Feb. 14, 1967 S. HASSON 3,304,396

THERMAL DISCONNECT MEANS FOR ELECTRICAL DEVICES

Filed Nov. 9, 1964

Fig. 1

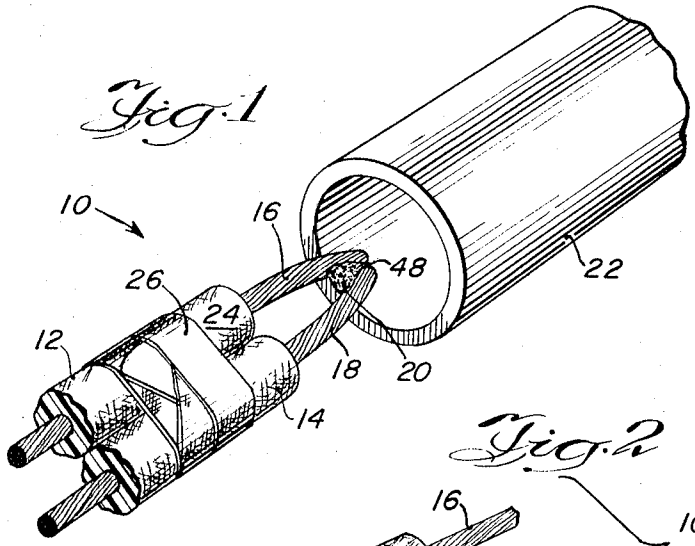


Fig. 3

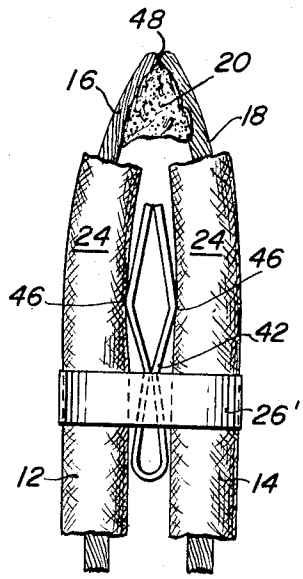


Fig. 2

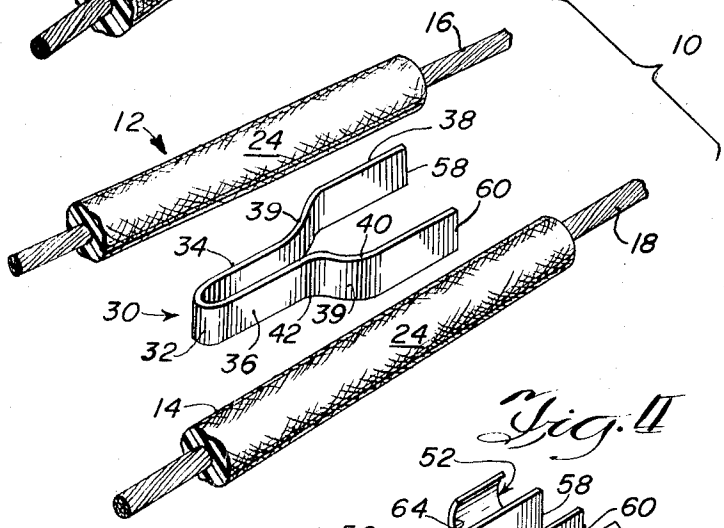


Fig. 5

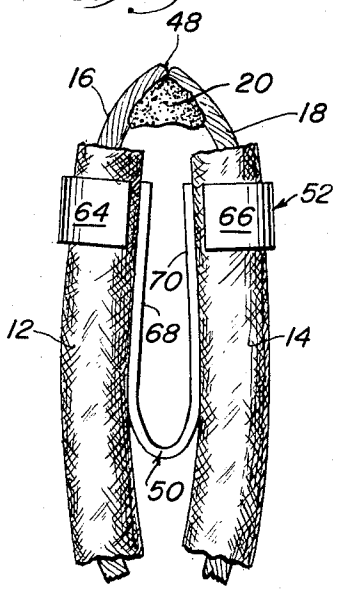


Fig. 4

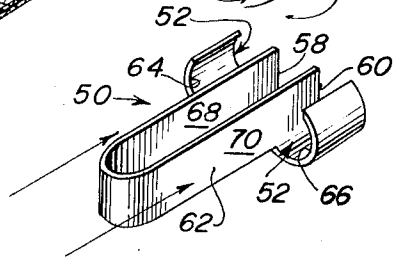


Fig. 6

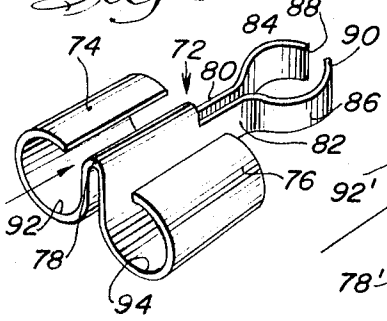
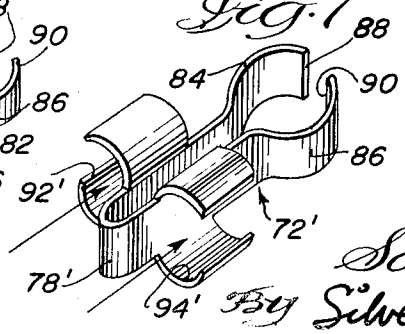


Fig. 7



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THERMAL DISCONNECT MEANS FOR ELECTRICAL DEVICES

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This invention relates generally to thermal responsive disconnect means for electrical devices and more particularly concerns such a disconnect means especially for use in respect of ballast apparatus for gaseous discharge devices.

It is known to utilize thermal responsive instead of current responsive fuse or disconnect devices in a ballast circuit for starting and operating gaseous discharge devices. Such devices may be located generally at the area of highest internal heat generation in the ballast canister and are responsive to break the circuit and deactivate the ballast should the operating temperature of the ballast rise above a preselected level. This preselected level is chosen so as to prevent the flowing of the generally asphaltic based insulating or potting compound normally surrounding the ballast device when the same is incorporated in the usual container or a canister. Excessive heat will cause the potting compound to soften and flow from the canister to damage property and become hazardous and offensive to personnel. It has been known that excessive heat generation may occur without the increase in current ordinarily required to activate current responsive fuse devices and hence the advantage of thermal responsive disconnect devices is evident.

One disadvantage occasioned with the use of available thermal responsive disconnect devices has been their relative high cost. Another frequently occurring disadvantage of available devices has been erratic response thereof upon reaching of the preselected temperature, and, on occasion, the time lag between the reaching of the preselected temperature and the separation of the conducting members to effect disconnect. Often when the low-melting metal connection usually provided in prior devices actually melts, the members connected thereby are sometimes held in conductive relationship by the melted metal since the surrounding space is often restricted in dimension and the members are under no positive stress to separate.

