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2,267,098

GLOW RELAY

Filed May 25, 1940

Fig. 1.

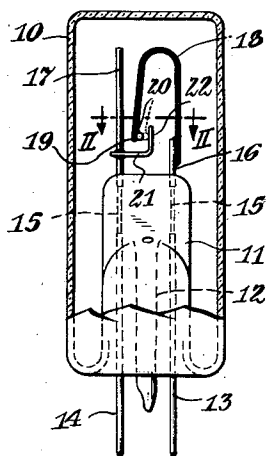


Fig. 3.

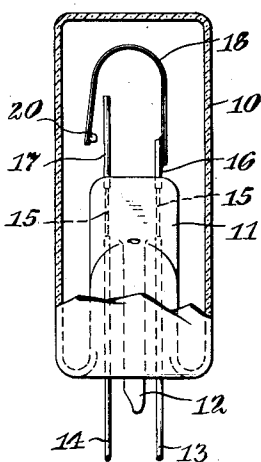


Fig. 4.

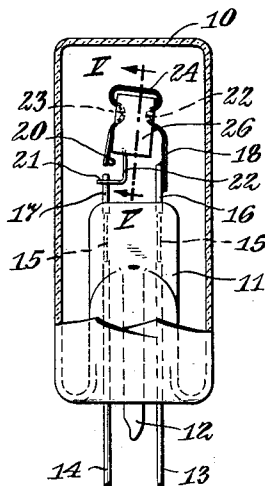


Fig. 2.

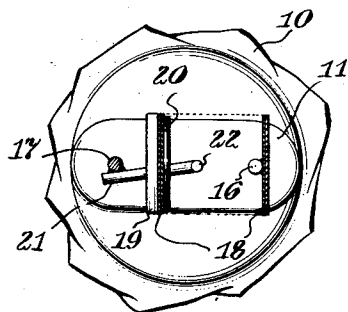


Fig. 5.

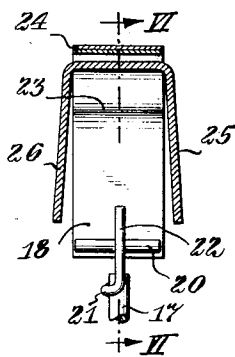
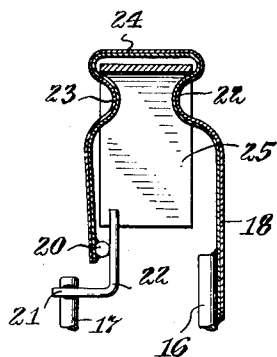


Fig. 6.



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2,267,098

GLOW RELAY

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Application May 25, 1940, Serial No. 337,155

8 Claims. (Cl. 250—27.5)

The present invention relates to a gaseous electric discharge device and more particularly to what may be termed a no-power-loss relay for making and breaking an electric circuit.

A device of this type has many uses and, as shown in several copending applications of which I am the sole or joint inventor, namely, Ser. No. 252,875, filed January 26, 1939, Ser. No. 258,382, filed February 25, 1939, Ser. No. 264,705, filed March 29, 1939, and Ser. No. 265,164, filed March 31, 1939, and assigned to the same assignee as the present invention, this device finds particular utility in the starting of a gaseous discharge lamp. Fig. 1 of Dench Patent 2,200,443, issued May 14, 1940, discloses such a starting circuit with this type of device.

In lamps of the discharge type it is customary to employ electrodes of the thermionic type and to connect such electrodes in series with a suitable source of supply through a medium of suitable switching means. It is highly desirable in a circuit for discharge lamps that the relay device which operates to open and close the circuit not only be positive in its operation, but at the same time consume no power from the circuit which is otherwise supplied to the lamp. A relay of this type is shown and described in the above noted applications and the present invention constitutes an improvement of such a device.

During operation of the gaseous electric relay device, a glow discharge is initiated; and since at least one of the electrodes is a bimetallic element, it is heated by the ensuing discharge. Upon heating of the bimetallic electrode, it deflects into contact with the other electrode to short-circuit the same and extinguish the discharge. This enables the bimetallic element to rapidly cool and return to its normal position with but a momentary contact with the electrodes.

