May 7, 1968 C. N. GANDHI ET AL 3,382,413

SOLDERLESS METHOD FOR CONNECTING AND APPARATUS INCLUDING A GLOW DISCHARGE LAMP

Filed June 30, 1965

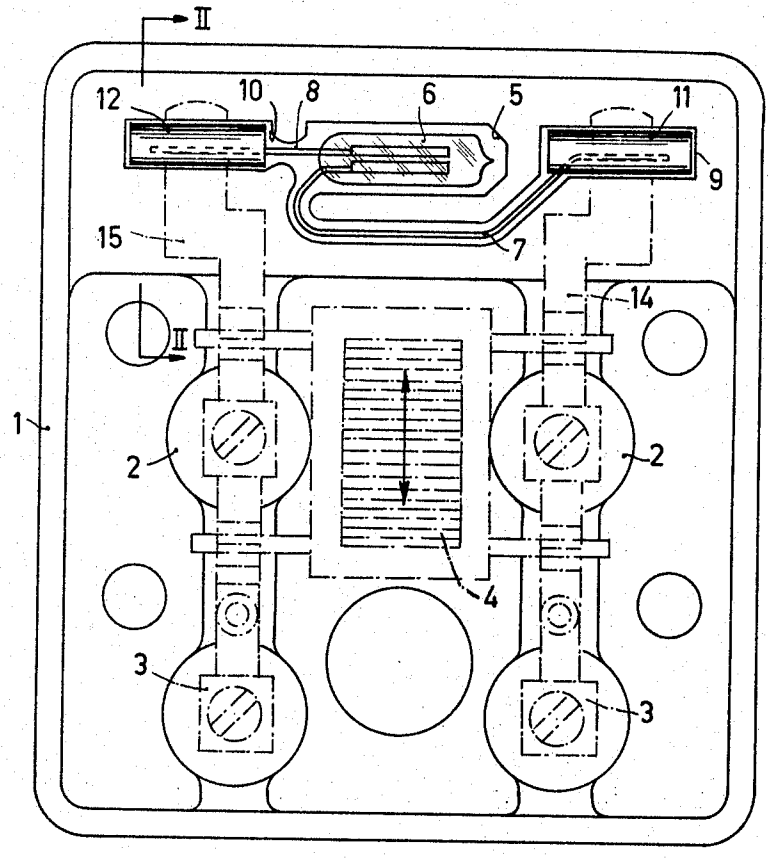


FIG.1

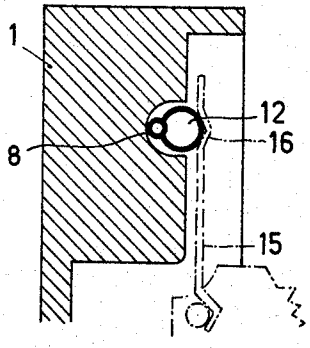


FIG.2

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# SOLDERLESS METHOD FOR CONNECTING AND APPARATUS INCLUDING A GLOW DISCHARGE LAMP

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## ABSTRACT OF THE DISCLOSURE

A solderless method of and apparatus for mounting an electric discharge lamp and a ballast resistor on a support. The ballast resistor comprises an electrically conductive resilient member. The resilient member and one electric lead of the lamp are mounted in compressive coupling relationship within a groove in the support, preferably by means of a resilient contactor member. The resilient member provides the physical connection to the lamp lead and also functions as the ballast impedance for the lamp.

The present invention relates to glow discharge lamps, and more particularly, but not exclusively, to neon lamps, and is concerned with apparatus including such lamps and with a method for connecting them to such apparatus.

Because of their nature it is necessary to stabilize glow discharge lamps by incorporating a resistance in series therewith. In the case where the lamps are small, such as are used for indicating purposes, the resistance is often attached to the lamp by soldering the resistance to a lamp hand at a point very near to the envelope of the lamp. This can often give rise to trouble from the heat produced by the soldering process as well as trouble arising from bent or broken wires. Further, this soldering process is time consuming and relatively expensive in comparison with the work done. Therefore, a more reliable means of securing a ballast resistance is desired, preferably one which does away with soldering altogether. It is an object of the present invention to provide a method whereby this can be achieved and to provide apparatus to which a glow discharge lamp and its ballast resistance is connected in a solderless manner.

According to one aspect of the present invention, a method of connecting a glow discharge lamp in apparatus comprises causing one part of an electrically conductive resilient member to contact an electric lead of the lamp and of causing an electric current supply lead to contact a different part of the member, the section of the member between the two parts forming a ballast resistance for the lamp.

The electric lead of the lamp is preferably laid at the bottom of a slot or groove and the resilient member is placed on top of it and held there under pressure by the electric supply lead bearing on that part of the member which is at the open end of the slot or groove. Alternatively one or both of the said leads may be pushed into the said member and retained there by the resilience of the member.

According to another aspect of the present invention, in apparatus including an electric glow discharge lamp, the lamp is electrically connected to the apparatus by an



electrically conductive resilient member which also acts as a ballast resistance for the lamp.

The said member is preferably used to secure the lamp to the apparatus and may be constructed from a material such as an electrically conductive rubber or thermoplastic in which the conductivity is obtained by including conductive material, for instance carbon particles, therein. One only or each lead of the lamp may be connected in the manner of the invention.

One construction of apparatus in accordance with the invention and an application of the method thereof will now be described by way of example only with reference to the two figures of the accompanying drawing in which, FIGURE 1 shows a top plan view of a double pole electric switch with the top cover removed, and FIGURE 2 shows a part section on the lines II—II of FIGURE 1.

