Oct. 16, 1956 J. C. YAEGER 2,767,343

ELECTRIC GASEOUS DISCHARGE DEVICE

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FIG. 1.

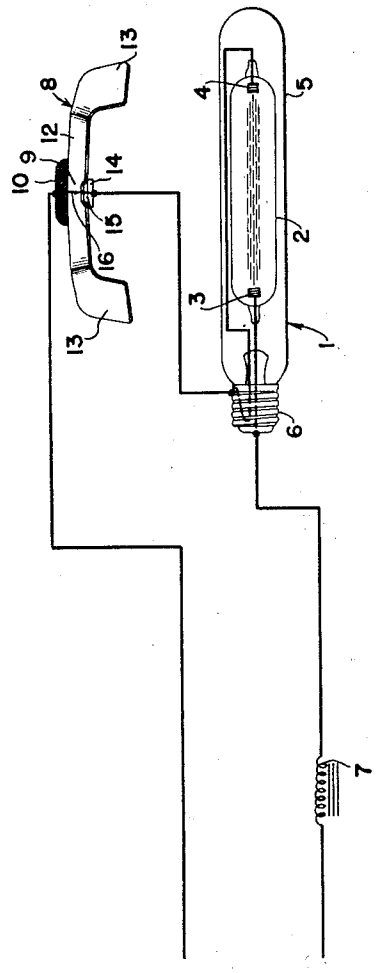
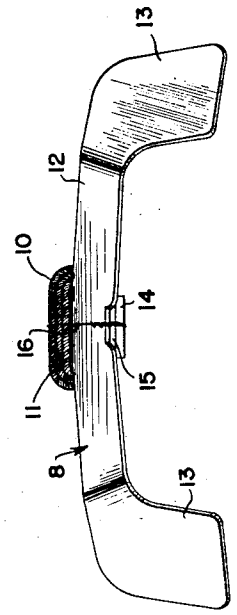


FIG. 4.



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FIG. 2.

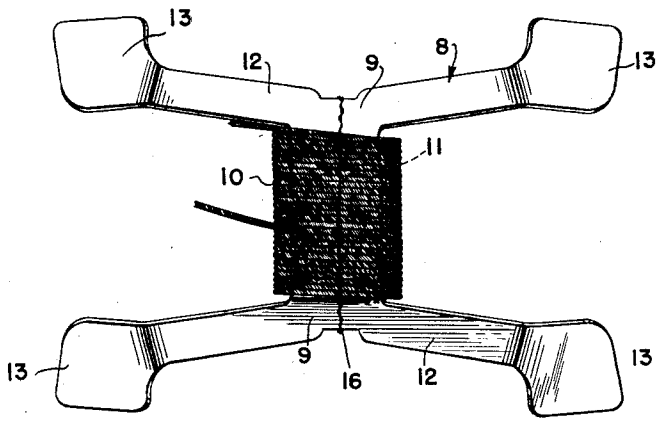
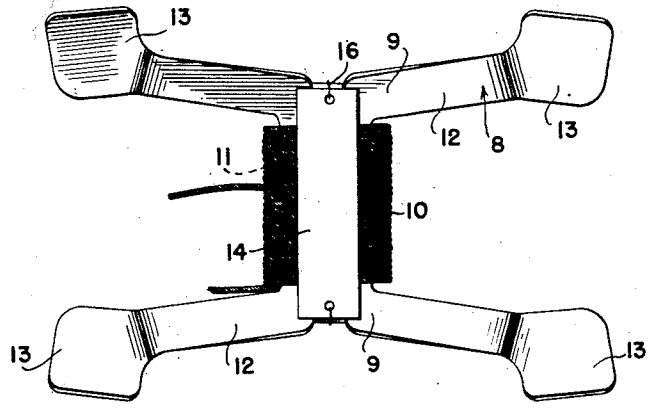


FIG. 3.



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ELECTRIC GASEOUS DISCHARGE DEVICE

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5 Claims. (Cl. 313—161)

The present invention relates to electric gaseous discharge devices, and particularly to an improved electromagnetic means for controlling the deflection of the discharge arc when such devices are operated in a position inclined from the vertical.

One of the major difficulties encountered during operation of gaseous electric discharge devices, such as high intensity mercury vapor lamps, has been in the manner of operating these lamps in any other position than with the arc extending in a vertical plane. Mercury vapor lamps usually comprise an inner and an outer glass envelope with electrode members being positioned at opposite ends of the inner envelope or tube. The inner envelope generally contains argon gas which immediately supports an arc between the electrodes when voltage is applied to the lamp. The heat of this arc discharge starts the vaporization of mercury to give the characteristic bluish glow of the energized mercury vapor. When the gas in the arc stream is heated, it tends to rise curving upwardly towards the wall of the arc tube as the lamp is inclined from the vertical position. The curved arc stream causes a severe localized heating of the tube with a consequent softening of the glass. The softened glass has often permitted the tube to collapse, and thereby divert the gas from the desired discharge path, in addition to permitting the evolution of copious amounts of the gas into the arc stream which will ruin the device.