Accordingly, it is the principal object of this invention to provide a thermal responsive disconnect means for connection in an electrical circuit, principally one of a fluorescent lamp ballast, which substantially eliminates the above enumerated disadvantages of earlier devices while being simple in character and structure, economical to manufacture and install, and instantaneously responsive to the environmental temperature to effect disconnect upon reaching of a preselected environmental temperature level.

Another object of this invention is the provision of a thermal responsive disconnect means adapted to be connected in a fluorescent lamp ballast circuit which means utilizes a pair of bared end ordinary electrical lead wires arranged side by side with the bared ends thereof connected by a low melting point metal, said lead wires being secured together with means provided therebetween to place the bared ends in a resiliently biased relationship whereby, when the low melting connection is severed by the occurrence of a preselected temperature level, the bared ends instantaneously are separated one from the other, thereby effecting disconnect.

Still another object of this invention is the provision of a spring member disposed in compressed condition between a pair of bared ended lead wires which are arranged side by side and joined together with the bared ends placed under tension and secured one to the other

in a low-melting metal connection whereby the said bared ends spring away one from the other when the preselected environmental temperature for melting of the said connection is reached.

A further object of this invention is the provision of a disconnect device of the character described for connection in a ballast circuit and which comprises a pair of ordinary electrical lead wires having an insulating cover and bared wire ends, said pair of lead wires arranged side by side with the bared ends thereof being solder connected and a compressed spring-like member being disposed laterally between said leads sufficiently adjacent said bared ends to place the same under tension while they are solder connected whereby the bared ends are forced apart positively when the solder connection melts, and, wherein said spring-like member includes means for securing said lead wires.

Yet another object of the invention is to utilize as the last mentioned means, loops formed on said spring-like member for receiving the lead wires therethrough, said loops being constructed and arranged so that the bared ends of said lead wires are placed under spring apart tension when the lead wires are passed through said loops and the solder connection therebetween is made.

A further object of the invention relates to the provision of a thermal disconnect device comprising a pair of bared end lead wires having the ends thereof connected in a soldered connection, means for biasing said ends one from the other whereby the same are forced apart when the solder connection melts, and including an electrical insulative sheath covering adapted to overlie said lead wires including said soldered connection.