In the copending applications above referred to, the bimetal has been constructed to bend outward under the heat of the discharge until it makes contact with the other electrode. This particular type of no-power-loss relay has proved especially efficient over other types of relays proposed for the control of fluorescent lamps. The increasing popularity of fluorescent lamps has made these no-power-loss relays an item of mass production.

In the construction of these relays it was necessary to exhaust and heat treat the device before inserting the gaseous atmosphere. On exhaust the contacts are spaced to cross over to

prevent deformation of the bimetal, so that the contacts maintain their original spacing. Because the adjustment is not perfect, some of the contacts cannot cross over and the bimetal is deformed or the press is cracked. The glass in the press has a very low tensile strength but a very high compressive strength. The result has been that, as the bimetal moves outward against the other electrode, the glass may crack adjacent the electrode. If the contacts wear away so that they do not touch, then an arc discharge may be created between the contacts that may melt the glass container and create a fire hazard.

The main problem in assembling these switches was the production of parts to close tolerances, inspection of the parts and careful adjustment during assembly. Each mount was placed in a projection microscope and the lead wires were bent to adjust the contact spacing. Bending the wires resulted in a great deal of shrinkage by breaking welds and cracking glass. During the exhaust, another proportion of switches were lost because of roughness of contact wires, causing locked contacts and inaccurate spacing. The excessive cost of the inspection of parts, manual adjustment and large shrinkage in assembly made necessary a new construction that would not require close tolerances or adjustment.

It is an object of my invention to construct a switch that will automatically adjust itself during assembly.

Another object of my invention is to provide a construction that does not require inspection of parts or assembly.

Another object of the present invention is to provide a gaseous electric relay device in which the heat treating and operation of the device will not result in cracking the glass in the press.

Another object of the invention is to produce a simplified structure requiring a minimum of operation in securing the various elements of the relay in position.

Specifically, it is an object of the invention to provide a construction in which the bimetal is curved with the metal of higher expansion on the upper or outer side and the metal of lower expansion on the under or inner side. The other contact arm or lead is placed in the path of the bimetal to stop its movement as it curves or bends still more under the heat, first of the exhaust, and later the heat of discharge in operation of the device.

This construction eliminates adjustment and careful inspection of parts because, when the bi-

metal bends into contact with the other lead during heat treatment and exhaust, the bimetal's further movement is stopped by the other lead while the heat treatment is continued. When the heat treatment is stopped and the bimetal cools, the bimetal pulls back from the other contact lead a distance depending on the difference between the exhaust temperature and the ambient or room temperature to which the bimetal cools. The spacing between the bimetal and other contact lead during initial assembly should not be greater than the final spacing, but otherwise this initial spacing is not critical. The reason this spacing is not critical is that, when the bimetal and the other lead are in contact and the heating continued, either because the bimetal is stressed beyond the elastic limit or because the heat relieves stresses in the bimetal or because of a combination of both actions, the bimetal is permanently deformed to take the particular contact shape at the temperature of heat treatment.

Of course, if the initial spacing is made close to that of the final desired spacing, there will naturally be very little stress and deformation during the continued heat treatment so that the final spacing at room temperature will not be appreciably greater than the initial spacing. My construction and method of assembly eliminates the production and assembly of parts to close tolerances and to careful inspection, which was heretofore necessary.

Since the contacts are not arranged to brush by one another, there will not be any arcing due to wear of these contacts, which would permit them to press by each other without making contact. In my construction, the movement of the bimetal is always stopped by the other contact or lead.

The leads are positioned in the glass of the press of the relay so that any strain on the glass will be a compressive strain which the glass is able to withstand. This arrangement also provides a minimum of welds in the assemblage of the device.

Other objects and advantages of the present invention will be apparent from the following description and drawing in which:

Fig. 1 is a view mainly in cross-section of a preferred embodiment of the invention.

Fig. 2 is a cross-sectional view on lines II—II of Fig. 1.