The prior art discloses a variety of devices to be used for correcting this problem. In fact, there are many devices which utilize an electromagnetic means for diverting the arc away from the tube wall when the lamp is inclined from the vertical. However, the prior devices were dependent upon a plurality of electromagnets, various mounting arrangements of solenoids between the lamp envelopes, the use of additional resistors and capacitors in series with the magnet or magnets, or were dependent upon the field of the coil alone. Although the prior devices were effective to a degree, they permitted the arc stream to bow or curve at certain portions without achieving the desired straight line path between electrodes. This was especially true where a single iron core block was used at the center of the path. The flux field tended to depress the mid-portion of the arc stream away from the tube wall, while portions at either side of the core block tended to rise as the field decayed at areas spaced from the core.

The present invention contemplates the use of a unitary structure comprising a specially designed core having a coil wound about its central portion, and preferably with the addition of a high reluctance "magnetic shunt member" which effectively reduces the deflection of the mid-portion of the arc to thereby provide an essentially straight line arc stream between the electrodes. The device has particular application for use where there has heretofore been a tendency for the mid-portion of the arc stream to be depressed with the consequent bowing effect at either side of this portion. In addition, prior devices permitted the ends of the arc at each electrode

to rise to the uppermost portion of the electrode to cause a severe localizing of the arc stream at the top of the electrode with a consequent early disintegration of the electrode members.

It is among the objects of the present invention to provide an improved electromagnetic control device for effectively providing a straight line arc stream in an electric gaseous discharge device throughout the entire length of the stream, and which further acts to force the arc emanating from the electrodes of the device away from the uppermost portion of the electrode members to the center of the electrodes where its intense heat may be properly distributed throughout the entire member.

Another object of the present invention is to provide an improved electromagnetic arc controllinng means for electric gaseous discharge devices, which means preferably takes the form of a saddle-like member, preferably having a general H-shape with opposed arm portions lying substantially parallel with the arc stream, and which arc portions are further formed with the ends thereof projecting in a direction substantially normal to the arc stream and in the proximity of either end of the arc stream.

It is a further object to provide an improved electromagnetic arc controlling means for electric gaseous discharge devices, which means preferably takes the form of a saddle-like H-shaped member, and which is further preferably provided with a high reluctance magnetic field shunting member for equalizing the arc stream depressing characteristics of the controlling means, whereby the arc stream defines an essentially straight line between electrode members.

Referring now to the drawings:

Fig. 1 is an elevational view showing a gaseous discharge lamp, and is partially in schematic diagram to illustrate a preferred circuit for the operation of the lamp when positioned inclined from the vertical.

Fig. 2 is a top plan view of the improved arc controlling device for a gaseous discharge lamp.

Fig. 3 is a bottom plan view of the device.

Fig. 4 is a side elevational view of the improved arc controlling device.

As illustrated in Fig. 1, the preferred electrical circuit for operating the gaseous discharge lamp, such as a mercury vapor lamp, comprises the conventional circuit components including the lamp shown generally at **1**, and consisting of an inner envelope **2** containing and supporting the electrodes **3** and **4**. The inner envelope is supported within an outer heat conserving envelope **5**, to which is attached the customary screw base **6** comprising contacts to which the electrodes **3** and **4** are respectively connected. The electrodes **3** and **4** may be of the conventional type and the composition of the gas within the envelope **2** is such that the discharge will occur between the electrodes when a suitable potential is applied therebetween. The gas may comprise argon at a low pressure sufficient to cause a glow discharge to occur between the electrodes when the operating voltage is applied thereto. A predetermined amount of mercury is also contained within the envelope **2**, such that after a glow discharge has been in operation for a certain time, the mercury will be vaporized to cause the pressure within the envelope to rise to a pressure of the order of atmospheric. The glow discharge initiated in argon will then be converted into an arc discharge in the mercury vapor. As shown in this figure, the lamp **1** is connected in series with a conventional arc stabilizing inductance, or ballast **7**, supplied by a suitable source of current.

The improved arc controlling device, indicated generally by the reference character **8**, may be connected in series with the lamp and to the supply source. It will be apparent, that the present invention is not to be limited

to the schematic diagram of Fig. 1, but may be used in any of the conventional circuits supplying electrical energy to gaseous discharge devices.

Referring now to Figs. 2, 3 and 4, the novel arc controlling device comprises a saddle-like, H-shaped core 9, preferably stamped from sheet magnet iron or other similar material having magnetic properties. A magnetizing coil of wire 10 is wound with its convolutions circumjacent to the intermediate integral bar portion 11 joining the opposed leg portions 12 of the core 9. Approximately 160 turns of coil wire is ordinarily employed in a 3.2 ampere circuit. Each of the leg portions 12 of the core are further formed with laterally extending foot portions 13 at either end thereof for a purpose hereinafter described.

