Jan. 24, 1956 H. J. HAMMERLY 2,732,535

ELECTRIC TERMINAL CONNECTOR

Filed Feb. 14, 1955 2 Sheets-Sheet 1

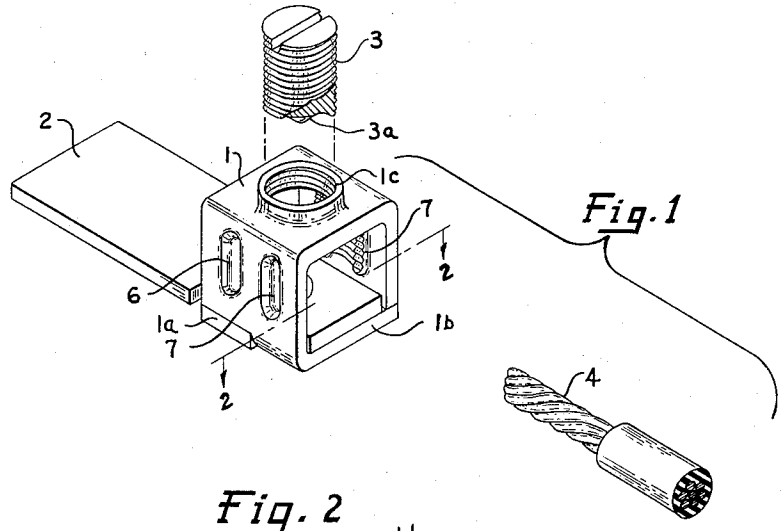


Fig. 1

Fig. 2

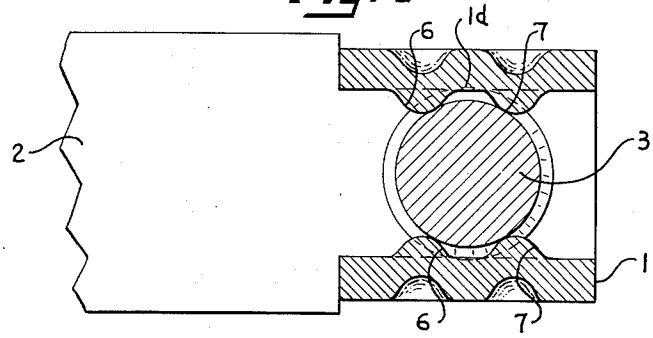
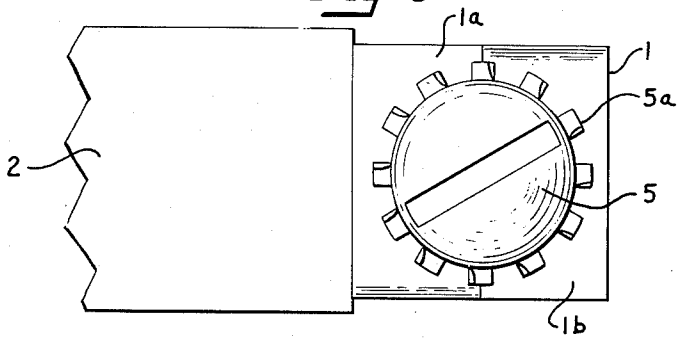