Fig. 3 is a modification of the embodiment of Fig. 1.

Fig. 4 is a still further modification of the relay of Figs. 1 and 3, which modification is especially adapted for low or 110 volt circuit operation.

Fig. 5 is a cross-sectional view on lines V—V of Fig. 4.

Fig. 6 is a cross-sectional view on lines VI—VI of Fig. 5.

In Fig. 1 I have illustrated a preferred embodiment of my invention which comprises an envelope 10 of glass which, after evacuation, is filled with an ionizable medium, such as neon or the like, at a pressure which may range from approximately 10 to 100 mm. The device is provided with a reentrant press portion 11 having an exhaust stem 12 as customarily employed in the fabrication of incandescent lamps.

A pair of conductors 13 and 14 have a dumet portion 15 sealed through the reentrant press portion 11. These conductors have an interior portion 16 and 17 of metal such as a nickel wire or rod extending into the interior of the device.

To the rod 16 is secured, as by welding, a U-shaped bimetallic electrode 18.

This bimetallic electrode may be of any suitable pair of materials having a difference of expansivity. The lower expansion metal layer is located on the inside and the higher expansion metal layer on the outside of the U. While various combinations may be utilized, such as nickel and molybdenum, I prefer to use nickel steel of approximately 36% nickel for the low or inner portion of the bimetal, and chromium nickel steel for the high expansion or outer portion of the U-shaped bimetal. The bimetal is coated with an electron emitting material, such as the oxides of barium and strontium.

The free end 19 of the bimetal has a contact rod 20 welded thereto. An L-shaped wire 21 is welded to the shaft of the electrode 17 and has the bottom portion of the L 22 in such a position as to be contacted by the contact bar 20, as illustrated in the dotted lines in Fig. 1, showing the position of the bimetal under the application of heat of the discharge. It has been found that the bimetal will not interfere with an extension of the conductor 17 above the press, so 17 has been purposely elongated to increase the discharge area cooperating with the bimetal as the other electrode.

It will be noted that the pressure of the bimetal when it is heated places a compressive strain on the electrodes 15 and 17. This compressive strain is transferred to the glass between the electrodes and this is capable of withstanding this strain. If, however, the bimetal were reversed in structure so that it pressed against the electrode 17, then the glass would be apt to crack between the electrode 17 and the adjacent sloping side of the reentrant press.

It will be noted in the structure in Fig. 1, that the electrodes are assembled by a weld of the L-shaped bar 21 to the standard 17. The contact bar 20 to the free end of the bimetal, and the weld of the bimetal and the standard 16, make only a total of three welds in assembling the device.

In Fig. 3, I have illustrated a still further simplification of the device in which the bimetal 13 is enlarged so that it bends over the standard 17. When the discharge is started, the bimetal will contract and the bar 20 will be brought into contact with the outer side of the electrode 17. In this construction the bimetal is welded to the electrode 16 and the contact bar 20 to the bimetal, making only a total of two welds. In Fig. 3 the standard 17 is preferably of tungsten or molybdenum. The electrode 16 is preferably of nickel.

In Figs. 1 and 3 I have illustrated a relay device suitable for operation on 220 or 230 volt commercial circuits.

My invention, however, is also adapted for operation on 110 or 115 volt commercial circuits. For use on this relay voltage it is necessary that means be provided for lowering the breakdown voltage of the relay, and I have carried out the simplicity present in the preceding figures in applying this means for lowering the breakdown voltage for utilization on 110 to 115 volt circuits.

A preferred embodiment is illustrated in Figs. 4, 5, and 6. This structure is somewhat similar to that of Fig. 1 in that the bimetal 18 is welded to a standard 15 and the L-shaped bar 21 welded to the standard 17. The bimetal is crimped at 22 and 23 just before the base of the U. The curving U-shape of Figs. 1 and 3 is preferably flat-

tened out at the bottom. This flat base 24 of the bimetal is clearly shown in Fig. 6. A piece of magnesium slightly smaller than the width of the base of the bimetal but wider than the portion between the crimped sides 22 and 23 is fed through the constricted crimped portion of the bimetal, as illustrated in Fig. 6, and then bent downward on each side at 25 and 26, as illustrated more clearly in Fig. 5. This piece of magnesium thus bounds the discharge space between the two electrodes and provides means for lowering the breakdown voltage between the two.

