Nov. 27, 1962 W. H. EDMUNDS 3,066,277

SOLDERLESS CONNECTOR

Filed April 21, 1958 2 Sheets-Sheet 1

FIG. 1.

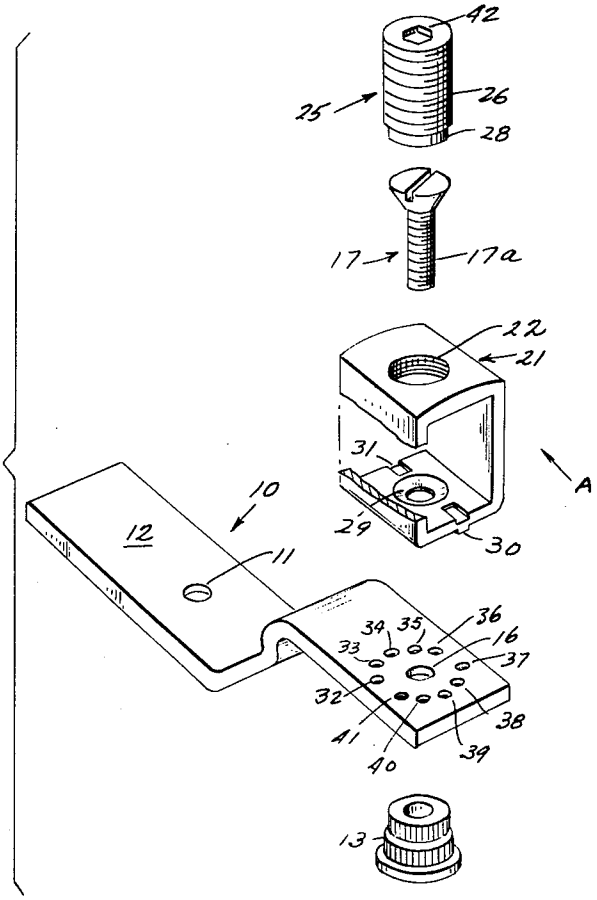


FIG. 6.

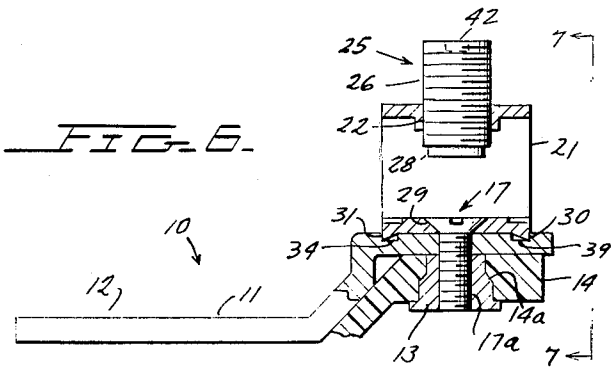
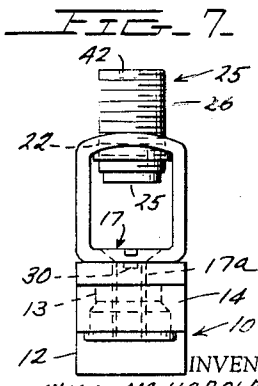


FIG. 7.



INVENTOR.
WILLIAM HAROLD EDMUNDS
BY Ostrolenk, Faber, Gerb & Soffen
ATTORNEYS

Nov. 27, 1962 W. H. EDMUNDS 3,066,277

SOLDERLESS CONNECTOR

Filed April 21, 1958 2 Sheets-Sheet 2

FIG. 2A.

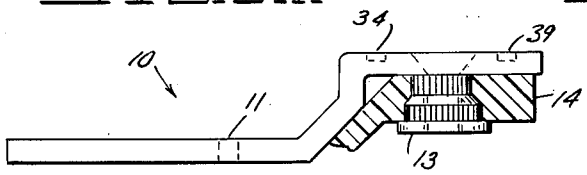
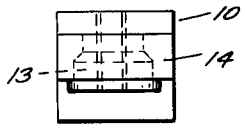


FIG. 2C.



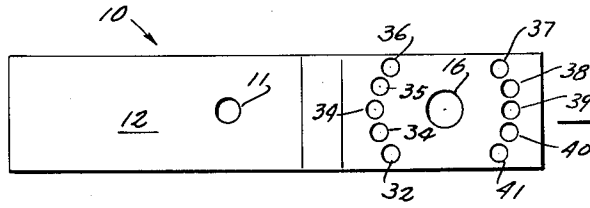
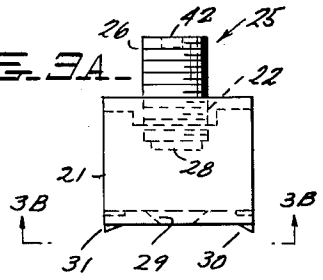


FIG. 2B.

