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CONNECTOR FOR STRAP CONDUCTOR

Filed Feb. 15, 1960

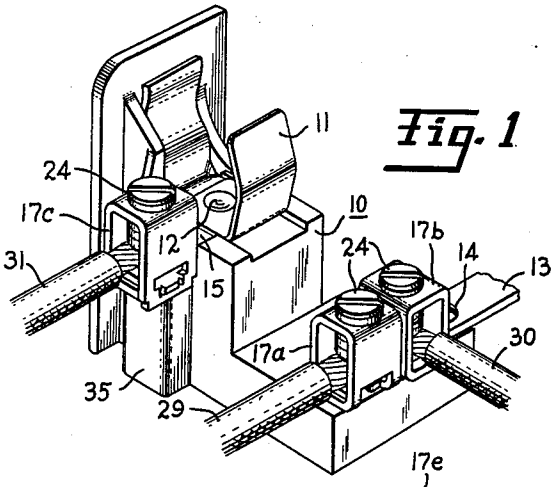


Fig. 1

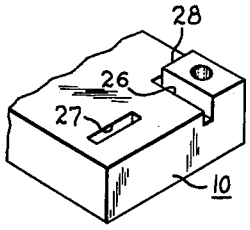


Fig. 3

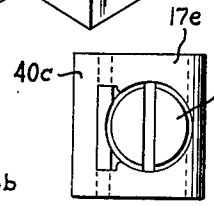


Fig. 9

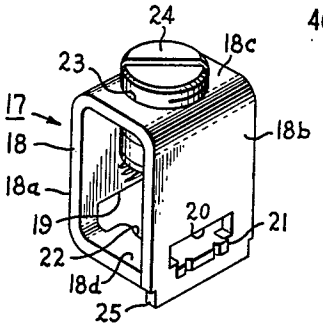


Fig. 2

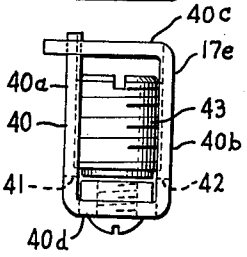


Fig. 8

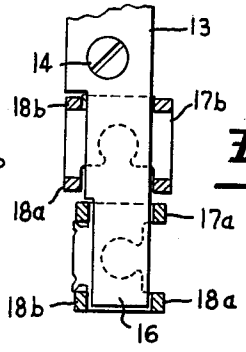


Fig. 4

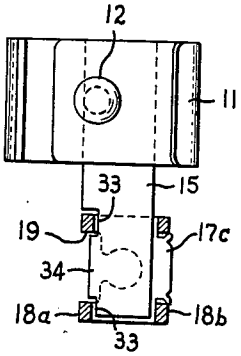


Fig. 5

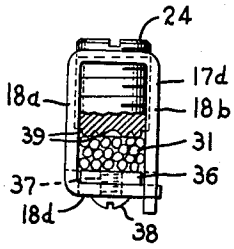


Fig. 6

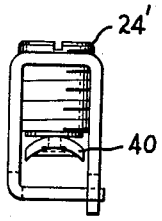


Fig. 7

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CONNECTOR FOR STRAP CONDUCTOR

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1 Claim. (Cl. 339—32)

Our invention relates to electrical connectors and particularly to electrical connectors of the type which are adapted to clamp a conductor or wire to a conductive flat strap or bus bar.

In electrical devices of the type which include an insulating base and conductive parts supported on the insulating base, there is often a need for electrical connectors of the type adapted to connect wires or cables to flat strap members mounted on such insulating bases, both at intermediate portions of such strap members and at projecting end portions.

The complexity and increasingly exacting requirements of modern electrical devices have generally required greater compactness and increased electrical capacity of such devices, both in terms of voltage and current. The expense of providing suitable connectors of the type described which are also adapted to contribute to such compactness and increased capacity constitutes a significant portion of the expense of such devices.

