Oct. 14, 1941. A. H. LAIDIG 2,259,111

DOUBLE BIMETALLIC GASEOUS RELAY

Filed Aug. 14, 1940

Fig. 1.

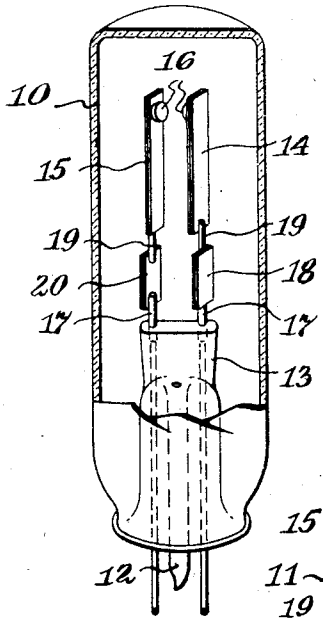


Fig. 2.

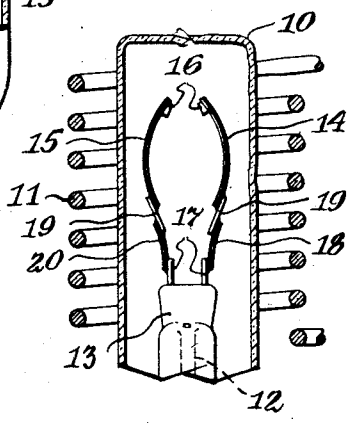


Fig. 3.

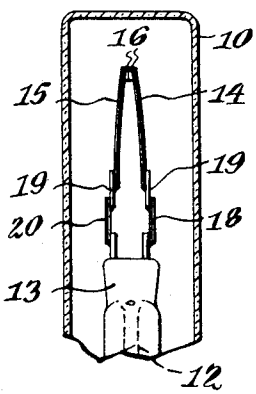


Fig. 4.

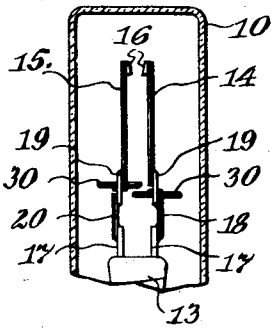


Fig. 5.

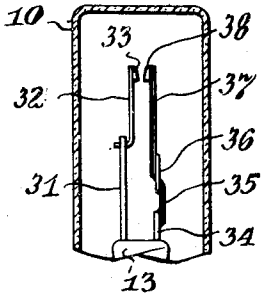


Fig. 6.

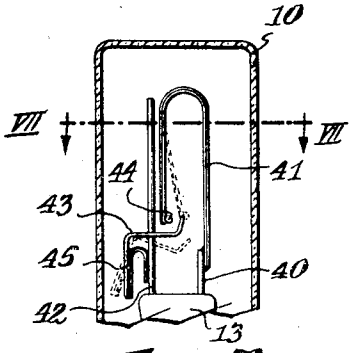


Fig. 7.

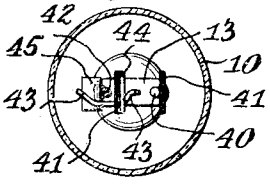
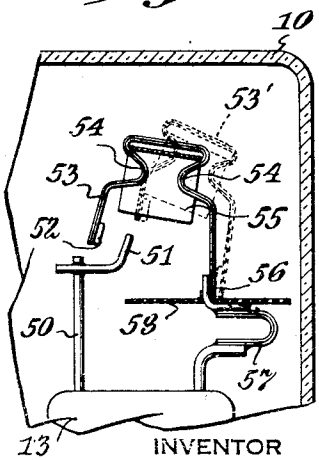


Fig. 8.



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Patented Oct. 14, 1941

2,259,111

UNITED STATES PATENT OFFICE

2,259,111

DOUBLE BIMETALLIC GASEOUS RELAY

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Application August 14, 1940, Serial No. 352,500

10 Claims. (Cl. 250—27.5)

My invention relates to gaseous discharge devices and especially to gaseous discharge thermal relays.

An object of my invention is to provide a gaseous discharge thermal relay in which the ambient temperature does not affect the normal spacing between the electrodes.

Another object of the invention is to prevent distortion of the electrodes during heat treatment and exhaust of the device.

Another object of the invention is to provide a gaseous discharge thermal relay that may be utilized near places of high temperature or in large size refrigerators.

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

Fig. 1 is a view in perspective, with parts broken away, of a preferred embodiment of the invention.

Fig. 2 is an elevational view of the device in Fig. 1 during heat treatment.