FIG. 3A.



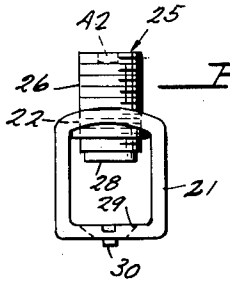
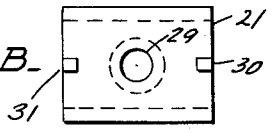


FIG. 3C.

FIG. 3B.



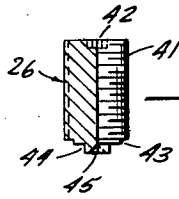


FIG. 4.

FIG. 5A.

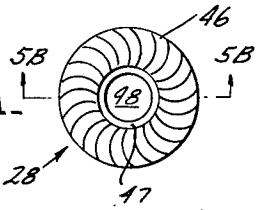
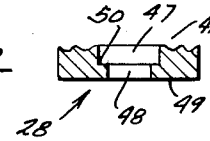


FIG. 5B.



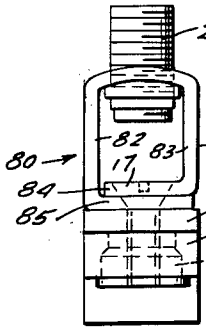


FIG. 8.

INVENTOR.
WILLIAM HAROLD EDMUNDS

BY Strauch, Faber, Gerk & Soffen
ATTORNEYS

United States Patent Office 3,066,277 Patented Nov. 27, 1962

3,066,277

SOLDERLESS CONNECTOR

William Harold Edmunds, Havertown, Pa., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed Apr. 21, 1958, Ser. No. 729,634
2 Claims. (Cl. 339—245)

My invention relates to a solderless connector for circuit interrupters and more particularly is directed to a novel arrangement whereby the connector can be both front connected and at the same time provide means to protect the wire to be connected to the connector.

The problems arising in connection with connectors for circuit interrupters include the following:

(1) In molded case circuit breakers the handle protrudes from the front of the breaker and this portion of the breaker is always accessible to the installer of the unit. On the other hand the remaining portions of the breaker, namely the back and sides are usually inaccessible when the circuit breaker is placed within a panelboard or switchboard arrangement. Thus, it is desirable to construct the terminal connectors so that they can be "front" connected. That is, the connectors can be secured to the circuit breaker from the front of the circuit breaker.

(2) In the utilization of terminal connectors the unit frequently has to connect both load and line conductors to the circuit interrupter which will have to carry current in the order of several hundred amperes. Thus, it is essential that a high pressure contact be made between the conductor and the connector. In some prior art arrangements the screw means which provides the high pressure between the conductor and the connector directly rotated upon the surface of the conductor and thereby caused the conductor to not only rotate but frequently cause damage to either the conductor or strands and thereby substantially reduced its cross-sectional area. It is therefore desirable to provide a connector whereby high pressure contact can be made between the connector and the conductor without damaging the conductor.

(3) It is noted that in the prior art arrangement the problems recited in 1 and 2 above have been overcome by providing an enlarged connector so that in one section of the connector an opening was left to provide front connection and in the second section of the connector a captured rider was positioned within the connector to prevent damage to the connector. However, this solution to the problem has been unacceptable to the industry since it requires more material, it is more expensive, and there generally is insufficient room available within commercial molded case breakers to accommodate the enlarged connector.

(4) Some of the problems recited in 2 and 3 above have been overcome in the prior art constructions with a terminal connector which must be soldered in place. However, this arrangement has not been acceptable in most instances since it requires the application of heat to the circuit interrupter in an area which, frequently, is immediately adjacent the bimetallic trip element and the application of heat will frequently cause a distortion thereof and upset the calibration of the circuit interrupter. This arrangement also necessitates the application of heat in a confined and restricted area wherein damage may be done to adjacent units. Furthermore, this arrangement necessitates the use of soldering equipment at the point of installation.

With my novel terminal connector I have provided an arrangement wherein the connector is (*a*) solderless, (*b*) can be front connected, (*c*) will not damage the conductor to be positioned therein, (*d*) is relatively small and economical.

