

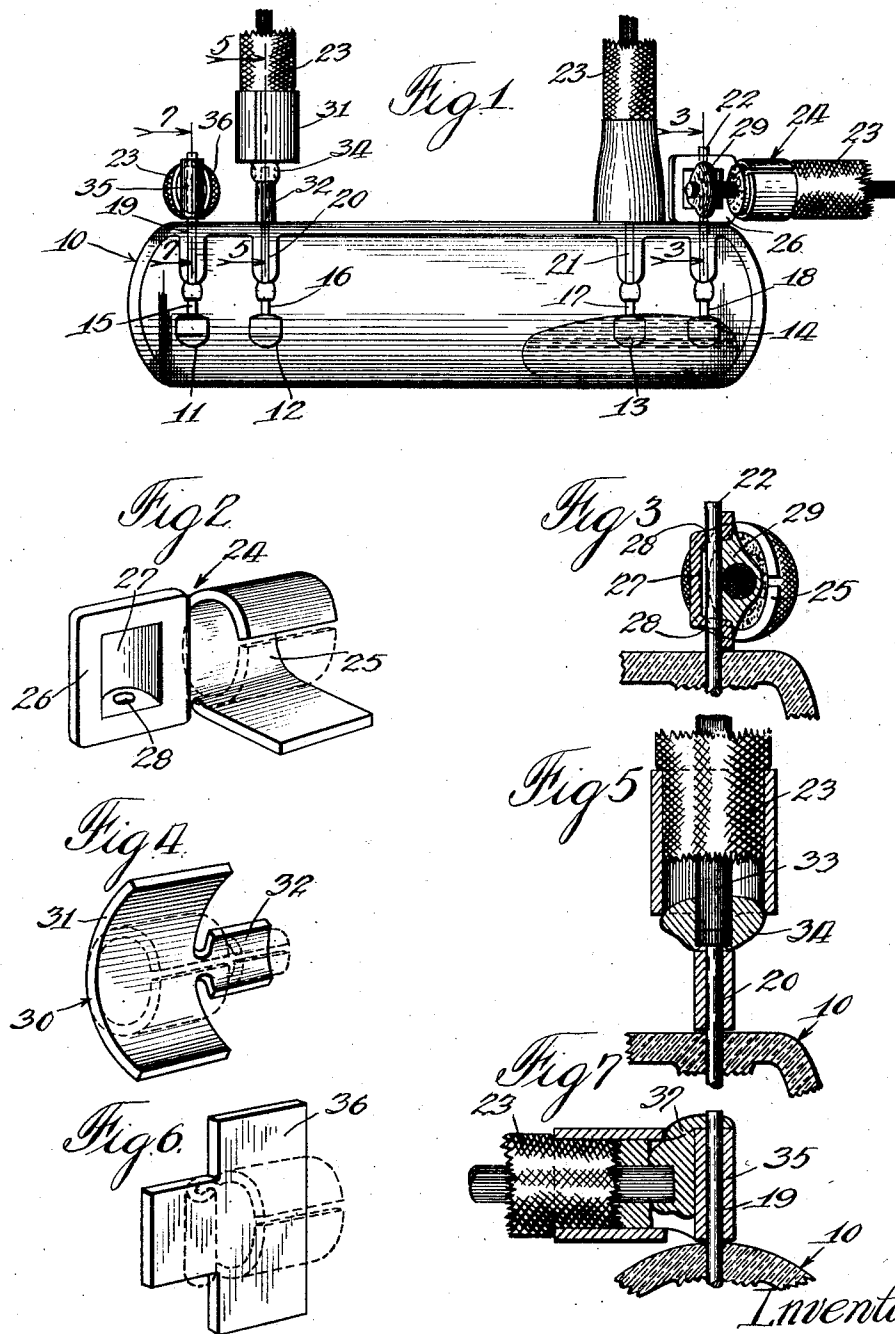
Feb. 28, 1933.

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1,899,254

ELECTRICAL CONNECTION

Filed March 9, 1929



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UNITED STATES PATENT OFFICE

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ELECTRICAL CONNECTION

Application filed March 9, 1929. Serial No. 345,693.

This invention relates to an electrical connection and has special reference to the connection of a flexible conductor between a stationary binding post and a tiltable switch.

5 More particularly, this invention has reference to an electrical connection for a tiltable switch comprising a flexible conductor having a clip attached thereto, the clip being fixed, in turn, to a terminal of a tiltable switch
10 such, for example, as a sealed glass tube having cooperating electrodes therein employing a body of current conducting fluid for changing the circuit connections there-through.

15 Automatic systems, such as heating systems, refrigerating systems, electric sign flashers and the like are intermittently operated and, therefore, require the actuation of a switching member to energize and to deenergize the
20 operating mechanism thereof. The switching member is preferably of the tiltable type such as a mercury tube contactor above described, which latter requires but a minimum amount of energy for its successful operation. The contactor, being tilted into position so as to cause the mercury to bridge or to flow away from the cooperating electrodes therein, requires a flexible connection between the electrodes and the fixed terminal
25 of the circuit leading to the electrode.
30

Ordinarily, the contactor includes a short stiff wire which is sealed in the glass wall of the tube and extends a short distance on each side thereof, the interior end being provided
35 with an enlarged head portion called an electrode and the exterior end being adapted to receive the flexible connection. The short stiff wire herein mentioned is known generally as the sealing-in-wire.

40 It has been found difficult in practice to form a good electrical connection between a flexible conductor and the sealing-in-wire. Usually, the flexible connection is soldered directly to the sealing-in-wire and the constant flexing of the conductor adjacent the soldered joint causes a breakage of the individual strands of wire. Further, the practice of soldering a stranded conductor to a wire of a single piece is quite difficult. In the present
45 application, the braid around the strands is

secured in a clip which latter is attached to the sealing-in-wire of the contactor whereafter the strands, clips and sealing-in-wire are soldered together. In this construction it will hereinafter be pointed out that the flexible conductor may be brought off toward the end, center or at any angle toward either side of the contactor best suited to the individual installation. 55

For a better understanding of the nature, scope and characteristics of this invention, reference may be had to the following description when taken together with the accompanying drawing, in which latter: 60

Figure 1 is a front elevational view of a tiltable switch embodying the features of this invention. 65

Fig. 2 is a perspective view of a connecting member between the flexible conductor and a stiff wire of the tiltable switch. 70

Fig. 3 is a vertical sectional view taken on the line 3—3 of Figure 1, employing the connecting member illustrated in Fig. 2.

Fig. 4 is a view similar to Fig. 2 of a modified form of a connecting member. 75

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 1, and employing the embodiment illustrated in Fig. 4.

Fig. 6 is a perspective view of a modified form of a connection between the flexible conductor and a stiff wire of the tiltable switch. 80

Fig. 7 is a vertical sectional view taken on the line 7—7 of Fig. 1 and embodying the connection illustrated in Fig. 6.

Referring now to the drawing, and more particularly to Figs. 1 to 3, inclusive, thereof, the tiltable switch of this application comprises a container 10, in which a pair of spaced electrodes 11 and 12 are hermetically sealed adjacent one end thereof, and a second part of spaced electrodes 13 and 14 are hermetically sealed adjacent the other end thereof. The electrodes 11, 12, 13 and 14 are fixed to supporting members 15, 16, 17 and 18, respectively. The supporting members are, in turn, connected to sealing-in-wires 19, 20, 21 and 22, respectively, which latter provide means for electrically connecting the electrodes to their respective accessible terminals,

or, as will hereinafter be more fully described, the flexible conductors.

A body of current conducting fluid 23 such as mercury is also disposed within the container 10, and serves to bridge the pair of electrodes 11 and 12 or the other pair of electrodes 13 and 14. Thus under certain conditions, such as by tilting the contactor, an electrical circuit is established through the cooperating electrodes 11 and 12 or through the cooperating electrodes 13 and 14. The container 10 may be made of glass of the quality usually employed in manufacturing incandescent lamp bulbs, etc., or it may be of either pyrex or borosilicate glass. When the container is made of glass such as is usually employed for bulbs and the like, the sealing-in-wires 19, 20, 21 and 22 are preferably made of a suitable wire that will insure the retention of permanent hermetical seals for the container, this latter being necessary for instance when the seals become heated or when substantially high currents are handled by the container.

A well-known sealing-in-wire is known in the trade as "Dumet" which consists of an external copper coating over nickel iron alloy. If, however, the container be made of pyrex or borosilicate glass, sealing-in-wires are preferably made of tungsten. Either of the materials of the sealing-in-wires are comparatively stiff and are formed of a single comparatively thick strand as contrary to highly flexible thin strands employed in flexible conductors.

The supporting members 15, 16, 17 and 18 for the electrodes are connected to their respective sealing-in-wires by means of soldering or by any other suitable method, the connection being made within the interior of the glass container or being embedded in glass shanks projected inwardly from the surface of the container in order to prevent exposure of the sealing-in-wires situated in the interior of the container. These supporting members may be made of a nondeteriorating or inert metal such as iron.

The interior of the container is preferably inert to the material entering into the construction of the switch by means of evacuating the atmospheric air from the container to a substantially high degree and then filling the container with an inert gas such as hydrogen to a pressure approximating atmospheric pressure. This is done in order to prevent the deterioration and disintegration of the contactor when subjected to a comparatively high voltage or to similar conditions.

The tiltable switch above described is actuated many times a day during the normal operation of the device to which it is applied, such for example as heating systems, refrigerating plants and the like. It is therefore necessary that the wires leading to these mer-

cury tubes be provided with a flexible conductor of indefinite life, as many of these switches are designed to be operated millions of times during the normal operation of the devices with which they are employed. The flexible conductors are connected to stationary binding posts in proximity to the tiltable switch, and it has been found to be very difficult to make a good connection between the flexible conductor and the comparatively stiff sealing-in-wire of the container or tiltable switch. The flexible conductor is formed preferably of a plurality of strands of very fine wires, and in order to make a good electrical connection the flexible conductor is soldered directly to the sealing-in-wire. A constant flexing of the conductor adjacent this outer joint has a tendency to break the individual strands of wire, and further, the practice of soldering the stranded conductor to a comparatively thick and stiff wire is found to be quite difficult.

In the first embodiment illustrating the installation contemplated by this invention and illustrated by Figs. 1 to 3, inclusive, the flexible conductor 23 is formed of a plurality of fine strands of wire enclosed by the usual insulating braid. A clip 24 is provided for gripping the outer braided portion of the flexible insulated conductor, and for engaging the comparatively stiff sealing-in-wire 22 of the tiltable switch, whereby a fixed relation is established therebetween. The clip as shown more particularly in Fig. 2 is preferably formed of sheet metal and comprises a body portion 25 and an extension 26 preferably formed integrally therewith. The main body portion 25 is adapted to envelope the outer braided portion of the insulated conductor 23, and is secured to said braided portion by crimping means which cause the clip to grip the flexible insulated conductor 23. This latter condition is illustrated very clearly in dotted lines in Fig. 2 and in elevation in Fig. 3.

The extension 26 has a depressed portion 27 extending at right angles to the axis of the main body portion when formed into its enveloped relation with the flexible conductor 23, the depressed portion having a pair of apertures 28 through which is inserted the sealing-in-wire 22 of the tiltable switch.

The stranded wires of the flexible conductor 23 extend outwardly beyond the enveloped braided portion 23 of the conductor and contact with the sealing-in-wire 22. After the main body portion of the clip is crimped over the flexible conductor and the sealing-in-wire 22 is passed through the apertures 28, a drop of solder 29 is disposed in the depressed portion and over the conduit wire to intimately unite the extension 26, the conducting wire of the conductor 23 and the sealing-in-wire 22. It is to be noted that the flexible conductor 23 is brought off from the

contactor at right angles to the axis of the sealing-in-wire 22 thereby requiring but very little head room in the casing for the tiltable switch.

5 Where there is a considerable amount of headroom with very little space at the sides of the containers, the clip 30 illustrated in Figs. 4 and 5 may be used. This modified form of clip comprises a main body portion 10 31 for enveloping and gripping the outer braided portion of the flexible insulated conductor 23 and an extension 32 of the main body portion 31 for enveloping and for gripping the sealing-in-wire 22 whereby the flexible conductor 23 and the sealing-in-wire 20 20 are substantially coaxial. The main body portion 31 is secured to the outer braided portion by means of a crimping tool or other means. Likewise the extension 32 is formed 20 to envelop and to grip the sealing-in-wire 20 as by means of crimping, whereafter the conducting portion 33 of the flexible conductor 23 extends beyond the end of the insulation or braiding to overlap the upper end of 25 the sealing-in-wire 20. A drop of solder 34 may be disposed at the junction of the sealing-in-wire and the conductor of the flexible lead, the solder running over onto a portion of the clip to intimately unite these members and form a good electrical connection. 30

A further modification is presented which is adapted particularly for use where there is but very little headroom, this form being illustrated more particularly in Figs. 6 and 35 7 of the drawing. In this instance the flexible conductor 23 extends at right angles to the axis of the sealing-in-wire 19 as in the embodiment illustrated in Figs. 2 and 3. However, in lieu of the depressed portion 40 and the apertures therein for receiving the sealing-in-wire 22, an extension 35 is formed on a main body portion 36, the extension 35 being wrapped around the sealing-in-wire 19 in a gripping relation therewith. The main 45 body portion 36 of the clip envelopes the braided insulated portion of the flexible conductor 23 in the same manner as hereinbefore described with reference to the main body portions 24 and 31. A drop of solder 50 37 is disposed in the space between the extension 35 and the main body portion 36, when in position, to obtain a fixed relation between the conducting wire of the flexible conductor 23, the sealing-in-wire 19 and the 55 clip proper.

It will be noted that as a result of this invention the flexible conductor may be brought off from its connection with the sealing-in-wire of the contactor toward either 60 end, or at any angle toward either side of the contactor best suited for the particular installation in which it is embodied. The flexible conductor need not be stiffened or annealed inside of the cap portion which 65 allows for a maximum flexibility and permits

of the positioning of the flexible leads near the seat of rotation. The contactor may be accommodated in a casing of any size or shape whether or not there is a small amount of headroom or a small space at the sides of 70 the contactor.

While several embodiments of this invention are herein shown and described, it is to be understood that various modifications may be apparent to those skilled in the art 75 without departing from the spirit and scope of this invention, and therefore, the same is to be limited only by the scope of the prior art and the appended claims.

I claim:

1. An electrical connection for tiltable 80 switches comprising a clip having a main body portion for enveloping and for gripping a substantial portion of the insulation of a flexible conductor, and an extension on 85 said main body portion having a depressed portion through the material of which a comparatively stiff wire of said tiltable switch extends to be fixed thereto whereby a fixed 90 relation is obtained between said conductor and said stiff wire, the conducting wire extending outside of said insulating portion to be fixed to said stiff wire and said extension in a current conducting relation.

2. An electrical connection for tiltable 95 switches comprising a clip having a main body portion for enveloping and for gripping a substantial portion of the insulation of a flexible conductor, and an extension on 100 said main body portion having a depressed portion, a comparatively stiff wire of said tiltable switch extending through an aperture in the material of said depressed portion in a fixed relation therewith, the axis of said 105 main body portion extending substantially at right angles to the axis of said stiff wire, the conducting wire extending outside of said insulating portion to be fixed to said stiff wire and said extension in a current conducting relation. 110

3. An electrical connection for tiltable 115 switches comprising a clip having a main body portion and an extension thereon formed of a single piece of material, said main body portion enveloping and gripping 120 the insulating periphery of a flexible conductor and extending substantially at right angles to the axis of said stiff wire, said extension gripping said fixed wire to fixedly connect said flexible conductor thereto, the 125 conducting wire extending outside of said insulating portion to be fixed to said stiff wire and said extension in a current conducting relation.

In witness whereof, I have hereunto subscribed my name.

PAUL S. BEAR.