Fig. 3 is an elevational view of the device in Fig. 1 during operation.

Figs. 4, 5, 6, and 7 are elevational views illustrating various modifications of the electrode structure of Fig. 1.

Fig. 7 is a cross-sectional view on line VII—VII of Fig. 6.

The purpose of my invention is to provide a gaseous discharge thermal relay that will not be deformed during heat treatment and exhaust common with such devices.

An additional object is to prevent the effect of ambient temperatures on the spacing between the electrodes of such a relay. In its specific form, my invention is an improvement on the gaseous discharge thermal relay, such as disclosed in Patent 2,200,443 to E. C. Dench, issued May 14, 1940. Such gaseous discharge thermal relays include electrodes inside of a casing, such as the glass tube 10 disclosed in Fig. 1. This tube contains a gaseous atmosphere, such as neon, argon, or a similar ionizable medium or combination of gases.

In order to make certain that the gaseous medium is pure, the various metal parts of the device are heat treated, preferably by a high frequency induction coil 11 disclosed in Fig. 2. This coil is energized during the time that atmosphere and occluded gases in the metal parts are being exhausted through the tubulation 12. Since the device in the Dench patent is to gradually close the contacts under the heat of discharge, such contacts will close under the effect of the heat treatment, and frequently the effect of this heat treatment is to distort the electrodes both in shape and desired spacing from one another.

After the device has been formed for operation in the usual room temperature, an installation might be made in an atmosphere of very low temperature, such as in the large size refrigerators utilized in butcher shops or cold storage warehouses. The effect of such an installation with its low ambient temperature is to considerably slow up the action of the discharge relay. Furthermore, the device may be installed in a climate where the ambient temperature is always warm, with the result that the action of the relay may be accelerated too much by the ambient temperature.

It is specifically an object of my invention to provide bimetallic means that will automatically compensate for the effect of the ambient temperature on the bimetal or bimetals affected by the discharge. This bimetallic means is connected to one or both of the electrodes and is designed to prevent ambient temperature closing the contacts. With such means, the closing of the contacts will be the sole result of a discharge between the two electrodes.

In Fig. 1, I have disclosed a preferred embodiment in which a press 13 supports two electrodes. One of these electrodes such as 14 is preferably composed of a bimetallic strip having the metal layer of lower expansion on the side facing the other electrode 15. This other electrode 15 may likewise be a bimetallic strip with its layer of metal of lower expansion facing the electrode 14. These electrodes are preferably coated with zinc to provide a low work function, and at a suitable distance from the upper ends each electrode preferably has a contact area 16 to take the wear from the shock of contact. Normally these bimetallic electrodes would be supported on standards 17 passing through the press 13.

In its preferred embodiment, I insert a bimetallic element 18 between the standards 17 and a connection 19 to the bimetallic element 14. As disclosed in Fig. 1, I prefer to install a second bimetallic element 20 between the standards 17 and the connection 19 to the bimetallic electrode 15. The bimetallic elements 18 and 20 are arranged so that the metallic layers of lower expansion are on the outside and the metals of higher expansion face one another. The surface of these bimetallic elements, or at least the surfaces facing one another, may be coated with a material of very high work function such as

aluminum oxide. The effect of heat on the two pairs of bimetals, namely, 14 and 15, and 18 and 20, is the reverse. In other words, the top ends of the bimetals 14 and 15 will tend to contact one another, but the top portions of 18 and 20 will be to widen the distance between the two electrodes.

After the parts have been assembled and sealed inside the casing 10, the tubulation 12 is attached to any suitable exhaust system and the atmosphere inside of the glass tube is exhausted. In order to also exhaust the gases occluded in the metal parts, a high frequency coil 11 is placed about the device and the metal parts are heated by the induced current therein. This heat will bend the contact points 16 toward one another, but at the same time the top portions of the bimetals 18 and 20 will spread further apart with the result that contact and consequent distortion of the electrodes will not result from the high heat treatment necessary to remove the gases. After desired vacuum is obtained inside the casing 10, the induction coil 11 is removed and the desired gaseous atmosphere inserted within the tube and the tubulation sealed off.

The device is now ready for installation in an arrangement such as illustrated in Fig. 1 of Dench Patent No. 2,200,443. This figure illustrates one of the most common applications of my invention which is for the purpose of starting a fluorescent lamp.

When the electrodes of my relay are connected to the lamp electrodes and a suitable source of power, a discharge will be initiated from one bimetal 14 to the other 15. This discharge will heat up the two bimetals 14 and 15 taking part in the discharge. The bimetals 16 and 20 will not be affected to any extent.

The result will be that the contact points 16 will close as illustrated in Fig. 3 because of the heat of discharge applied to the two bimetals. As the contacts 16 close, the discharge between the two electrodes will be short-circuited by the contact, and the discharge in my relay will stop. The bimetals 14 and 15 will then cool and separate. As these two bimetals separate the discharge will be initiated in the gaseous atmosphere of the lamp.

If desired, shields 30 may be placed around the connecting portions 19 between the two bimetals to prevent the possibility of the discharge between the two sets of bimetals such as from electrode 15 to the lower bimetal 18.

In Fig. 5, I have illustrated an embodiment in which the electrodes have only one bimetal of each set. The standard 31 has an electrode extension consisting of a small diameter wire 32 with a contact area 33 thereon, and the other electrode comprises a standard 34 connected to a broad strip bimetal 35 similar to the bimetal 18 in Fig. 1 which is connected in turn by a connection 36 to a bimetal 37 similar to the bimetal 14 of Fig. 1 and having upon its upper end a contact area 38. The action of the bimetal 35 in this modification is to counteract the effect of ambient temperature on the bimetal 37, as previously explained. The construction of the broad area electrode 37 and the small area electrode 32 is more particularly described in the copending application of R. F. Hays, Jr., S. N. 264,705 filed March 29, 1939.

My invention is also applicable to various shapes of electrodes. In Figs. 6 and 7 the standard 40 supports a bimetal 41 in the form of an inverted U with the metal of lower expansion on the inner side of the U. The other standard 42 has an extension 43 entering the mouth of the U so that the application of heat to the bimetal will move its contact end 44 to make contact with the extension 43, as illustrated in dotted lines.

Intermediate the standard 42 and the contact portion 43 of this electrode, I preferably insert a U-shaped bimetal 45 with the metal of lower expansion on the outer side of the bimetal. The action of the bimetal 45 will be the reverse of the bimetal 44, namely, heat will move the extension 43 away from the bimetal 44 as shown in dotted lines, whereas heat will move the bimetal 41 closer to the extension 43.

Accordingly, under the heat treatment of the induction coil illustrated in Fig. 2, the contact portion of 43 will move away from the path of movement of the end of the bimetal 41 and there will be no distortion. However, when the discharge is started, the bimetal 45 will not be affected thereby to any appreciable extent, and contact will be made between the two electrodes by the movement of the bimetal 41.

In Fig. 8, I have disclosed a still further modification of electrode structure in which the standard 50 has a contact-making portion 51 adjacent the contact end 52 of an inverted and crimped bimetal 53. This bimetal 53 has two lateral indentations 54 near the flat bottom portion of the U in order that a tab of magnesium 55 may be inserted at the base of the U and bent down at either side of the U to be held loosely therein. This tab of magnesium provides the lowered work function desired in starting the discharge.

The inverted U-shaped bimetal has a connection 56 to a U-shaped bimetal 57 having the position of its metallic layers reversed from that of the bimetal 53. The bimetal 53 has its metal of lower expansion on the inner side and the bimetal 57 has its metal of lower expansion on the outer side. A shield 58 preferably of insulating material, intercepts any direct discharge lines between the two bimetals so that the discharge will be confined to the bimetal 53 and the extension 51 of the other electrode. The shield 58 in this figure as well as the shield 30 in Fig. 4 acts also as a heat shield between the discharge and the lower bimetal or bimetals.

Under the influence of heat treatment as illustrated in Fig. 2, the bimetal 57 will bend the bimetal 53 to the position disclosed in dotted lines 53'. In this position, contact will not be between the bimetal and the other electrode at 51, and hence there will be no distortion of the electrode structure.

It is apparent that I have disclosed an arrangement whereby the effect of ambient temperature will be automatically compensated for in the gaseous discharge thermal relays illustrated. It is also apparent that many modifications may be made in the form, number and arrangement of the various elements disclosed in my preferred embodiment, and accordingly I desire only such limitations to be imposed upon my invention as are necessitated by the spirit and scope of the following claims.

I claim:

1. A gaseous discharge device comprising a container provided with an ionizable medium therein, two closely spaced electrodes therein, one of said electrodes including a bimetal with its metal of lower expansion facing the other electrode whereby the heat of discharge will bend

said electrode into contact with the other electrode to short-circuit said electrodes and extinguish said discharge, and a second bimetal connected to one of said electrodes at a place removed from the shortest discharge path between said electrodes, said second bimetal having its metal of lower expansion faced in the opposite direction to that of the lower expansion metal of said first bimetal whereby said second bimetal will tend to compensate for the effect of ambient temperature on the first bimetal.