Basically, I provide a terminal connector wherein a rider is pivotally secured to a screw with the rider and the screw having substantially the same cross-sectional area so that the rider with its screw can be removed as a unit from the terminal connector. Hence, with this arrangement one is able to gain access to the interior of the terminal connector so that it can be front connected. Thereafter, the cable conductor can be inserted in the terminal connector and the screw with its rider can be threaded into the connector to provide high pressure contact without damage to the conductor.

Accordingly, a primary object of my invention is to provide a terminal connector which can be front connected, does not have to be soldered in place, does not damage the conductor to be connected thereto and is compact and economical.

In the prior art arrangements means have been provided for terminal connectors whereby the terminal connector has appropriate protrusions for mating with recesses in the conductor of the ciruuit interrupter to thereby prevent rotation of the connector This prior art arrangement as shown in U.S. Patent 2,777,119 has met with commercial success and is satisfactory for specific applications. However, there are some cases where it is desirable to mount the terminal connector at either a plus or minus angle and I have provided a novel key arrangement whereby the connector can be connected on the terminal at a predetermined angle and thereafter due to the mating of a protrusion and recess between the terminal and terminal connector the terminal connector is rigidly positioned.

Thus, it is another main object of my invention to provide a novel arrangement wherein there is a key arrangement between the terminal and terminal connector for achieving positive selective angular positioning.

A further object of my invention is to provide a terminal connector in which the tubular cable receiving chamber is formed of folded over flat stock to provide a locking means for the holding screw which fastens the connector to the terminal.

These as well as other objects of the instant invention shall become readily apparent after reading the following description of the accompanying drawings in which:

FIGURE 1 is an exploded view of my novel solderless connector and a terminal to which it may be connected.

FIGURE 2A, 2B and 2C are detailed views of the terminal wherein FIGURE 2A shows a side view of the terminal, FIGURE 2B a top view of the terminal, and FIGURE 2C an end view of the terminal.

FIGURES 3A, 3B and 3C are detailed views of the solderless connector wherein FIGURE 3A is a side view illustrated with one wall transparent, FIGURE 3B is a bottom view and FIGURE 3C is an end view.

FIGURE 4 is a partially cross-sectioned side view of the clamping screw which forms part of my novel solderless connector before the rider is secured thereto.

FIGURE 5A is a plan view of the rider which is carried by the clamping screw of the solderless connector.

FIGURE 5B is a cross-sectional view of the rider of FIGURE 5A taken along the line 5B—5B looking in the direction of the arrows.

FIGURE 6 is a cross-sectional side elevation view illustrating the engagement and attachment of the solderless connector to the terminal.

FIGURE 7 is an end view of the assembled connector and terminal of FIGURE 6 looking in the direction of arrows 7—7.

FIGURE 8 is an end view of my novel connector in a modified construction utilizing folded sheet stock.

Referring now to the figures, terminal 10 is a stepped bus conductor which will be secured to a molded housing of a circuit breaker (not shown) by a nut or bolt passing through opening 11. The conductors for one pole of the circuit breaker will be brazed or soldered to the left end of the terminal at the area generally indicated at 12. The right hand end of the terminal 10 is provided with a threaded opening 16 which is adapted to receive the connector holding screw 17. Opening 16 is positioned to be in alignment with the threaded central opening of cylindrical member 13 which forms an insert in the molded casing 14 of the circuit breaker. Member 13 has a substantially tapered configuration which is received by the similarly tapered aperture 14*a* in casing 14.

The solderless terminal connector 20 comprises a rectangular tube shaped metallic member 21 which may be made of any desirable conducting material such as copper. A threaded opening 22 in the upper surface thereof receives the clamping screw assembly 25 which will be used to hold and maintain a cable conductor (not shown) within the tubular member 21.

Two protruding sections 30, 31 extend from the bottom surface of the tubular member 21. The protrusions 30, 31 may be the result of an extruding or clamping operation. Terminal 10 is provided with an indexing means comprising a plurality of circumferentially arranged recesses 32–41, two of which will receive the protruding section 30, 31 of tubular member 21 to thereby determine the relative angular position between terminal 10 and connector 20. That is, with protrusion 30, 31 nested within recesses 39, 34, respectively, connector 20 is positioned to receive cable conductors which are aligned parallel to terminal 10. With protrusions 30, 31 disposed within recesses 38, 33 respectively, connector 20 is positioned to receive a cable which approaches terminal 10 from the right with respect to FIGURE 1. Conversely, with protrusions 30, 31 nested within the recesses 40, 35, respectively, connector 20 is positioned to receive a cable which approaches terminal 10 from the left with respect to FIGURE 1.