Fig. 3



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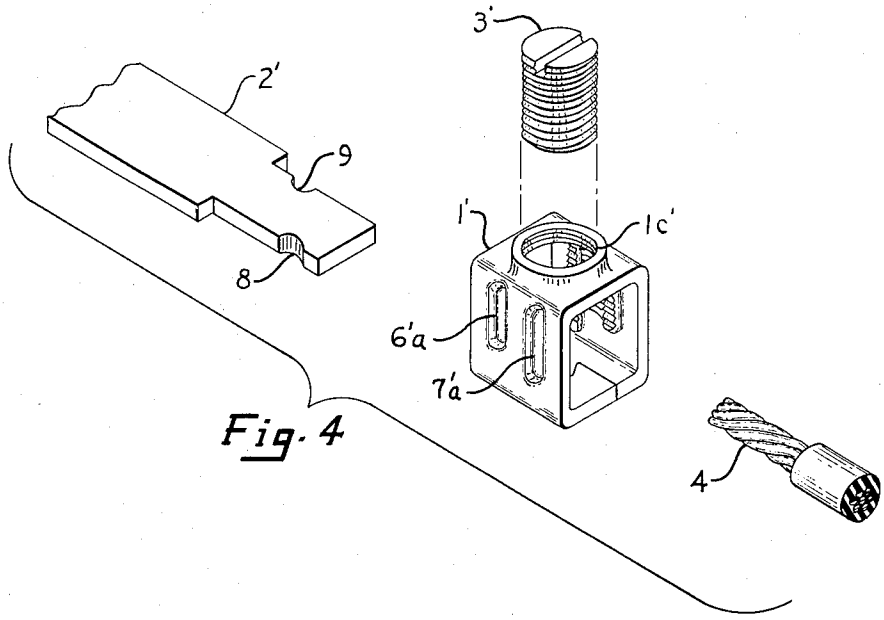


Fig. 4

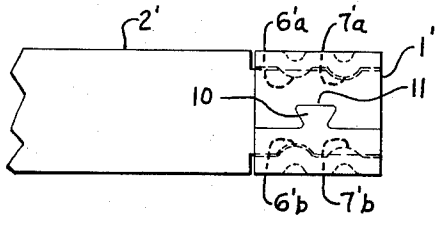


Fig. 5

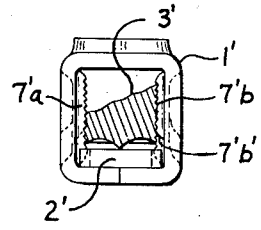


Fig. 6

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ELECTRIC TERMINAL CONNECTOR

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Application February 14, 1955, Serial No. 487,855

8 Claims. (Cl. 339—272)

This application is a continuation-in-part of my earlier-filed application, Serial No. 341,171, filed March 9, 1953, and assigned to the same assignee as the present invention.

My invention relates to electric terminal connectors, and more particularly to clamping devices for securing the ends of electric wires, cables and the like.

My invention is especially applicable to connectors of the "solderless" or pressure type for securing the end of a solid or stranded electric wire conductor to the end of a flat conductive terminal strap of an electrical device such as an electric switch or circuit breaker.

In connectors of this type an electrical connection and a mechanical connection must be provided in a small space, both types of connection being equally important to the satisfactory performance of the connector. Such connectors, for instance, are commonly required by the Underwriters' Laboratories to pass severe mechanical "pull-out" tests consisting of the application of a substantial force on the connected wire tending to pull it out of the connector, while simultaneously moving the wire in a circular path continuously for many hours.

Due to the large volume of such devices used, it is extremely desirable that the cost of materials and manufacture be kept to a minimum. In this connection it has long been realized that the materials most suitable for the provision of a good electrical connection are not best suited for the provision of a good mechanical connection and, moreover, add greatly to the cost. Many attempts have, therefore, been made to devise such connectors utilizing a first type of material, such as steel, to provide the mechanical connecting functions and a second type of material, such as copper or silver, to provide the electrical connection functions. Such composite connectors have in the past, however, been relatively complex and difficult to manufacture or have left much to be desired in the performance of the respective functions.

Because such connectors are used in electrical devices where it is desirable that physical spacings and dimension be kept to an absolute safe minimum, it is likewise desirable that such connectors be as small and compact as possible.

It is the principal object of my invention to provide a solderless terminal connector for clamping the ends of electric wires and cables, which connector is simple, reliable and of reduced cost, but which nonetheless grasps the wire or cable securely and resists with great force efforts to dislodge the wire after clamping.

A particular object of my invention is to provide an electric terminal connector of the pressure type for clamping the end of a wire conductor to the end of a flat terminal strap of an electrical device which connector grips the wire with a mechanical interlocking action and effectively resists forces tending to pull the wire out of the connector.