Many other objects and advantages will occur to those skilled in the art as a description of the invention proceeds in connection with which the drawings illustrate several preferred embodiments thereof.

In the drawings,

FIG. 1 is a perspective view of the disconnect means according to the invention in its simplest form illustrated in the last stage of assembly.

FIG. 2 is a perspective view of a pair of electrical lead wires and a spring clip arranged just prior to assembly into another embodiment of the disconnect means according to the invention.

FIG. 3 is a plan view of the disconnect means assembled from the elements shown in FIG. 2.

FIG. 4 is a perspective view of another form of spring clip means which may be substituted for the spring clip shown in FIG. 2.

FIG. 5 is a plan view of the disconnect means as assembled using the pair of lead wires shown in FIG. 2 and the spring clip illustrated in FIG. 4.

FIGS. 6 and 7 are perspective views illustrating different forms of the spring clip means shown in FIGS. 2 and 4.

Referring now to the drawings, in FIG. 1, the invention is illustrated for clarity in its simplest form, same being designated generally by reference character **10**. The disconnect device **10** includes a pair of ordinary electrical lead wires **12** and **14** arranged side by side and taped together adjacent the bared ends **16** and **18** thereof. The said bared ends **16** and **18** are soldered together as shown at **20**. A sheath **22** of electrical insulating material is provided for enveloping the soldered connection **20** as well as the taped portion of the wires **12** and **14**.

The electrical lead wires **12** and **14** are such as those normally used to extend, as for example, from the primary winding of a ballast or a fluorescent lamp transformer. Such wires have a wire center and are provided with rubberlike resilient insulation covering **24** of diameter greater than that of the wire. Paper or other tape having adhesive characteristics can be utilized as

a wrap 26 to secure the pair of wires in side by side relation. The wires 12 and 14 are so secured at a location adjacent the bared ends 16 and 18 thereof so that the resilience of the wires provided by the resilience of the insulating covering 24 caused the bared ends to separate when the soldered connection 20 melts.

On occasion, it has been found that operation of this simplest form of the invention can be somewhat erratic and not as fully effective as desired. Sometimes the wire ends become bowed permanently while connected, hence the resilience of the lead wires alone may be insufficient to cause the wire ends to spring apart upon melting of the solder connection 20. Also, on many occasions involving erratic behavior, the quantity of solder utilized for the connection 20 overcomes the tendency for the wire ends to spring apart when only the natural resilience of the lead wires is depended upon for disconnect. Principally for these reasons, the invention further provides means for exerting a positive bias on said wire ends causing same unerringly to spring apart when the solder connection is severed. The embodiments of the invention incorporating such means are illustrated in FIGS. 2 through 7, said means being in the form of spring means generally represented by reference character 30, which is arranged laterally between the pair of lead wires 12 and 14 preferably closely adjacent the bared ends 16 and 18 thereof. The wires and the spring means 30 are secured by some form of loop or clamp or band or tape 26'. The spring means 30 positively forces the wire ends apart upon melting of the solder connection 20. The bared ends 16 and 18 of the wires 12 and 14 are forced against the bias of the spring means 30 when brought together to make the soldered connection 20.

More particularly, spring means 30 comprises a generally U-shaped clip or band member 32 formed of spring metal and having a pair of fingers 34 and 36 extending outward from and parallel to the arms 38 and 40 of said U-shaped member 32. The fingers 34 and 36 are connected to the respective arms 38 and 40 of the U-shaped member 32 by means of an integral diagonally disposed connecting web shows respectively at 39. Thus, the fingers 34 and 36 are spaced apart a distance greater than the distance between the arms 38 and 40 of said U-shaped member 32.

In FIG. 2, the pair of lead wires 12 and 14 and the spring clip 32 are illustrated just prior to assembly thereof to form the disconnect means according to the invention. One of said lead wires may already be connected to the primary winding of a ballast (not shown) while the other may serve as the power lead extending from the ballast canister (also not shown). The lead wires 12 and 14 are stripped of their electrical insulation 24 at their ends to form bared ends 16 and 18. The thus bared lead wires 12 and 14 are arranged side by side with the spring 32 disposed therebetween. The arms 38 and 40 as well as the fingers 34 and 36 of spring 32 are parallel to the pair of lead wires 12 and 14. With the lead wires thus arranged and the spring 32 disposed therebetween, the parts are clamped or taped together by fastening means such as band 26' with the arms 38 and 40 of spring 32 compressed or squeezed together at a location closely adjacent the bared end portions 16 and 18. In compressed condition the arms 38 and 40 of the U-shaped member 32 are in contact one with the other at 42. The free ends 44 of the fingers 34 and 36 also are in contact. The bends 46 which connect fingers 34 and 36 to connecting webs 39 bear against the insulation covering 24 of the wires 12 and 14. The bared end portions 16 and 18 of the wires are flexed toward one another against the bias of the spring member 32 and are soldered together utilizing a low melting point metal to form the soldered connection 20. The bared ends are relatively short, for example, about 5/16 inch in length while the solder connection preferably extends along most of the