The requirements as to compactness, and the consequent limitations on space available are such that in many cases electrical connectors cannot be mounted to such conductive straps by conventional bolting means. In addition, it is often necessary or desirable in making optimum use of available space that the direction of access for such a conductor or wire to be connected by such a connector be at some times in line with the longitudinal direction of the strap and at other times to be at right angles to the longitudinal direction of the strap.

Electrical connectors of the type adapted to connect electrical wires or flexible conductors to flat conductive straps, according to the prior art, are generally restricted to making connections at a predetermined access direction. In addition, such connectors ordinarily require the use of mounting bolts to attach them to the conductive straps. Other types of connectors suffer from the disadvantage of relatively high cost as, for instance, being formed from a tubular stock with side punching or drilling operations necessary, or being cast, rather than being stamped and fabricated from relatively inexpensive flat strip metallic stock. Also, such connectors often require separate fabricating operations to provide a means for retaining them in proper predetermined position on such strap or insulating base and for preventing twisting about their mounting.

It is an object of the present invention to provide an electrical connector construction which may be mounted selectively in one of two predetermined desired relations on a conductive strap so that a wire or other conductor may be connected thereto with the access direction in line with the longitudinal direction of the strap or at right angles thereto, selectively.

It is another object of the invention to provide an electrical connector of the type described which may be fabricated from flat strip metallic stock.

It is a further object of the invention to provide an electrical connector of this type which is adapted to receive a flat metallic strap conductor therewithin to clamp the wire or other conductor directly against the strap, whereby the connector body itself may be constructed of relatively inexpensive metallic material such, for instance, as steel.

It is another object of the invention to provide a connector of the type described which includes a downwardly extending integral projection portion which may be utilized for positioning purposes.

In accordance with the invention in one form, an electrical connector assembly is provided comprising a generally tubular clamping body having aligned openings in its opposite side walls, extending to the bottom wall. The connector is adapted to receive a flat conductive strap member through the aligned openings in contact with the bottom wall, and the conductor may therefore be assembled onto such a conductive strap member selectively in either of two predetermined positions which are displaced ninety-degrees with respect to each other. In accordance with another aspect of the invention, the connector body is formed of a continuous strip of metallic material having its ends interlocked at one side of the connector body.

The invention will be more fully understood from the following detailed description, taken in conjunction with the accompanying drawing, and its scope will be pointed out in the appended claim.

FIGURE 1 is a perspective view of an electrical apparatus assembly embodying the invention;

FIGURE 2 is a perspective view of a portion of the assembly of FIGURE 1;

FIGURE 3 is a fragmentary perspective view of a portion of the insulating base of the assembly of FIGURE 1;

FIGURE 4 is a top plan view of a portion of the assembly of FIGURE 1 showing a conductive strap with two connector bodies mounted thereon, the latter being shown in section;

FIGURE 5 is a top plan view of another portion of the assembly of FIGURE 1 showing a conductive strap with a connector body mounted thereon, the latter being shown in section;

FIGURE 6 is an end elevation view of a connector constructed in accordance with the invention shown in clamped condition;

FIGURE 7 is an end elevation view of a modified form of the invention;

FIGURE 8 is an end view of a second modified form of the invention, and

FIGURE 9 is a top plan view of the connector of FIGURE 8.

In the drawings, the invention is shown as embodied in electrical apparatus comprising an insulating base portion 10 having an electrical fuse clip or fuse connector 11 mounted thereon by suitable means such as by rivet 12 and an electrically conductive strap member 13 also mounted on said base by means of screw 14. The fuse clip member 11 has an integral laterally extending strap portion 15 and the conductive strap 13 has an integral extension 16.