It is a further object of my invention to provide a connector of this type having greatly increased thread-engaging area for the clamping screw whereby high pressure may be exerted upon the clamped members, thereby making feasible a substantial decrease in the amount of relatively highly conductive material without excessive heating.

An important object of a modified form of my invention is to provide such a connector having means interlocking it in place on the conductive strap to which it is attached without the use of a screw, which means does not require extending the strap through the connector beyond the end thereof, thereby providing an extremely compact structure.

In carrying out my invention in one form, I provide a generally rectangular tubular clamping sleeve having a clamping screw threadedly engaged in an opening in the top wall thereof and a pair of generally parallel closely-spaced inwardly-directed embossed ribs in each of its opposite side walls extending generally parallel to the axis of said clamping screw, the ribs of each pair being substantially equally spaced from and on opposite sides of the said axis of said clamping screw, whereby a wire clamped under the clamping screw is compressed between said ribs and deformed therebetween, furnishing a mechanical interlocking action which firmly grips the wire and resists high pull-out forces.

In accordance with a further feature of my invention, the spacing of the inwardly directed ribs and the diameter of said clamping screw are so chosen that the clamping screw threadedly engages a portion of said ribs whereby a greatly increased thread-engaging area is provided, permitting application of very high pressures.

In accordance with a feature of a modified form of my invention, I make certain of said ribs longer than others and provide a specially formed strap for use therewith and having portions interlocking with portions of elongated said ribs to retain the clamping member in place on the strap without the use of mounting screws and without the necessity of extending the strap beyond the end of the clamping member, and providing an extremely compact and effective connector.

My invention itself will be more fully understood and its various objects and advantages further appreciated by referring now to the following detailed specification taken in conjunction with the accompanying drawing, in which Figure 1 is a perspective view of an electric terminal connector embodying my invention; Figure 2 is a cross-sectional view taken along the line 2—2 of Figure 1; and Figure 3 is a bottom plan view of the connector shown at Figure 1.

Figure 4 is a perspective view of a modified form of my invention, the parts being shown in exploded relation.

Figure 5 is a bottom plan view of the connector of Figure 4 the parts being shown in assembled relation.

Figure 6 is an end view of the connector of Figure 4 the parts being shown in assembled relation.

Referring now to the drawing, I have shown my invention in one form as a terminal clamp comprising a flat metallic ring 1 having its bottom wall fixed to a strap 2 of electric conducting material and having threaded through its top wall a clamping bolt 3. The clamping loop 1 is adapted to receive therein, in clamping relation, the exposed end of a stranded electric conductor or cable 4. The clamping member 1 is of tubular rectangular configuration having a flat bottom wall formed by disposing in side-by-side coplanar relation the oppositely extending and complementally cut-away ends 1*a* and 1*b* of the loop. The conducting strap 2, reduced at its end, projects into the rectangular clamping member 1 and is bolted to the bottom wall thereof by means of a clamping bolt 5 threaded into the strap 2 and firmly held in place by a lock washer 5*a* (Figure 3).

The top wall of the tubular rectangular clamping member 1 is provided with a threaded aperture 1*c* having

a diameter substantially equal to the distance between the parallel spaced apart side walls of the clamping member. The inner surfaces of the opposite side walls are each inwardly embossed directly beneath and in alignment with the bolt receiving aperture 1*c*, as at 6 and 7. The inwardly projecting embossments 6 and 7 on each side wall are in parallel spaced relation, extend in the direction of the clamping bolt 3, and are threaded as a continuation of the threads in the aperture 1*c*. These embossments are more particularly shown in the cross-sectional view at Figure 2. From this figure it will be evident that each pair of parallel spaced apart embossments forms therebetween a discrete threaded area of arcuate configuration extending along a circular arc of appreciable angular length. Finally the clamping bolt 3 is provided at its lower end with a central pointed projection 3*a* engageable with the clamped wire or cable.