While I have disclosed magnesium in my prior filed applications, yet I have not disclosed such a simplified arrangement in these prior filed applications. It will be noted that this simplicity of supporting the magnesium strip follows from the fact that the ends of the bimetal are contracted together during operation of the discharge, thus holding the magnesium still more firmly in position.

In manufacture, the two conductors are sealed through the press and the bimetal and contact portions welded thereto and enclosed in the glass bulb casing. The bulb is then placed in a combined exhaust and heat treating machine. The device is subjected to a temperature of approximately 425° C. for approximately 1½ minutes. It is then permitted to cool and the bimetal to take its desired spacing from the other contact lead. Part of the magnesium or other metal, such as zinc, is flashed and coats the bimetal and the bulb. Then the desired gaseous atmosphere, such as neon, helium, or argon at a pressure of 10 to 150 mm. of mercury, is inserted.

I prefer to use neon from 40 to 100 and preferably 60 mm. of mercury pressure. Helium may be used at 50 to 150 mm. of mercury pressure and argon at 10 to 20 mm. of mercury.

It is apparent from the above description that I have invented a very simplified arrangement of the no-power-loss relay for making and breaking an electric circuit and of such simplified structure and assemblage that the excessive inspection and adjustment necessary with prior constructions are entirely eliminated.

Although several embodiments of the present invention have been shown and described, it is understood that still further modifications thereof may be made without departing from the spirit and scope of the appended claims.

I claim:

1. A relay discharge device comprising a container, a gaseous medium therein, a glass press forming part of said container, two conductors sealed through said press, a bimetal with layers of different expansion having one end secured to one of said conductors, the other end of said bimetal being bent over toward the other conductor, the layer of lower expansion being on the

under side of said bent over bimetal whereby the bimetal will bend still further with the application of heat, and a contact portion of said other conductor in the path of movement of the free end of the bimetal in bending still further thereby putting said glass stem under compression, said bimetal having a coating of electron emitting material.

2. A relay discharge device comprising a container, a gaseous medium therein and two electrodes, one of said electrodes comprising a bimetallic ribbon bent over and another ribbon of electron emitting material loosely supported by said bent over portion.

3. A relay discharge device comprising a container, a gaseous medium therein and two electrodes, one of said electrodes comprising a bimetallic ribbon bent over and another ribbon of electron emitting material loosely supported at right angles to said bimetallic ribbon by said bent over portion.

4. A relay discharge device comprising a container, a gaseous medium therein and two electrodes, one of said electrodes comprising a bimetallic ribbon bent over and another ribbon of magnesium loosely supported by said bent over portion.

5. A relay discharge device comprising a container, a gaseous medium and two electrodes therein, one of said electrodes being a bimetallic ribbon bent over, said bimetallic ribbon having upper and under layers of different expansion, a magnesium ribbon loosely supported by the bent over portion of said bimetallic ribbon, the under layer of said bimetallic ribbon being of lower expansion, whereby said bimetallic ribbon will bend still more with the application of heat.

6. A relay discharge device comprising a container, a gaseous medium and two electrodes therein, one of said electrodes being a bimetallic ribbon bent over and having two inwardly projecting portions, and a ribbon of magnesium resting on the two inward projecting portions.

7. The method of spacing a bimetallic switch element from its contact lead which comprises heating the bimetallic switch element until its movement is stopped by said contact lead, continuing the heating of said bimetallic switch element until the bimetal is deformed, and then cooling the bimetallic switch element to withdraw from said contact lead.

8. The method of spacing a bimetallic switch element from its contact lead inside a container which comprises subjecting said container to a heat treatment until the bimetallic switch has its movement stopped by said contact lead, continuing the heat treatment for at least one minute, and then cooling the bimetallic switch element to withdraw from said contact lead.

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