March 8, 1949. R. H. SEAMAN 2,463,812

AUTOMATIC CUTOFF FOR TRANSFORMERS

Filed Sept. 25, 1945

Fig. 1

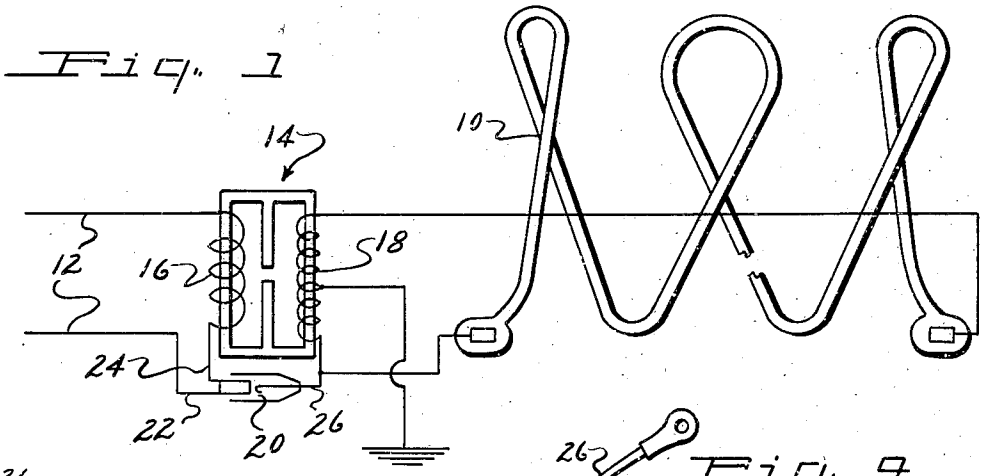


Fig. 5

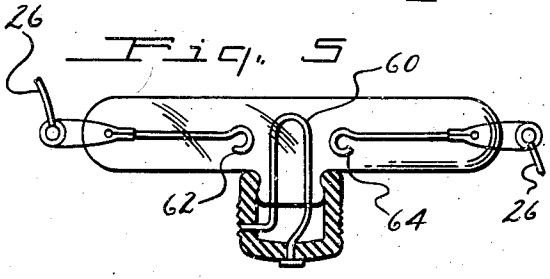
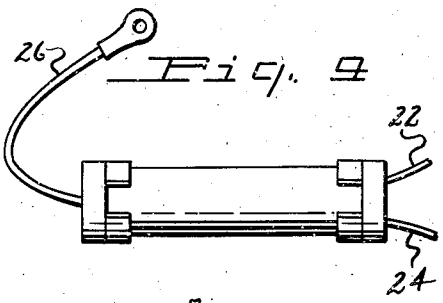


Fig. 4



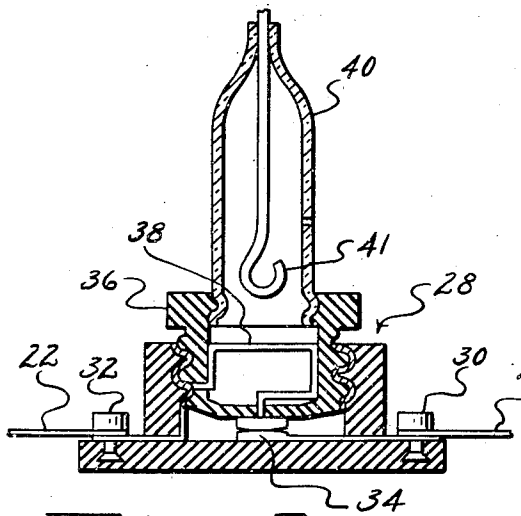


Fig. 2

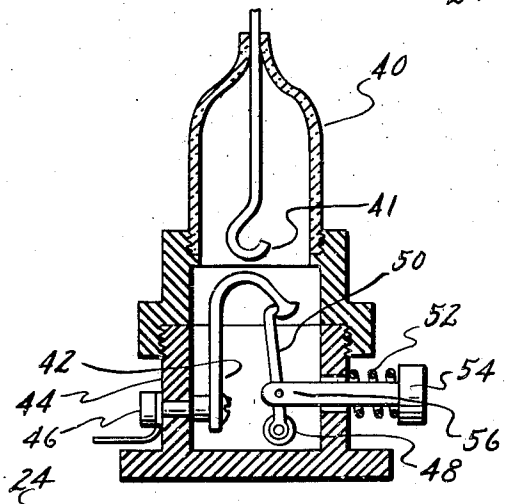


Fig. 3

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AUTOMATIC CUTOFF FOR TRANSFORMERS

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2 Claims. (Cl. 315—124)

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This invention relates to the provision of means to protect electrical transformers of the step-up type from injury in the event that the secondary circuit of the transformer becomes accidentally opened.

The invention is hereinafter described as particularly applied to transformers used in neon sign work, although the scope of the invention is evidently not necessarily so limited.