length of said ends 16 and 18, even as much as 1/4 of an inch of a 5/16 inch bared end. The relative shortness of the bared ends and the closeness to the covering of the solder connection, the more tension is exerted upon the bared ends, hence they will be maintained under tension and positively react on melting of the connection. Both the simpler embodiment shown in FIG. 1 and those embodiments illustrated in FIGS. 2 and 7, preferably, may be dipped in a resin-wax mixture and so encapsulated in a sheath 22 of paper, plastic or similar electrically insulating material, the sheath being of a diameter large enough to enclose the pair of wire ends and the spring 32 but without interfering with the separation of the bared ends 16 and 18 when the solder connection 20 melts. The resin-wax composition utilized functions also as a flux to cause the melted solder of the solder connection 20 to "ball up" and hence prevent same from bridging the gap between the bared ends when the ends separate upon reaching the selected environmental temperature.

In FIGS. 4 through 7, there is illustrated other spring clips such as clip 50 of FIGS. 4 and 5, which are similar to the spring clip 32 shown in FIGS. 2 and 3. The spring clip 50 basically differs from the spring clip 32 in the provision of loop means thereon adapted to receive and hold the lead wires 12 and 14 thereby functioning in lieu of tape, metal band or other clamping means. The lead wires are inserted or threaded, bared ends through the loop means in the direction of the arrows.

In the embodiments shown in FIGS. 4 and 5, the loop means designated generally by reference number 52 comprise a pair of loop extensions 54 and 56 disposed adjacent the free ends 58 and 60 of a U-shaped spring member 62 similar to the U-shaped member 32 except being much larger in dimension. When the wires 12 and 14 are inserted through the loops 64 and 66 defined by said looped extensions 54 and 56, the same are located closely adjacent the bared end portions 16 and 18 of the lead wires. When the bared ends 16 and 18 thereafter are brought together and the solder connection 20 made, the said bared ends 16 and 18 are placed under spring-apart tension since the spring arms 68 and 70 are flexed one toward the other against their normal bias. When the soldered connection 20 is severed by melting of the solder, the said bared ends 16 and 18 spring apart due to the return of the spring arms 68 and 70 to their normal position.

Referring now to FIG. 6, there is there illustrated spring clip 72 which is similar to the spring clip 50 shown in FIGS. 4 and 5. The spring clip 72 is formed of a pair of laterally opening loop defining portions 74 and 76 connected together along a fold or bend 78 integral therewith. Said loop defining portions 74 and 76 are provided respectively with forwardly extending fingers 80 and 82. Each of the fingers 80 and 82 is provided respectively with arcuate end portions 84 and 86. The free ends 88 and 90 of end portions 84 and 86 are spaced apart with the arcuate sections thereof extending into the cylindrical plane of the loops 92 and 94 defined by said portions 74 and 76 to assemble the disconnect means according to the invention utilizing spring clip means 50, the wires 12 and 14 are passed bared ends first respectively through the loops 94 and 96, in the direction of the arrows, and are urged a sufficient distance therethrough so that the insulation covering 24 thereof extends just past the ends of the arcuate portions 84 and 86. This results in the arcuate portions being compressed toward one another. The soldered connection 20 then is made by flexing the otherwise divergent bared ends together and applying a sufficient quantity of solder to ends 16 and 18. Thus, the bared end portions 16 and 18 and ends 48 are placed under stress when converged and, upon melting of the soldered connection, will spring apart. Tape or other fastening means, such as band 26', may not be required where the clip means 50 is provided. In FIG. 7, similar

clip 72' has the loops opening outwardly and disposed between the fingers and connecting bend 78'.

The character of the solder utilized is variable to the extent that the desired temperature at which disconnect is desired may be preselected by choosing a metal which melts at that temperature. As an example, a conventional solder composed of 45% lead and 55% bismuth which composition melts at 125° C. was successfully utilized to provide a soldered connection 20 for a disconnect device according to the invention for protection of a fluorescent lamp ballast disposed in a conventional canister and immersed in an insulating potting compound softening at about 130° C.