2. A gaseous discharge device comprising a container provided with an ionizable medium therein, two closely spaced electrodes therein, said electrodes having contact areas, one of said electrodes having a bimetal adjacent said contact area with the metal of lower expansion facing the contact area of the other electrode whereby the heat of discharge will make said contact areas join and short-circuit said electrodes, and a second bimetal connected to one of said electrodes at a place remote from said first bimetal and having its metal of lower expansion faced in an opposite direction from that of the lower expansion metal of said first bimetal whereby the effect of a change in ambient temperature on one bimetal to vary the electrode spacing is compensated by the effect on the other bimetal.

3. A gaseous discharge device comprising a container provided with an ionizable medium therein, a curved bimetal having its metal of lower expansion on the inner side, an electrode within the curved bimetal cooperating to form a discharge path therewith, a second bimetal connected to said bimetal at a place removed from said discharge path and adapted to move said electrode out of the curved bimetal upon the application of high ambient temperature.

4. A gaseous discharge device comprising a container provided with an ionizable medium therein, two electrodes forming a discharge path, one of said electrodes having a bimetal as a terminal for the discharge path with its metal of lower expansion facing the other electrode whereby the heat of discharge will move the electrode into contact with the other electrode, said other electrode having a bimetal connected to it remote from the discharge path between the electrodes, said last mentioned bimetal compensating for the effects of variations in ambient temperature on said first mentioned bimetal.

5. A gaseous discharge device comprising a container provided with an ionizable medium therein, electrodes disposed within said container and between which a glow discharge occurs upon the application of a potential thereto, one of said electrodes being adapted to emit electrons, a bimetallic element in said container adapted to be heated by the ensuing discharge and operable to short-circuit said electrodes and extinguish said discharge, means compensating for the effect of ambient temperature upon said bimetallic element, and a shield interposed between said last mentioned means and said bimetallic element.

6. A gaseous discharge device comprising a container provided with an ionizable medium therein, electrodes disposed within said container and between which a glow discharge occurs upon the application of a potential thereto, one of said electrodes being adapted to emit electrons, a bimetallic element in said container adapted to be heated by the ensuing discharge and operable to short-circuit said electrodes and extinguish said discharge, bimetallic means compensating for the effect of ambient temperature upon said bimetallic element, and a shield interposed between said bimetallic element and said last mentioned bimetallic means.

7. A gaseous discharge device comprising a container provided with an ionizable medium therein, two closely spaced electrodes therein, one of said electrodes including a bimetal with its metal of lower expansion facing the other electrode whereby the heat of discharge will bend said electrode into contact with the other electrode to short-circuit said electrodes and extinguish said discharge, and a second bimetal connected to one of said electrodes at a place removed from the shortest discharge path between said electrodes, said second bimetal having its metal of lower expansion faced in the opposite direction to that of the lower expansion metal of said first bimetal whereby said second bimetal will tend to compensate for the effect of ambient temperature on the first bimetal, and a shield interposed between said first and second bimetals.

8. A gaseous discharge device comprising a container provided with an ionizable medium therein, two closely spaced electrodes therein, said electrodes having contact areas, one of said electrodes having a bimetal adjacent said contact area with the metal of lower expansion facing the contact area of the other electrode whereby the heat of discharge will make said contact areas join and short-circuit said electrodes, and a second bimetal connected to one of said electrodes at a place remote from said first bimetal and having its metal of lower expansion faced in an opposite direction from that of the lower expansion metal of said first bimetal whereby the effect of a change in ambient temperature on one bimetal to vary the electrode spacing is compensated by the effect on the other bimetal, and a shield interposed between said first and second bimetals.

9. A gaseous discharge device comprising a container provided with an ionizable medium therein, a curved bimetal, having its metal of lower expansion on the inner side, an electrode within the curved bimetal cooperating to form a discharge path therewith, a second bimetal connected to said bimetal at a place removed from said discharge path and adapted to move said electrode out of the curved bimetal upon the application of high ambient temperature, and a shield interposed between said first and second bimetals.

10. A gaseous discharge device comprising a container provided with an ionizable medium therein, two electrodes forming a discharge path, one of said electrodes having a bimetal as a terminal for the discharge path with its metal of lower expansion facing the other electrode whereby the heat of discharge will move the electrode into contact with the other electrode, said other electrode having a bimetal connected to it remote from the discharge path between the electrodes, said last mentioned bimetal compensating for the effects of variations in ambient temperature on said first mentioned bimetal, and a shield interposed between said bimetals.

ALFRED H. LAIDIG.