The projection 3*a* of the bolt 3 extends slightly below the peripheral portion of the end of the screw and is surrounded by an annular recess, as indicated especially at Figure 6. By means of this construction the projection 3*a* acts as a stop or spacer and prevents the peripheral portion of the screw from cutting through and thereby severing portions of the conductor to be clamped. The projection 3*a* is preferably pointed so that it always deflects a conductor or conductor-strand to one side or the other.

It will now be evident to those skilled in the art that, when the stranded wire 4 is inserted within the rectangular clamping loop 1 and the clamping bolt 3 firmly screwed down, the wire is squeezed laterally against the inwardly projecting threaded embossments 6 and 7 on both sides of the clamping member 1. The arcuate surfaces between each pair of embossments 6 and 7 tend to produce a node in the wire, while the embossments themselves act as cleats to bite into the side of the wire and firmly resist its longitudinal displacement. I have found that a simple rectangular clamping member of this configuration resists removal of the clamped wire or cable with unusual tenacity, and thus avoid the necessity for the provision of additional interfitting parts which have commonly been provided heretofore for grasping the wire.

Referring now to the modification illustrated particularly in Figures 4 through 6, I have shown a form of my invention wherein the anchoring screw 5, washer 5*a*, corresponding holes in the sleeve, clamping member 1 and the strap 2 may be omitted with subsequent saving in cost and rendering assembly much more convenient. In accordance with this modification I extend one of the inwardly directed rib 7'*a* on one side and the diagonally opposite rib on the opposite side 6'*b*, substantially to the bottom wall of member 1' and I provide corresponding notches 8 and 9 in the reduced portion of the strap 2'. The bottom wall of the clamping member 1' may be formed in the manner indicated in the form of Figures 1 through 3 or I may form the bottom wall in the manner indicated in Figure 5, having a dovetailed fit made up of a projection 10 and a correspondingly shaped recess 11.

This form of connector is assembled in the following manner. The screw 3' is backed out a substantial amount out of the opening 1*c*'. The clamping member 1' is then placed over the reduced portion of the strap 2' with the reduced portion extending diagonally within the opening of the clamping member 1' so that its edges clear the inwardly embossed ribs. The lug is thereafter rotated a small amount so that the reduced portion of the strap 2' lies against the bottom wall of the clamping member 1', and the notches 8 and 9 fit closely around the lower part of the corresponding ribs 7'*a* and 6'*b*. It will be observed that so long as the clamping member 1' is not rotated with respect to the strap 2' it is positively retained from pulling off or sliding off in an outwardly direction. The connector is moreover prevented from moving more than a small amount in a downward direction with respect to the conductor strap 2', by reason of the fact that the ribs 6'*a* and 7'*b* provide shoulders as indicated at 7'*b*' which, in the absence of correspondingly located notches in the strap 2', prevent such movement. It will further be observed that because of the diagonal location of the notched and unnotched portions it is immaterial which open end of the tubular clamping member 1' is inserted over onto the conducting strap 2' first. By means of this construction the cost of my improved connector is further materially reduced and its ease of assembly is enhanced, while fully adequate performance is achieved.

While I have described only two preferred embodiments of my invention by way of illustration, other modifications will occur to those skilled in the art and I, therefore, wish to have it understood that I intend by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric terminal connector comprising a generally rectangular tubular clamping member having a flat bottom wall, a top wall having a threaded aperture therein and generally parallel opposite side walls, a clamping screw threadedly engaged in said threaded aperture in said top wall, and a pair of generally parallel closely-spaced inwardly-directed embossed ribs in each of said opposite side walls extending generally parallel to the longitudinal axis of said clamping screw, the ribs of each pair being substantially equally spaced from said axis of said screw.

2. The connector as set forth in claim 1 wherein the diameter of said threaded aperture is substantially the same as the distance between the opposite side walls of the generally rectangular tubular clamping member.