Holding screw 17 is of a flat headed machine type and passes through countersunk opening 29 in the bottom surface of tubular member 21 and thereafter is engaged by the threads of terminal opening 16 as well as the threads of cylindrical member 13 to thereby secure connector 20 to terminal 10. It is to be noted that the flat head of holding screw 17 is flush with the bottom inner surface of tubular member 21 so that no adaptors are required to prevent damage to the cable conductor which might otherwise be caused by an extending head of a holding screw.

Clamping screw 26 comprises a threaded body 41 having a hexagonal bore 42 communicating with one end thereof to receive an Allen wrench. The other end of body 41 is provided with narrow shoulder section 43 whose diameter is considerably less than the diameter of rider 28. Extending outwardly from shoulder section 43 is a pivot section 44 of reduced diameter, the free end of which is countersunk at 45.

Rider 28 comprises a wafer-like member, one surface 46 of which is provided with serrations in the form of a diagonal knurl as illustrated, or of any suitable design which will, when clamping screw assembly 25 is brought down against the cable, set up friction to prevent rotation of rider 28. Rider 28 is provided with a central opening, a first section 47 of which communicates with the serrated surface 46 and a second section 48 of which communicates with a flat surface 49.

In order to assemble clamping screw 26 and rider 28, pivot section 44 is entered through opening section 48 with surface 49 resting against shoulder section 43. Thereafter the walls defining countersunk opening 45 are upset in an outward direction and are thereby captured by surface 50 of rider 28. In this manner, rider 28 is pivotally mounted to clamping screw 26. The small diameter of

narrow shoulder section 43 provides a small contact surface between shoulder section 43 and flat surface 49 of rider 28 thereby considerably reducing the frictional forces acting between the rider 28 and clamping screw 26 to prevent rider 28 from rotating once it has engaged the cable.

In order to secure connector 20 to terminal 10, protrusions 30, 31 are inserted in the selected recesses 32, 37. This places countersunk opening 29 in alignment with terminal opening 16. Holding crew 17 is then passed through threaded opening 22 in the top surface of tubular member 21 with threads 17*a* mating with the threads of opening 16 and the threads of cylindrical member 13. This securely fastens tubular member 21 to terminal 10 in a preselected angular position with respect thereto.

Next, the load or line cable (not shown), as the case may be, is entered into tubular member 21 in the direction indicated by arrow A (FIGURE 1). Clamping screw assembly 25 is then connected to tubular member 21 by entering the rider end of clamping screw 26 into threaded opening 22 and thereafter rotating clamping screw 26 in a clockwise direction as the threads thereof mate with the threads of opening 22. The diameter of rider 28 is small enough so that it passes freely through threaded opening 22. Rider 28 will then contact the cable conductor and when sufficient pressure exists between the two further rotation of clamping screw 26 will cause rider 28 to exert only a transverse pressure on the cable conductor with the twisting motion of clamping screw 26 being lost at the pivot connection between screw 26 and rider 28.

FIGURE 8 illustrates a modified construction for the solderless connector hereinbefore described. Solderless connector 80 differs from solderless connector 20 only in a manner in which their tubular members are constructed. Tubular member 81 is manufactured of flat stock rather than being drawn to shape from a tube as was tubular member 21. The bottom wall of tubular member 81 includes a double thickness of the stock while the other walls of tubular member 81 are of a single thickness. This construction provides a locking means for holding screw 17 which secures connector 80 to terminal 10.

The locking action is brought about by the fact that as the cable fastening screw assembly 25 is tightened at the cable, the cable will have a tendency to flatten and bulge outwardly toward the side walls 82, 83 of tubular member 23 thereby having a tendency to push these walls outwardly. This means that the overlapping sections 84 and 85 which are not normally fastened together will be pulled in opposite directions. That is, sections 84 and 85 will be pulled to the right and left respectively with respect to FIGURE 8. Thus, forces directed in opposite directions will be exerted upon holding screw 17 to provide a very substantial locking means thereby preventing the loosening of holding screw 17.

Thus, I have provided a novel solderless connector which may be front connected to a terminal of a circuit breaker and rigidly secured thereto in a preselected angular position with respect thereto.

Although I have here described preferred embodiment of my novel invention, many variations and modifications will now be apparent to those skilled in the art, and I therefore prefer to be limited, not by the specific disclosure herein, but only by the appending claims.