The improved arc control device preferably includes a magnetic shunt member 14. The shunt member 14 is of a magnetic material, such as stamped sheet iron, and extends substantially parallel with the cross bar portion of the H-shaped core to join at its ends with the opposed leg portions 12. The shunting member 14 is also provided with an air gap 15 at least one end thereof. The member may be tack welded at either end to the core, preferably with some non-magnetic material, or may be held in place by means of a short piece of wire 16 in order to insure that there will be provided a high-reluctance air gap 15 at one end, or preferably at both ends thereof.

The operation of the improved arc control device is quite similar to that of the prior devices, in that the position of the arc stream is controlled by means of a magnetic field. The field is established by means of the core and coil assembly, preferably placed immediately above the lamp as shown in Fig. 1. As soon as potential is applied from the supply source, an arc is immediately initiated within the inner tube 2, and this arc current flows in series through the coil 10. As a result, the magnetic field produced by the magnetic oil 10 establishes a magnetic force which is exerted on the arc stream in a direction substantially normal to the axis of the inner tube 2. If the full effect of the magnetic force were permitted to be exerted, the arc stream, at its mid-portion, would tend to be over-amplified with the possibility of the arc impinging on the lower wall of the inner tube when the lamp is operated in a horizontal position.

The core has been particularly shaped to minimize any accentuation of the magnetic force on the arc stream. It will be noted that it is of a general saddle-shape and each leg 12 of the core is provided with foot portions 13 at either end extending downwardly towards the arc stream in the proximity of the electrodes 3 and 4. Thus, the magnetic forces are brought physically closer to the electrode portions of the arc stream. In addition, the core has been provided with the magnetic shunt member 14 which introduces an air gap 15, preferably at both ends, and between the member 14 and each leg portion 12. The air gap 15 obviously provides a high reluctance characteristic to the magnetic core at a portion of the core which has heretofore tended to over-accentuate the magnetic forces at the mid-portion of the arc stream. Thus, the improved core, and preferably with its magnetic shunt member 14, acts to provide a straight line characteristic to the arc stream coextensive with the entire length of the arc stream.

From the foregoing, it will be apparent that the important feature of the present invention is the novel design of the coil and core unit in addition to the use of a solid shunt member intermediate the spaced legs of the saddle-shaped core and providing a high reluctance air gap therebetween, thereby to confine the arc stream at all times to a straight line path within a comparatively limited zone at the axis of the gaseous discharge lamp.

I claim:

1. In an electromagnetic arc control device for a gaseous discharge lamp having a tubular sealed envelope containing a gaseous atmosphere and having electrodes sealed therein with the path therebetween at an angle to the vertical, an improved core and coil assembly for producing a magnetic field within said lamp and comprising a core member substantially coextensive with and substantially parallel to the path between said electrodes, said core member including portions at either end extending laterally relative thereto and in a direction towards each of said electrodes.

2. In an electromagnetic arc control device for a gaseous discharge lamp having a tubular sealed envelope containing a gaseous atmosphere and having electrodes sealed therein with the path therebetween at an angle to the vertical, an improved core and coil assembly for producing a magnetic field within said lamp and comprising a saddle-shaped core member having spaced leg portions substantially coextensive with and substantially parallel to the path between said electrodes, the extremities of said leg portions being formed to extend in a direction towards each of said electrodes.

3. In an electromagnetic arc control device for a gaseous discharge lamp having a tubular sealed envelope containing a gaseous atmosphere and having electrodes sealed therein with the path therebetween at an angle to the vertical, an improved core and coil assembly for producing a magnetic field within said lamp and comprising a saddle-like, core member having spaced legs substantially coextensive with and substantially parallel to the path between said electrodes, the extremities of said legs being formed to extend in a direction towards each of said electrodes, and a magnetic shunt member providing a high reluctance air gap intermediate said spaced legs.

4. In an electromagnetic arc control device for a gaseous discharge lamp having a tubular sealed envelope containing a gaseous atmosphere and having electrodes sealed therein with the path therebetween at an angle to the vertical, a core and coil assembly for producing a magnetic field within said lamp and comprising a core member formed so as to have a cross bar with spaced arms on opposite sides thereof extending substantially normal to said bar, each of said arms being substantially coextensive with and substantially parallel to the path between said electrodes.

5. In an electromagnetic arc control device for a gaseous discharge lamp having a tubular sealed envelope containing a gaseous atmosphere and having electrodes sealed therein with the path therebetween at an angle to the vertical, a core and coil assembly for producing a magnetic field within said lamp and comprising a core member formed so as to have a cross bar with spaced arms on opposite sides thereof extending substantially normal to said bar, each of said arms being substantially coextensive with and substantially parallel to the path between said electrodes, said coil having its convolutions circumjacent to said cross bar, and a magnetic shunt member substantially parallel with said cross bar and providing an air gap between said spaced arms.

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