For the purpose of making electrical connection between conductors such as wires or other flexible conductors and the flat strap portions 15 and 16, in various ways, I provide an electrical connector indicated generally at 17 and comprising a body portion 18 formed of a single continuous strip of flat metal stock bent into a generally rectangular tubular configuration with opposed side walls 18*a* and 18*b* and opposed top and bottom walls 18*c* and 18*d*, respectively. The opposed side walls 18*a* and 18*b* are provided with aligned rectangular apertures 19 and 20 for a purpose to be described. The aperture 20 has a contiguous portion 21 which is adapted to receive the reduced end portion of the bottom wall 18*d*, the two parts being attached together by suitable means such as by staking or swaging. This construction provides an extension portion 25 of the side wall 18*b* which projects below the general plane of the bottom wall 18*d*, and is used for positioning purposes, in a manner to be described. It will be observed, that the

end of the bottom wall 18*d* fills the opening portion 21 but does not enter into the opening 20. Thus the rectangular openings 19 and 20 extend to and are terminated at one side by the bottom wall 18*d* of the body 18.

The bottom wall 18*d* of the connector body 18 is provided with a generally central circular aperture 22, which is preferably made contiguous with the opening 19 and the side wall 18*a* for the purpose of facilitating the stamping and bending of the part. The opening 22 serves to admit a mounting bolt when the connector is mounted in certain instances.

The top wall 18*c* of the connector is provided with a circular aperture 23 which is preferably made slightly larger in diameter than the distance between the inner surfaces of the walls 18*a* and 18*b*. The opening 23 is tapped to receive a clamping screw, the threads being continued in part in the intermediate side portions of the side walls 18*a* and 18*b* to receive a clamping screw 24.

The connector body 18 is preferably formed and dimensioned so that the apertures 19 and 20 in their longest dimension are approximately equal to the inner dimension between the side walls 18*a* and 18*b*. The connector body 18 may, therefore, be mounted on a conducting strap of the proper width in either of two positions which are ninety-degrees rotated with respect to each other, as indicated particularly at 17*a* and 17*b* in FIGURES 1 and 4. At 17*a* the connector is shown assembled on the strap 16 with the strap 16 extending between and parallel to the side walls 18*a* and 18*b*. At 17*b* the connector is shown assembled on the strap 16 with the strap 16 extending through the apertures 19 and 20, in a direction perpendicular to the side walls 18*a* and 18*b*.

In the assembly illustrated in the right-hand portion of FIGURE 1, and in FIGURE 4, the connectors 17 are first slid on to the extension 16 of the strap 13, and the strap 13 is then fastened to the base 10 by means of screw 14. When the strap 13 is thus mounted, the extension 16 retains the connectors 17 in place, with the projection 25 (see FIG. 2) of each of the connectors extending into correspondingly positioned recesses 26 and 27 in the insulating base 10. The strap 13 is preferably supported on a raised boss portion 28 of the base 10 so that the level of the strap 13 is such as to retain the bottom walls 18*d* of each of the connectors 17 properly in position on the general plane of the base 10. By means of the engagement of the projection 25 of each of the connectors in the recesses 26 and 27, the connectors are securely retained in position and prevented from sliding off of the extension 16, even when the clamping screws 24 thereof are in retracted condition. Following mounting of the connectors 17 in the manner described, conductors 29 and 30 are inserted into the connectors 17*a* and 17*b* respectively, and clamped directly to the extension 16 of the strap 13 by means of the clamping screws 24.

It will be observed that the conductor 29 enters the connector 17*a* in a direction parallel to the longitudinal direction of the strap 13, while the conductor 30 enters the connector 17*b* at ninety-degrees to the longitudinal direction of the strap 13. In many applications of such electrical devices, it is desirable to be able to insert a conductor in a predetermined direction to connect it to a strap, such direction depending on the general direction from which the conductor approaches. In the particular device illustrated, it is desirable that the conductors 29 and 31, which approach from the direction parallel from the longitudinal direction of the straps 15 and 16, respectively, be inserted in the connectors in that direction. At the same time, it is desirable that the conductor 30, which represents a ground conductor, be connected from a direction at ninety-degrees to the longitudinal direction of the strap 16.