I claim:

1. The combination of a solderless terminal connector and a circuit breaker terminal; said terminal having a flat front surface and a first opening therein; said connector comprising an open ended tubular member having a top and a bottom wall; a second opening in said top wall and a third opening in said bottom wall; a holding screw having a head small enough to pass through said second opening and too large to pass through said third opening; said third opening being positionable in alignment with said

first opening in said terminal; said holding screw having a threaded body portion passing through said third opening, and said screw to mate with threaded formations of said circuit breaker terminal opening to thereby firmly secure said connector and said terminal together; said head being positioned within said tubular member; a clamping screw assembly comprising a clamping screw and a rider rotatably secured thereto; said second opening being threaded; said clamping screw having a body portion having threads mated with the threads of said second opening; said rider being of sufficiently small size to pass through said second opening without engagement with the threads thereof; at least one protrusion extending outwardly from the bottom surface of said tubular member; said flat front surface having a plurality of circumferentially arranged recesses surrounding said first opening; said protrusion being positioned to be received by one of said recesses and when so received being effective to align said connector with said terminal in a selected predetermined angular position and prevent both clockwise and counterclockwise rotation of said connector with respect to said terminal from said predetermined angular position; said bottom wall of said connector abutting said flat front surface of said terminal when said connector is received by said terminal to maintain good electrical contact therewith, a circuit breaker casing having an aperture tapered inwardly toward the surface of said casing, a tapered cylindrical member having an axially aligned tapped aperture, said cylindrical member being mounted in said tapered aperture of said circuit breaker casing, said holding screw being adapted to engage the tapped aperture of said cylindrical member so as to rigidly secure said terminal connector and said circuit breaker terminal to said circuit breaker casing.

2. The combination of a solderless terminal connector and a substantially Z-shaped circuit breaker terminal; said terminal having a flat front surface and a flat rear surface and a first and a second opening therein; said openings being at opposite ends of said terminal; said connector comprising an open ended tubular member having a top and a bottom wall; a third opening in said top wall and a fourth opening in said bottom wall; a holding screw having a head small enough to pass through said third opening and too large to pass through said fourth opening; said fourth opening being positionable in alignment with said first opening in said terminal; said holding screw having a threaded body portion passed through said fourth opening, and said screw being adapted to mate with threaded formations in said first opening of said circuit breaker terminal to thereby firmly secure said member and said terminal together; said terminal connector further being fastened to a circuit breaker casing having a fifth opening by means of threaded

formations in said fifth opening, said flat rear surface engaging a flat surface of said casing, said head being positioned within said tubular member; a clamping screw assembly comprising a clamping screw and a rider rotatably secured thereto; said third opening being threaded; said clamping screw having a body portion having threads mated with the threads of said third opening; said rider being of sufficiently small size to pass through said third opening without engagement with the threads thereof; at least one protrusion extending outwardly from the bottom surface of said tubular member; said flat front surface having a plurality of circumferentially arranged recesses surrounding said first opening; said protrusion being positioned to be received by one of said recesses and when so received being effective to align said connector with said terminal in a selected predetermined angular position and prevent both clockwise and counterclockwise rotation of said connector with respect to said terminal from said predetermined angular position; said holding screw being adapted to secure said terminal connector, said circuit breaker terminal and said circuit breaker casing so as to prevent rotational movement therebetween; said bottom wall of said connector abutting said flat front surface of said terminal when said connector is received by said terminal to maintain good electrical contact therewith; said fourth opening being countersunk; said head of said holding screw being flat and positioned flush with the inner surface of said bottom wall; said clamping screw having a narrow shoulder section; said rider comprising a wafer-like member having a flat surface and an irregular surface; said flat surface being positioned adjacent to said shoulder section; said shoulder section being of substantially less diameter than said flat surface to thereby reduce the frictional surface forces acting between said clamping screw and said rider when an external electrical conductor is being secured to said solderless connector.

References Cited in the file of this patent

UNITED STATES PATENTS

615,455	Jones	Dec. 6, 1898
1,557,870	Pachman	Oct. 20, 1925
1,793,911	Dann	Feb. 24, 1931
2,239,100	Jackson	Apr. 22, 1941
2,285,928	Jensen	June 9, 1942
2,539,628	Kingdon	Jan. 30, 1951
2,777,119	Edmunds	Jan. 8, 1957

OTHER REFERENCES

Great Britain specification 449,152, published March 23, 1935.