3. An electric terminal connector comprising a generally rectangular tubular clamping member having a flat bottom wall, a top wall having a threaded aperture therein and generally parallel opposite side walls, a clamping screw threadedly engaged in said threaded aperture in said top wall, and a pair of generally parallel closely-spaced inwardly-directed embossed ribs in each of said opposite side walls extending generally parallel to the longitudinal axis of said clamping screw, the ribs of each pair being substantially equally spaced from said axis of said screw, the diameter of said threaded aperture being substantially the same as the distance between the opposite side walls of the generally rectangular tubular clamping member, the said embossed ribs having at least the major portion thereof threaded as a continuation of the threads in said threaded aperture.

4. An electric terminal connector comprising a generally rectangular tubular clamping member having a flat bottom wall, a top wall having a threaded aperture therein and generally parallel opposite side walls, a clamping screw threadedly engaged in said threaded aperture in said top wall, and a pair of generally parallel closely-spaced inwardly-directed embossed ribs in each of said opposite side walls extending generally parallel to the longitudinal axis of said clamping screw, the ribs of each pair being substantially equally spaced from said axis of said screw, at least one of said ribs extending substantially to said bottom wall, and a relatively thin flat conductive member having a contact portion adapted to be received within said clamping member, said contact portion having shoulder portions engageable with said extended rib to prevent relative sliding movement of said conductive member and said clamping member.

5. An electric terminal connector comprising a generally rectangular tubular clamping member having a flat bottom wall, a top wall having a threaded aperture therein and generally parallel opposite side walls, a clamping screw threadedly engaged in said aperture in said top wall, an inwardly-directed embossed rib in each of said opposite side walls extending generally parallel to the longitudinal axis of said clamping screw, and a flat conductive member

having a contact portion adapted to be received within said clamping member, said contact portion having shoulders engageable with at least one of said ribs to prevent relative sliding movement of said flat conductive member and said clamping member, the said embossed rib having at least a portion thereof threaded as a continuation of the threads in said threaded aperture.

6. An electric terminal connector comprising a generally rectangular tubular clamping member having a flat bottom wall, a top wall having a threaded aperture therein and generally parallel opposite side walls, a clamping screw threadedly engaged in said threaded aperture in said top wall, and a pair of generally parallel closely-spaced inwardly directed embossed ribs in each of said opposite side walls extending generally parallel to the longitudinal axis of said clamping screw, the ribs of each pair being substantially equally spaced from said axis of said screw, two diagonally opposite ribs being extended substantially to said bottom wall, the other two of said ribs terminating a short distance from said bottom wall, and a relatively thin flat conductive member having a contact portion adapted to be received within said clamping member, said conductive plate having shoulder portions engageable with said extended ribs for preventing relative sliding movement of said clamping member on said conductive member and having other portions engageable with said other ribs for limiting relative vertical movement of said clamping member on said conductive member.

7. An electric terminal connector comprising a rectangular tubular clamping member having a flat bottom wall adapted to be fixed to a conducting strap and having a top wall provided with a threaded aperture therein, the

diameter of said threaded aperture being substantially the same as the distance between the parallel spaced apart side walls of said clamping member, the interior surfaces of said side wall having opposed inwardly directed embossed areas directly beneath diametrically opposite sides of said threaded aperture and said embossed areas being threaded continuously with the threads in said aperture, and a clamping bolt cooperating with the threads in said aperture and said embossed areas thereby to clamp an electric conductor between said bolt and bottom wall and against the embossments of said side walls.

8. An electric terminal connector comprising a generally rectangular tubular clamping member having a flat bottom wall adapted to be connected to a flat conducting strap and having a top wall provided with a threaded aperture therein, the diameter of said threaded aperture being substantially the same as the distance between the parallel spaced apart side walls of said clamping member, the interior surfaces of each of said walls having a pair of elongated inwardly extending embossments in parallel spaced apart relation and in alignment with said threaded aperture, said embossments being threaded continuously with the threads of said aperture thereby to form on each side wall a discrete embossed area threaded along a circular arc of appreciable angular length, and a clamping bolt cooperating with the threads in said aperture and on said embossed areas thereby to clamp an electric conductor between said bolt and bottom wall and against the embossments of said side walls.

No references cited.