Transformers used in gaseous discharge tube circuits, and particularly in connection with neon tube signs, are of the high voltage type, the secondary voltage being usually of the order of 10,000 to 15,000 volts. Although it is general practice to provide tarnsformers of the high leakage type for such use, the accidental breaking of the sign, which is a common occurrence, will nevertheless cause high voltages to build up in the secondary winding of the transformer with the result that if the circuit is not promptly disconnected the transformer will probably become overheated and ruined.

Because of the danger of fire due to shorting of the high tension wiring of the sign caused by accidents or damage by storms which may possibly occur in view of the exposed positions in which illuminated signs are often necessarily placed, it is advantageous to provide protective devices for such signs which will act practically instantaneously to interrupt the electrical power supply to the transformer; such devices, for maximum safety, should operate if either side of the high tension circuit becomes open or accidentally grounded.

Also since it is frequently necessary to replace gaseous discharge tubes and such replacement may be attempted by unskilled persons, particularly in indoor installations in which gaseous discharge tubes are likely to be of the hot cathode high current type, serious injury from electrical shock may be experienced by contacting the socket terminals with the fingers if the person attempts to fit a new tube in the sockets without first turning off the current. By the use of the device of this invention the current is cut off from the tube circuits as soon as the secondary or high voltage circuit is interrupted either by breaking of the tube or removal thereof from the socket without first turning off the current so that electric shocks cannot be experienced.

The peak voltages used in neon sign work is necessarily high in order to secure the striking voltage of the tube, which may be 25% or more in excess of the normal operating voltage. The brief application of such voltage in the transformer

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previous to the lighting of the sign does not harm the transformer since the voltage drops immediately the sign is lighted, but the generation of this high voltage for any considerable period of time, should the sign be broken, will damage the transformer.

Neon signs are very commonly erected on the roadside or in relatively inaccessible places, such as on roof tops and the like, and a considerable period of time may elapse before the sign is visited for maintenance or the inoperativeness of the sign is noticed. Large numbers of transformers are used in connection with such gaseous discharge tube signs, both because of the great number of such signs and because large signs are commonly built up of separate sections, each provided with its own transformer, so that the cost of replacement of damaged transformers constitutes a relatively heavy item in the maintenance of such signs.

It is an object of the invention to protect transformers, particularly of the high voltage type used with gaseous discharge tubes, such as neon signs, by the provision of an inexpensive device which will act to interrupt the primary circuit of the transformer should the secondary circuit be accidentally opened.

It is a further object of the invention to provide a device of the kind described which is simple in construction and inexpensive to manufacture.

A further object of the invention is to provide a device of the kind described which may very readily be renewed or reset when the sign has been repaired.

A further object of the invention is to afford safety in the repairing of neon and the like signs by automatically disconnecting the tube sockets of the sign from the source of high voltage.

A further object of the invention is to provide a method of protecting transformers from damage due to building up of excessively high voltage in the secondary winding thereof.

Further features and objects of the invention will hereinafter appear in the following description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagram showing a neon sign having the transformer provided with the safety device of the invention;

Fig. 2 is a section through one form of the safety device;

Fig. 3 is a section through a safety device of a modified form in which the device is capable of being reset after each operation thereof;

Fig. 4 is a plan view of the device diagram-

matically shown in Fig. 1 formed as a tubular fuse; and

Fig. 5 is a section through another form of the invention in which two of the devices shown in Fig. 2 are combined in a single unit.

Referring now to Fig. 1, a neon sign is indicated by the numeral 10. The sign is supplied with electric current from power lines 12 by means of a high leakage transformer 14, the primary winding being indicated at 16 and the secondary winding at 18. The protective device 20 is furnished with three leads 22 and 24, which are connected in the supply line, and 26, which is connected to the secondary winding.

The protective device shown in detail in Fig. 2 comprises a fuse socket 28 provided with terminals 30 and 32 to which the leads 22 and 24 are connected in the usual manner, the lead 22 connecting with the metal shell of the socket and the lead 24 connected with a central contact 34. The socket may be connected in the power line by the terminals 30 and 32. A fuse plug 36 provided with a fusible element 38 of appropriate capacity is screwed into the fuse socket. A tubular member 40 is screwed or otherwise inserted into the fuse plug. The conductor 26 connected to the secondary of the transformers is sealed into one end of the tubular member and terminates in a hook 41 spaced above fusible element 38 to constitute a spark gap.

Should the secondary circuit be accidentally opened, as by breaking of the neon tube, and the voltage in the secondary therefore start to build up, an arc will be established between the end 41 of conductor 26 and the fusible element 38, which will rapidly cause melting of the fusible element and therefore interruption of the primary circuit of the transformer.