Referring now to the drawings, the switch comprises a moulded base plate **1** having output terminals **2** and supply terminals **3** which are arranged to be connected together upon operation of a switch dolly **4**. A recess **5** accommodates a neon glow discharge lamp **6** and the two leads **7**, **8** of the lamp lie in grooves **9**, **10**, respectively. The leads **7**, **8** are each held securely in the bottom of their grooves by a resilient rubber member **11**, **12** respectively. Each member **11**, **12** comprises a length of cylindrical rubber which has been made electrically conductive by incorporating carbon black in its composition. Such conductive rubber material is known from its application to air-craft tyres and in operating theatre equipment and no claim is made to its composition. The members **11**, **12** are forced into the grooves **9**, **10** and into good electrical contact with the leads **7**, **8** by leaf electrical contacts **14**, **15**, respectively (shown dotted for clarity). Contacts **14**, **15** extend from the respective output terminals **2** and are in electrical contact therewith and form a heat sink. The end of each leaf contact **14**, **15** is provided with an arched portion **16** (FIG. 2) at its free end so that it locates easily on the member **11** or **12**. When the switch is operated to its "on" position, the electrical supply from terminal **3** is connected to terminal **2** and to the load connected to them. The supply is also connected to the discharge lamp **6** through the lead contacts **14**, **15**, members **11**, **12** and leads **7**, **8**. The two members **11** and **12** have been described as being electrically conductive but they have, of course, an electrical resistance. This resistance acts as a series ballast resistance for the lamp **6**. The value of the resistance depends on the requirements of the lamp, the conductivity of the material of the members, and of the amount of the material between the respective leads and the leaf contacts.

In assembling the lamp **6** into the apparatus, no soldering is needed and the lamp is incorporated quickly by fitting it into its recess **5** and bending the wires **7**, **8** into grooves **9** and **10**, pushing the members **11**, **12** into the grooves and securing the leaf contacts **14**, **15** in position.

The above switch is described only as an example of apparatus to which the invention and its method can be applied. Many variations of both the apparatus and the method are possible. For example, the leads **7** and **8** may be pushed into the ends of the members **11**, **12** or may be placed and resiliently held in pockets formed therein. The leaf contacts may be of a different shape than shown and similarly connected to the members by pushing into a part thereof. Although both of the members **11** and

12 have been shown as forming part of the series ballast resistance, only one member need be used. The other lead of the lamp then is connected to the terminal 2 by any appropriate connecting means.

What we claim is:

1. Electric apparatus comprising a support having a groove in one surface for receiving a lamp, an electric discharge lamp having one electric lead disposed within said groove, a resilient electric impedance member positioned within said groove in compressive contact with said electric lead along one part of said resilient member, a first electric conductor member on said support and in contact with another part of said resilient member so that the section of said resilient member between said two parts forms a ballast impedance in series with said lamp, and means connecting a second electric lead of said lamp to a second electric conductor on said support.

2. Apparatus as described in claim 1 wherein said one electric lead is disposed at the bottom of said groove and said resilient impedance member overlies said one electric lead within the groove, said first conductor member being mounted to press against a part of said resilient member located near the top of said groove so as to compressively sandwich said resilient impedance member between said one lamp lead and said first conductor member.

3. Electric apparatus comprising an insulating support having an elongate groove in one surface, an electric discharge lamp having a wire-shaped lead disposed within said groove, a resilient electric contactor member mounted on said support, an elastic member impregnated with electrically conductive particles clamped in said groove between said wire-shaped lead and said contactor member so as to present a series impedance between said contactor member and said lead, and means connecting a second electric lead of said lamp to a second electric contactor member on said support.

4. Apparatus as described in claim 3 wherein said elastic member comprises a cylinder having its longitudinal axis arranged parallel to said wire-shaped lead so as to provide a substantial area of contact therebetween.

5. Apparatus as described in claim 3 wherein said second lamp lead is wire-shaped and is disposed within another part of said groove, said connecting means comprising a second elastic member impregnated with electrically conductive particles disposed in said groove in compressive contact with said second lamp lead and contacting said second electric contactor member so as to present an additional impedance in series with said lamp.



6. A method of assembling an electric discharge lamp and a ballast impedance member to a support member having a groove in one surface comprising the steps of, placing one electric lead of said lamp in said groove, inserting an electrically conductive resilient member in said groove so as to contact said lamp lead, and pressing an electric contactor member against another part of said resilient member so as to compressively engage said resilient member and said lamp lead in positive electrical contact.

7. A method of assembling an electric discharge lamp and a ballast impedance member to a support member having a groove in one surface comprising the steps of, placing one electric lead of said lamp in the bottom of said groove, placing an electrically conductive elastic cylinder in said groove and on top of said lamp lead, and compressively urging a resilient electric contactor member against the top surface of said cylinder so as to fasten said cylinder and lamp lead in compressive coupling relationship within said groove.

8. A method of assembling an electric discharge lamp and a ballast impedance member to a support member having a groove in one surface comprising the steps of, inserting an electrically conductive solid elastic member composed of rubber impregnated with carbon particles within said groove, forcing a wire-shaped lead of said lamp into said elastic member so that said lead is clamped therein by the elastic gripping action of said elastic member, and compressively contacting an exposed surface of said elastic member with an electric contactor member mounted on said support so as to sandwich said elastic member between the support member and the contactor member.

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# UNITED STATES PATENT OFFICE

# CERTIFICATE OF CORRECTION

Patent No. 3,382,413

May 7, 1968

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It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, between lines 10 and 11, insert -- Claims priority, application Great Britain, July 3, 1964, 27,543/64 --.

Signed and sealed this 23rd day of September 1969.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents