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H. ODENWALD  
INSULATED SPRING CLIP  
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Fig. 1

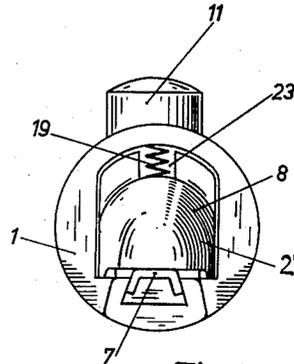
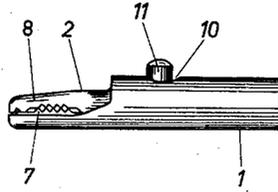


Fig. 2

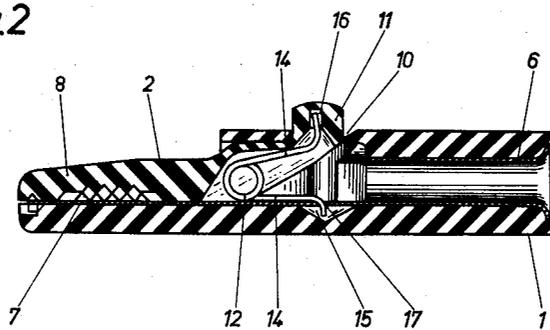
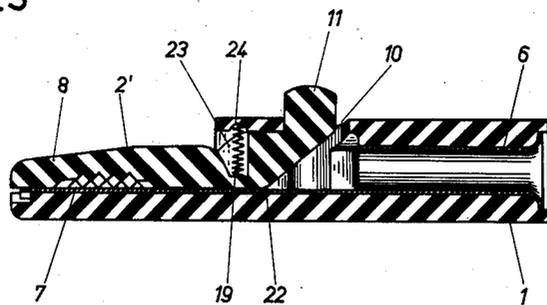


Fig. 4

Fig. 3



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**INSULATED SPRING CLIP**

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6 Claims. (Cl. 339—200)

The present invention relates to a new and improved electrical connector. More particularly, the present invention relates to a new and improved hand operated electrical connector capable of withstanding very high voltages.

There are conventional electrical connectors in use today that are primarily used for temporarily connecting measuring instruments to different parts of an electrical circuit. Such connectors are sometimes known as "alligator clips." They have a fixed member with a serrated edge that mates with a pivotally mounted member also having a serrated edge. A spring is mounted on a rod having its ends journaled in either the fixed member and/or the pivotally mounted member.

The spring normally urges the two members into engagement with each other and the pivotally mounted member is arranged so that finger pressure thereon will separate the members from each other. The clip can then be attached to a tube socket terminal, any one of a plurality of terminals on a terminal board or any other exposed parts of a wired electrical circuit. The clip remains connected to the terminal by means of the spring pressure and wires attached to the clip may be connected to measuring instruments to determine the current and/or voltage at the point to which the clip is connected.

Such connectors are in common use today for troubleshooting purposes in electrical and electronic circuits. These connectors are usually made of metal so that good contact can be made to the circuit component. However, since the connectors are clipped on by hand there is always the danger that the person using the connector will be exposed to high voltage that may be present at the component where the connection is made.

Also, the manner in which the known connectors of this type is assembled makes it difficult if not impossible to maintain or repair a connector that has become damaged. That is, since the ends of the rod on which the spring is mounted are usually journaled in one or both members of the connector, pressure is borne by the surfaces of the connector which are easily cracked.

On the other hand, the present invention provides an electrical connector of the type described which is fully insulated and capable of withstanding high voltages and currents. Also, the pivotally mounted member of the connector is a double-armed toggle member which pivots about its center portion. The spring which is used to normally urge one end of each of the connectors together is mounted between the members of the connector and requires no rod through the axis thereof.

It is accordingly an object of the present invention to overcome the disadvantages described for connectors of the type described.

It is another object of the present invention to provide a new and improved electrical connector.

It is a further object of the present invention to provide a new and improved hand operated electrical connector.

Yet another object of the present invention is to pro-

vide a fully insulated hand operated electrical connector.

It is a still further object of the present invention to provide an easily assembled electrical connector.

With the above objects in view the present invention mainly consists of an electrical connector including a hollow member made of an electrically insulating material and having at least one opening through the surface thereof, an electrically conductive member mounted within the hollow member, a double-armed toggle member made of an electrically insulating material and having at least a portion thereof pivotally mounted within the hollow member, one arm of the toggle member being adapted to engage one end of the electrically conductive member, and the other arm of the toggle member being adapted to extend through the opening in the surface of the hollow member, and means mounted on the hollow member for normally urging the one arm of the toggle member into engagement with one end of the electrically conductive member and normally urging the other arm of the toggle member through the opening in the surface of the hollow member.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view of a connector constructed in accordance with the principles of the present invention;

Fig. 2 is a longitudinal sectional view of one embodiment of the present invention;

Fig. 3 is a longitudinal sectional view of a second embodiment of the present invention; and

Fig. 4 is a front view of Fig. 3.

Referring now to the drawings and more particularly to Fig. 1, the electrical connector includes a hollow cylindrical member 1 in which is tiltably mounted a double-armed bell crank member 2 having an elongated serrated arm 8 and a button-shaped end 11 on its other arm. The button 11 extends through an opening 10 in the surface of the member 1.

Referring now to Fig. 2 it can be seen that in this embodiment, the hollow cylindrical member 1 and the double-armed bell crank member 2 are made of electrically insulating material. Disposed within the member 1 is an electrically conductive cylindrical member 6 having an elongated serrated end portion 7.

It is apparent that the electrically conductive member 6 may be molded within the cylindrical member 1 of the connector. Also, the elongated end portion 7 of the member 6 may be inserted in a groove in the inner surface of the member 1, as seen in Fig. 4. Member 6 has an opening 17 therein through which extends one end 14 of a coil spring 12 into a recess or groove 15 in the member 1. The spring 12 is lodged in an elongated recessed portion of one arm of member 2. The other end 14 of the spring 12 extends upwardly into a hollow portion 16 within the button 11 of the bell crank member 2.

Normally, the spring 12 urges the button 11 of the bell crank member 2 away from the opening 17 in the member 6. Therefore, the serrated arm 8 of the bell crank member 2 is normally urged into engagement with the serrated end 7 of the member 6. In operation, in order to clip the connector onto a desired terminal, finger pressure may be applied to the button 11 of the bell crank member 2. This tilts the toggle member about its rounded portion 22' which is held by the spring 12 in

contact with the inner side of member 1, causing the arm 8 to be moved away from the serrated end 7 of the member 6. The opened end of the connector is then attached to the desired terminal and the button 11 released. The connector will be held tightly to the terminal by the action of the spring 12 and electrical connection will be made to the terminal by the teeth on the serrated end 7.

It should be noted that all of the exposed parts of the connector are made of electrically insulated material. The electrically conductive parts are completely contained within the insulated parts so that it is almost impossible for anyone using this hand operated connector to make contact with an electrically conductive part thereof while the connector is being clipped onto the terminal.

Referring now to Figs. 3 and 4, a second embodiment of the connector incorporating the principles of the present invention is shown. In this embodiment the hollow cylindrical member 1 and the electrically conductive member 6 are substantially unchanged. However, the double-armed bell crank member 2' is modified. The double-armed bell crank member 2' is formed with a recessed portion 23 in which is disposed a compression spring 19. The spring 19 has one of its ends resting in the bottom of the recessed portion 23 and has its other end bearing against a recess 24 on the inner surface of the cylindrical member 1. The central portion of the bell crank member 2' also has a rounded contact area 22 about which it is tiltable.

The compression spring 19 normally urges the serrated arm 8 of the bell crank member 2' against the serrated end 7 of the member 6. In operation, pressure applied to the button 11 in the downward direction will cause the bell crank member 2' to pivot about its contact area 22 and urge the serrated arm 8 away from the end 7 against the action of the spring 19. When the connector is clipped onto the desired terminal, the button 11 is released and the spring 19 then holds the connector to the desired terminal until the button 11 is again depressed.

From Figs. 2, 3 and 4 it can be seen that a connector constructed in accordance with the principles of the present invention may be quickly and easily assembled by the insertion of the spring between the double-armed bell crank member and the hollow member. Since the spring is held between the members without the addition of any supporting rod there are no stresses or strains transmitted to the outer surfaces of the assembled members. This is normally a case where the supporting rod for the spring member has its ends journalled or fixed in the surfaces of the members of the connector.

The cylindrical member 6 may be made the proper size to mate with a conventional jack for connection to an electrical conductor.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of connectors differing from the types described above.

While the invention has been illustrated and described as embodied in hand operated, insulated electrical connectors, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

What is claimed as new and desired to be secured by Letters Patent is:

1. An electrical connector comprising, in combination, an open-ended hollow member made of an electrically insulating material and having at least one opening through the surface thereof; an electrically conductive member mounted within said hollow member; and elongated bell crank member made of an electrically insulating material and having a portion thereof contacting an opposed surface inside said hollow member for being tiltable about the area of contact, one arm of said bell crank member being adapted to engage one end of said

electrically conductive member, and the other arm of said bell crank member being adapted to extend through said opening in the surface of said hollow member; and a spring positioned between the inside of said hollow member and a portion of said bell crank member for normally urging said one arm of said bell crank member into engagement with said one end of said electrically conductive member and normally urging said other arm of said bell crank member to project through said opening in the surface of said hollow member.

2. An electrical connector comprising, in combination, an open-ended hollow member made of an electrically insulating material and having at least one opening through the surface thereof; an electrically conductive member mounted within said hollow member; an elongated bell crank member made of an electrically insulating material and having a portion thereof contacting an opposed surface inside said hollow member for being tiltable about the area of contact, one arm of said bell crank member being adapted to engage one end of said electrically conductive member, and the other arm of said bell crank member being adapted to extend through said opening in the surface of said hollow member, the end of said other arm of said bell crank member being button-shaped; and a spring positioned between the inside of said hollow member and a portion of said bell crank member for normally urging said one arm of said bell crank member into engagement with said one end of said electrically conductive member and normally urging said other arm of said bell crank member to project through said opening in the surface of said hollow member.

3. An electrical connector comprising, in combination, an open-ended hollow member made of an electrically insulating material and having at least one opening through the surface thereof and a recess on the inside thereof; an electrically conductive member mounted within said hollow member; an elongated bell crank member made of an electrically insulating material and having a portion thereof contacting said electrically conductive member inside said hollow member for being tiltable about the area of contact, one arm of said bell crank member being adapted to engage one end of said electrically conductive member, and the other arm of said bell crank member being adapted to extend through said opening in the surface of said hollow member, said other arm of said bell crank member having a recessed portion; and a spring positioned between the inside of said hollow member and a portion of said bell crank member for normally urging said one arm of said bell crank member into engagement with said one end of said electrically conductive member and normally urging said other arm of said bell crank member to project through said opening in the surface of said hollow member, said spring having one end extending into said recessed portion of said other arm of said bell crank member and having another end extending into said recess on the inside of said hollow member, so that said spring simultaneously serves to hold said bell crank member in assembly and to provide a clamping force for gripping an object between said electrically conductive member and said one arm of said bell crank member.

4. An electrical connector comprising, in combination, an open-ended hollow member made of an electrically insulating material and having at least one opening through the surface thereof and a recess on the inner surface thereof; an electrically conductive member mounted within said hollow member and having an opening substantially in alignment with said recess in said hollow member; an elongated bell crank member made of an electrically insulating material and having a portion thereof contacting the inside of said hollow member for being tiltable about the area of contact, one arm of said bell crank member being adapted to engage one end of said electrically conductive member, and the other

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arm of said bell crank member being adapted to extend through said opening in the surface of said hollow member, said other arm of said bell crank member having an elongated recessed portion and another recess between said recessed portion and the end of said other arm; a coil spring positioned in said elongated recessed portion in said other arm of said bell crank member for normally urging said one arm of said bell crank member into engagement with said one end of said electrically conductive member and normally urging said other arm of said bell crank member to project through said opening in the surface of said hollow member, said coil spring having substantially tangentially extending ends, one of said ends extending into said recess in said other arm of said bell crank member, and the other one of said ends extending into said opening of said electrically conductive member and through it into said recess on the inside of said hollow member so that said spring simultaneously serves to hold said bell crank member in assembly and to provide a clamping force for gripping an object between said electrically conductive member and said one arm of said bell crank member.

5. An electrical connector comprising, in combination, an open-ended hollow member made of an electrically insulating material and having at least one opening through the surface thereof; an electrically conductive member mounted within said hollow member and having an opening; an elongated bell crank member made of an electrically insulating material and having a portion thereof contacting the inside of said hollow member for being tiltable about the area of contact, one arm of said bell crank member being adapted to engage one end of said electrically conductive member, and the other arm of said bell crank member being adapted to extend through said opening in the surface of said hollow member, said other arm of said bell crank member having an elongated recessed portion and another recess between said recessed portion and the end of said other arm; a coil spring positioned in said elongated recessed portion in said other arm of said bell crank member for normally urging said one arm of said bell crank member into engagement with said one end of said electrically conductive member and normally urging said other arm of said bell crank member to project through said opening in the surface of said hollow member, said coil spring having substantially tangentially extending ends, one of said ends extending into said recess in said other arm of said bell crank member, and the other one of said ends extending into

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said opening of said electrically conductive member so that said spring simultaneously serves to hold said bell crank member in assembly and to provide a clamping force for gripping an object between said electrically conductive member and said one arm of said bell crank member.

6. An electrical connector comprising, in combination, an open-ended hollow member made of an electrically insulating material and having at least one opening through the surface thereof and a recess on the inner surface thereof; an electrically conductive member mounted within said hollow member; an elongated bell crank member made of an electrically insulating material and having a portion thereof contacting the inside of said hollow member for being tiltable about the area of contact, one arm of said bell crank member being adapted to engage one end of said electrically conductive member, and the other arm of said bell crank member being adapted to extend through said opening in the surface of said hollow member, said other arm of said bell crank member having an elongated recessed portion and another recess between said recessed portion and the end of said other arm; a coil spring positioned in said elongated recessed portion in said other arm of said bell crank member for normally urging said one arm of said bell crank member into engagement with said one end of said electrically conductive member and normally urging said other arm of said bell crank member to project through said opening in the surface of said hollow member, said coil spring having substantially tangentially extending ends, one of said ends extending into said recess in said other arm of said bell crank member, and the other one of said ends extending into said recess on the inside of said hollow member so that said spring simultaneously serves to hold said bell crank member in assembly and to provide a clamping force for gripping an object between said electrically conductive member and said one arm of said bell crank member.

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