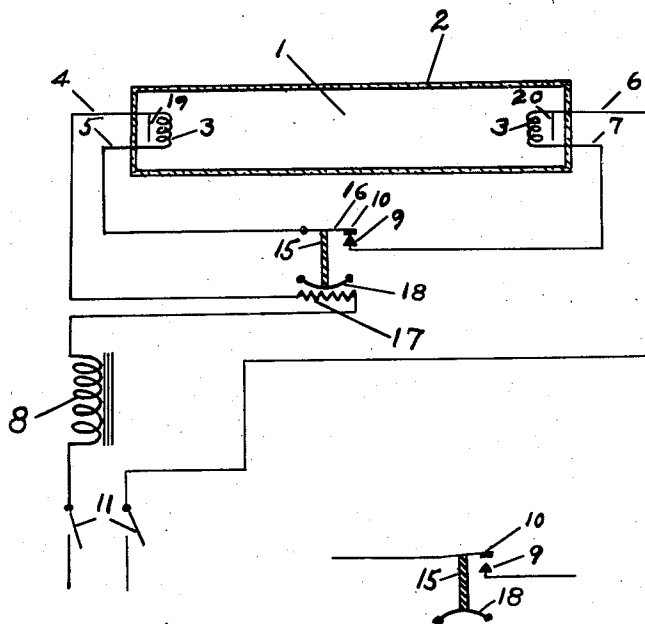


Fig. 3.

ORRICK H. BIGGS,

INVENTOR.

BY *Laurence Burns,*

ATTORNEY.

UNITED STATES PATENT OFFICE

2,181,294

ELECTRIC DISCHARGE LAMP

Orrick H. Biggs, Beverly, Mass., assignor to Hygrade Sylvania Corporation, Salem, Mass., a corporation of Massachusetts

Application December 31, 1938, Serial No. 248,812

2 Claims. (Cl. 176—124)

This invention relates to electric gaseous discharge lamps, and in particular to apparatus for properly operating such lamps.

An object of the invention is to provide for such a lamp a cathode which is pre-heated to facilitate starting of the main discharge, and apparatus to provide the preheating automatically for the proper period when voltage is applied to the lamp circuit.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing in which:

Figure 1 is a schematic circuit diagram of apparatus embodying one form of the invention;

Figure 2 is a schematic circuit diagram of apparatus embodying another form of the invention; and

Figure 3 is a view of the switching part of the circuit, after the lamp has started.

In Figure 1, the gaseous electric discharge lamp 1, comprises the sealed glass envelope 2, with an electrode 3 at each end of the tube, each electrode comprising a coil of wire, preferably tungsten, bearing an electron-emissive coating, such as a coating of the alkaline earth oxides. The tungsten coil is preferably of the coiled-coil or doubly-coiled type, in order to hold the oxide coating better, and to provide a higher voltage drop across the cathode at starting, than would a singly-coiled electrode. The use of such a coiled-coil electrode in a discharge lamp is recommended, for example, in United States Patent 2,061,892, issued November 24, 1936, to Laurence Burns.

Lead-in wires 4, 5, 6, 7, extend from the ends of the coil through the ends of the glass envelope 2, to act as contacts to the remainder of the apparatus. The tube contains a gaseous atmosphere. At one end of the tube, lead-in wire 6, is connected to one end of the power line from which the lamp is operated; the power line may conveniently have a voltage of 110 volts. At the other end of the lamp, lead-in 4, is connected to the other side of the power line through the reactance coil 8. Lead-in wires 2 and 3 are normally connected together through the contacts 9 and 10, but when the switch 11, a double pole switch in the drawing, is closed, allowing current to build up through the reactance coil 8, the magnetic field of the coil pulls down the arm 12, which is of iron or other magnetic material, thus opening the circuit through the contacts 9, 10.

For the period necessary for the current to build up through the reactance 8, the contacts 9, 10, are closed, and current flows through the coils

of electrodes 3, 3, bringing them to an electron-emitting temperature. When the current builds up to the proper value, contacts 9, 10 open and the current is then forced to flow through the gas in the tube between the heated electrodes. The current will ordinarily build up too fast to allow time for properly preheating the cathodes unless a small cap 13 of copper or other conducting metal is placed on the end of the magnetic pole 14. This conducting patch slows the building up of the magnetic field, because of the eddy currents in the cap. The cap must not be made too large, however, or it will cause too great a power loss.