After repair work on or replacement of the neon tube it is necessary to insert a new fuse plug in the fuse socket, which may be furnished with the cylindrical element 40, in which case of course the conductor 26 of the burned fuse element would have to be disconnected and the conductor 26 of the new element connected in its place, or the tubular element might be merely pulled out of or unscrewed from the burned fuse plug and inserted or screwed into the new plug.

In the form of the device shown in Fig. 3, the fusible element of the form of the device shown in Fig. 2 is replaced by a bimetallic strip 42 but the cylindrical element 40 may be formed as in the device previously described. The form of the device shown in Fig. 3 is designed for permanent installation and comprises a socket 44 provided with a terminal 46 connected to the bimetallic element and with a terminal 48 connected to a pivoted contact piece 50. The device may be connected in the primary circuit of the transformer by interrupting the line 12, connecting one terminal to the line at one side of the gap and the other terminal to the line at the other side of the gap.

The bimetallic element 42 is shown as bent into a curve against the inner side of which the pivoted contact piece 50 bears, by reason of the force exerted by compression spring 52 arranged between a button 54 and the outside surface of the socket 44. The button 54 is mounted at one end of a strip of insulating material 56 pivoted to the pivoted contact piece 50. In this construction, when arcing occurs between the end of conductor 26 and the bimetallic element 42, the heat generated will cause the bimetallic element to move out of contact with the pivoted contact piece 50, which will be pulled forwardly by spring 52, thus interrupting and maintaining the interruption of the primary circuit.

Cooling of the bimetallic strip 42 will cause it to return to its original position and after the gaseous discharge tube has been repaired or replaced the contact piece 50 may be brought to its original position by pushing in the stud 54.

It will be noted that the end of the bimetallic strip is shown as curved in such a manner as to enable the contact piece to flex the strip sufficiently to slip into position.

In the form of the invention shown in Fig. 4, the device is constructed in the form of a cylindrical fuse which may be inserted in clips mounted in the transformer housing, the leads 22 and 24 being connected in the primary circuit of the transformer and the lead 26 connected to the secondary winding of the transformer.

In order to be sure that the primary circuit will be broken, no matter how the secondary circuit is interrupted, it may be advisable to mount the device of the invention in both sides of the secondary circuit. The form of the invention shown in Fig. 5 is designed to enable this to be done with a single device instead of using two separate devices.

The fusible element 60 in Fig. 5 is arranged as in the form of the invention shown in Fig. 2 and is similarly connected in the primary circuit of the transformer but the device provides a spark gap for each side of the secondary circuit formed by conductors 62 and 64, each connected to one side of the secondary circuit and spaced from the fusible element 60.

While the device in all forms operates satisfactorily when the spark gaps are in air, the operation of the device may be speeded up to be practically instantaneous by positioning the elements in a tube evacuated of air and containing oxygen. While the fusible element is made of magnesium, in such a construction the first starting of the spark will of course immediately fuse the element 60. It will be obvious that other gases vigorously supporting combustion may be used, and that fusible elements may be made from other readily fusible but conductive materials.

It is pointed out that by the use of the device of the invention, the interruption of the primary circuit is positive and the sockets for the tubes are therefore free of high voltage, facilitating work on the sign.

The device of the invention is of great utility in that it enables the present relatively high expense of replacing damaged transformers to be avoided, and also because it avoids serious electrical shocks to workmen engaged in the moving and inserting of signs.

The invention is described and illustrated in a preferred form, but it is to be understood that the scope of the invention is not in any way limited by this illustrative showing but only as indicated by the scope of the appended claims.

I claim:

1. A protective device for use in combination with an electrical circuit including a step-up transformer having a primary circuit and a secondary circuit, and a gaseous discharge tube in said secondary circuit, comprising a base having a pair of terminals adapted to be connected in series with the primary circuit of said transformer, and formed to provide a socket, a hollow fuse body mounted in the socket of said base, a readily fusible conductor in said body, cooperating conductive means on said base and said body

establishing electrical connection between the terminals of said base and the respective ends of said fusible conductor, and an arcing terminal mounted in said body with its inner end forming an arc gap with said fusible conductor, said arcing terminal being adapted to be connected to one side of said secondary circuit, said fusible conductor and said arcing terminal being enclosed within said fuse body.

2. A protective device for use in combination with an electrical circuit including a step-up transformer having a primary circuit and a secondary circuit, and a gaseous discharge tube in said secondary circuit, comprising a base having a pair of terminals adapted to be connected in series with the primary circuit of said transformer, and formed to provide a socket, a hollow fuse body detachably mounted in the socket of said base, a readily fusible conductor in said body, cooperating conductive means on said base and said body establishing electrical connection between the terminals of said base and the respective ends of said fusible conductor, a tubular member mounted in said body, an arcing terminal supported by said tubular member and extending toward a side of said fusible conductor, said arcing terminal having a hook-like end forming an arc gap with said fusible conductor, said arcing terminal being adapted to be connected to one side of said secondary circuit, said fusible conductor and said arcing terminal being enclosed within said fuse body.

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