In the case of connector 17*c*, the strap portion 15 projects from the fuse clip 11, beyond the insulating base 10, and therefore it is not possible in this case to retain the connector 17*c* on the strap 15 by means of the projection portion 25 entering a recess in the base 10. In order to retain the connector 17*c* on the strap 15, therefore, the strap 15 is provided with a pair of notches 33, see FIG. 5, which leave therebetween a projecting portion 34 of the strap 15 which is received within the opening 19 of the connector. The connector 17*c* is assembled on the strap 15 by tilting it slightly so that the strap 15 may enter and then turning it to an upright position with the portion 34 projecting through the opening 19 in the side wall 18*a*. When the fuse clip 11 and its associated strap 15 are mounted on the insulating base, such as by means of the rivet 12, the strap 15 retains the connector 17*c* in contact with a short ledge or shelf portion formed by the upper surface of a boss 35 of the insulating base, which ledge prevents the connector from dropping below the strap 15. The engagement of the projection 34 of the strap 15 in the opening 19 of the connector prevents the connector 17*c* from sliding off of the strap 15. The clamping screw 24 of the connector 17*c* is then used to clamp a conductor such as 31 directly to the surface of the strap 15 inside the connector 17*c*.

In FIGURE 6 there is shown another means of retaining a connector 17*d* on a conductive strap 36. In this case the strap 36 is provided with a suitable tapped aperture 37 and a conventional clamping screw 38 is inserted from the bottom wall through the opening 22 in the bottom wall 18*d* of the connector to clamp it to the strap 36.

It should be noted that the clamping screw 24 includes a clamping end portion which is generally flat but which includes annular embossed rings 39 near its outer periphery. With this construction, the clamping forces exerted upon a conductor such as 31 in FIGURE 6 are exerted relatively closely adjacent the side walls 18*a* and 18*b*. This contributes largely to the ability of the connector to exert high clamping forces on the bottom wall 18*d* without deforming either the conducting strap or the bottom wall.

In the form of the invention shown in FIGURE 7, the clamping screw 24′ is provided with a clamping member 40 which also assists in distributing the clamping force to portions of the bottom wall closely adjacent the opposite side walls of the connector body. The clamping shoe 40 is preferably rotatably attached to the clamping screw 24′ by an integral axial projection carried by the clamping screw.

In the form of the invention disclosed in FIGURES 8 and 9, the connector 17*e* is inverted in comparison to the form of FIGURES 1–7. In other words, the bight portion of the strip 40 forming the connector is utilized as the bottom wall 40*d*, and apertures 41, 42 are provided in the side walls 40*a*, 40*b* adjacent the bight portion.

The ends of the strip forming the connector 17*e* are interlocked as shown by passing a reduced end portion of the side wall 40*a* through an opening in the top wall 40*c*. This particular interlocking arrangement makes it possible to tap or cut threads into the aperture in the top wall 40*c* and the side walls without the side walls spreading.

This form has the advantage that the interlocked connection of the ends of the strip 40 is essentially isolated from the stresses cerated by clamping a conductor between the clamping screw 43 and the bottom wall 40*d*. Thus in this form it is not necessary to rivet or "stake" the end of the side 40*a* to retain it.

It will be observed that we have provided an electrical connector which is extremely simple and inexpensive to fabricate but which is nevertheless extremely effective and versatile. We have also disclosed certain novel combinations of such connector and electrical apparatus comprising an insulating base and conductive parts mounted thereon.

Since many modifications of the invention may be made, we therefore intend by the appended claim to cover

all such modifications as fall within the true spirit and scope of the invention.

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

An electrical connector formed of a single continuous strip of metal, said connector having opposed side walls and opposed top and bottom walls, a tapped aperture in said top wall, a clamping screw threadedly engaged in said tapped aperture in said top wall for clamping a conductor against said bottom wall, said opposed side walls having a pair of aligned generally rectangular openings therein extending to said bottom wall whereby said connector is adapted to receive a flat conductive strap selectively through said openings in said side walls in contact with said bottom wall or between said side walls, one end of said continuous strip extending through one of said openings in said side walls, said one opening being dimensioned so as to be only partially filled by said one end, the other end of said continuous strip including a portion projecting below said bottom wall, providing a projection suitable for retaining said connector on a supporting base.

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