The arrangement of Figure 2 is the preferable form of the invention, because it allows a more careful adjustment and regulation of the period of preheating the electrodes. In Figure 2, instead of depending on the delay in magnetic field build-up to allow time for the filaments to preheat before the contacts 9, 10 are opened, I depend on the action of a thermostatic switch, which permits a longer and more definitely controlled preheating period. The switch arm 16, may be of phosphor bronze or other spring material, flexed to keep the contacts 9, 10, normally closed. A bimetallic disc 18, that is, a disc each of whose sides is of a different metal, one for example being of steel and the other of bronze, is flexed downward as shown, being supported along its circumference, and a piece 15 of insulating material is placed as shown between the disc and the switch arm. This piece is short enough to allow the switch arm to remain closed when the bimetallic disc is flexed as shown, yet long enough to open the switch controls 9, 10, if the disc is flexed upward. A small heating coil 17, in series with the circuit to the line, as shown, is placed near the bimetallic disc. When the switch 11, is closed, current flows through the reactance coil 8, the filaments 3, 4 and the disc heater 17. Current continues to flow until the heat from the heater 17, is sufficient to expand the metal on one side of the disc enough more than that on the other side, to cause the disc to reverse its curvature with a snap, that is, to become concave where it was convex, as shown more clearly in Figure 3. The contacts 9, 10, then open and the discharge through the gas in the discharge tube begins.

The filaments are thus heated for a definite period, generally a few seconds, sufficient to allow them to reach the proper electron-emitting temperature, say 700° C., and then the thermostatic disc buckles, opening the external connection between filaments with a definite, quick snap

which provides, because of the series reactance coil, a strong inductive voltage "kick" across the gas between the electrodes at each end of the tube, enabling the tube to start.

5 There is one further feature which facilitates starting of the lamp. The filament may be arranged, particularly if a coiled-coil filament is used, to have a drop across it, prior to starting the lamp, somewhat above the excitation or
10 ionization potential of the gas used. In that case a small discharge may occur across the ends of the filament. A small wire, such as 19 or 20, in Figures 1 and 2 may be placed alongside the filament and connected to one end of the filament
15 in which case the discharge may occur between that wire and the portion of the filament which is above the ionization voltage of the gas, with respect to the lead-in wires 4 or 6 respectively.

20 The distance between wire and filament will be less than that between the ends of the filament, and the filament, or auxiliary discharge, will more easily pass.

We thus have the filament at the proper electron emitting temperature, the gas around the
25 filament ionized, and an inductive voltage surge across the tube, all at the instant at which the bimetallic switch snaps. The combination of all these factors produces an effective starting arrangement for the lamp.

30 In the event that the lamp is too long to start from the 110-volt lamp, a higher voltage may be used across the entire circuit, or a transformer may be used across the line. The transformer may be designed to have sufficient leakage reactance to make the choke coil unnecessary in
35 Figure 2, and may be designed to have the proper magnetic effect to replace the choke in Figure 1 as well.

What I claim is:

40 1. In combination, a reactance coil, a heating coil, a lamp filament of the oxide-coated coiled-coil tungsten wire type, a normally closed pair of contacts, and another lamp filament of the same
45 type as the first, all connected in series electrically, the lamp filaments being at opposite ends of a sealed glass envelope containing a gaseous atmosphere, one of the contacts of said pair being fixed and directly connected to one terminal of
50 one of the filaments, the other being directly connected to one terminal of the other filament and attached to a movable arm, the heating coil being arranged to heat a flexed bimetallic disc so that the disc when heated to a critical temperature will push said movable arm to open the
55 circuit between the pair of contacts with a quick

snap to discharge the reactance coil through the lamp with a voltage surge, the reactance coil having a reactance sufficient to produce a voltage surge to start the discharge when the contacts
5 snap open and to limit the current to a value safe for the lamp while said contacts are open, yet small enough to allow sufficient current to flow through the filament before the contacts are opened to produce a voltage drop across each
10 filament greater than the excitation voltage of the gas, and a wire connected to one end of each filament and extending alongside and parallel to said filament toward the other end of said filament, to enable the passing of a small discharge
15 between the wire and the end of the filament prior to the opening of the pair of contacts.

2. In combination, a lamp filament, a normally closed pair of contacts, and another lamp filament, all connected electrically in series, with the pair of contacts between the two filaments and
20 connecting one lead of one filament to one lead of the other filament, said filaments being at opposite ends of a gaseous discharge lamp, a flexed bimetallic disc arranged to snap open the pair of contacts when said strip is heated for a sufficient
25 period, a heating coil for said bimetallic disc and electrically connected in series with the lamp filaments so that the flow of current through the lamp filament will begin the heating of the bimetallic disc, said disc being arranged with its
30 heater so that it reaches its snapping temperature shortly after the filaments reach their proper electron-emitting temperature, a reactance coil in series with said lamp filaments and having a reactance sufficient to provide an inductive voltage surge between the electrodes at opposite ends
35 of the tube when the contacts connecting the filaments snap open and sufficient to limit the current through the discharge to a value safe for the lamp after the discharge is started, yet small enough to provide, before said contacts are
40 opened, a voltage drop across each filament, at its electron-emitting temperature, greater than the excitation voltage of the gas, and a wire close to and alongside each filament, said wire being
45 electrically connected to one end of the filament and extending along the filament toward the other end of the filament and close enough to said other end of the filament to permit the passage of a small discharge between said wire and said filament at the voltage across the filament prior to
50 the opening of the pair of contacts, to insure that the gas around the filament is ionized at the instant the contacts open.

ORRICK H. BIGGS. 55