The disconnect device made in accordance with the invention is located in relation to the ballast device at the area in the canister where there is the likelihood of greatest heat generation. In most cases, this location is found closely adjacent the primary winding and the disconnect device is connected in the power lead between the power source and the primary winding of the ballast circuit. The particular ballast device and circuit is not shown since any one of a number of conventional circuits may be protected by use of the disconnect device of the invention.

It should also be pointed out that other spring forms may be effectively utilized as spring means within the scope of the invention.

It is believed that the invention in its several embodiments has been described sufficiently to enable one skilled in the art to make and practice same. It should be understood that many minor variations in dimension, configuration, and manner of employment can be made without departure from the scope of the invention as defined in the appended claims.

I claim:

1. A thermal disconnect device comprising a pair of electrical leads each formed of a center wire and an outer insulating cover of a diameter greater than that of the wire, each of said leads having at least one end thereof bared and the leads being arranged side by side, the bared ends being solder connected one to the other under tension whereby to spring apart upon melting of the soldered connection by force of a flat-spring member disposed in compressed condition between the leads and biasing same to the spring-apart condition, and a sheath insulating material having an inner diameter greater than the combined diameters of the pair of covered lead wires and engaged over said pair of leads whereby to enclose the bared ends and said soldered connection without interfering with the movement thereof in springing apart, said flat-spring member formed from a single piece of material as a pair of parallel arms connected at one end and having opposite free ends, said arms having integral bent portions extending outward from corresponding edges thereof and looped in opposed directions whereby to provide at least a pair of loops for receiving the respective wires therethrough.

2. A thermal disconnect device for a fluorescent lamp ballast which includes electrical components disposed within a canister and immersed in insulating potting compound, wherein said thermal disconnect device is disposed at an area of high heat generation in the canister and adapted to be connected in circuit with the ballast whereby to disable said circuit when the environmental temperature surrounding same reaches a preselected value, said disconnect device comprising a pair of electrical lead wires each formed of a central wire and an outer insulating cover of a diameter greater than that of the wire, each having at least one end thereof bared and arranged side by side, a low melting point solder connection between said bared ends and means for biasing the bared ends away one

from the other whereby upon melting of the solder connection the bared ends positively are forced apart, said biasing means comprising a flat-spring member interposed between said lead wires and along the length thereof adjacent to said bared ends, said flat-spring member formed from a single piece of material and having a portion thereof of U-shaped configuration, said flat spring member having at least a pair of loops integral with said portion and arranged extending outward from corresponding edges thereof in opposed directions, said pair of loops each receiving one of said lead wires for securing said lead wires and said spring member one to the other against the bias of said spring member whereby to place the bared ends under tension so that melting of the solder releases the bared ends to effect disconnect.

3. A thermal disconnect device for a fluorescent lamp ballast which includes electrical components disposed within a canister and immersed in insulating potting compound, wherein said thermal disconnect device is disposed at an area of high heat generation in the canister and adapted to be connected in circuit with the ballast whereby to disable said circuit when the environmental temperature surrounding same reaches a preselected value, said disconnect device comprising a pair of electrical lead wires each formed of a central wire and an outer insulating cover of a diameter greater than that of the wire, each having at least one end thereof bared and arranged side by side, a low melting point solder connection between said bared ends and means for biasing the bared ends away one from the other whereby upon melting of the solder connection the bared ends positively are forced apart, said biasing means comprising a flat-spring member interposed between said lead wires and along the length thereof adjacent to said bared ends and means for securing said lead wires and said spring member one to the other against the bias of said flat-spring member whereby to place the bared ends under tension so that melting of the solder releases the bared ends to effect disconnect, said flat-spring member comprising a spring metal clip and said last mentioned means comprising a pair of loops formed on said clip, each loop arranged for receiving one of the said pair of lead wires therethrough and said clip having forwardly extending finger portions, said finger portions having diverging-converging end sections, each section having free ends spaced one from the other, said free ends being disposed in close proximity one to the other when the lead wires are passed through the loops, thereby biasing the bared ends of said lead wires one from the other.

4. The structure as claimed in claim 3 in which said clip has an integral fold portion joining said finger portions one to the other along one edge of each thereof and said loops are connected integrally to said fold portion.

5. A structure as claimed in claim 3 wherein said clip is U-shape having an integral fold portion securing said finger portions in parallel relation one to the other and a pair of opposed loops are connected to each of said finger portions at a location spaced from said fold portion.

References Cited by the Examiner

UNITED STATES PATENTS

1,940,176	7/1933	Marshall	200—142
2,791,660	5/1957	Sims et al.	200—117
2,801,389	7/1957	Heppner	339—103
2,888,662	5/1959	Hammell	339—117

FOREIGN PATENTS

893,780	4/1962	Great Britain.

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