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PLUG-IN CONNECTOR

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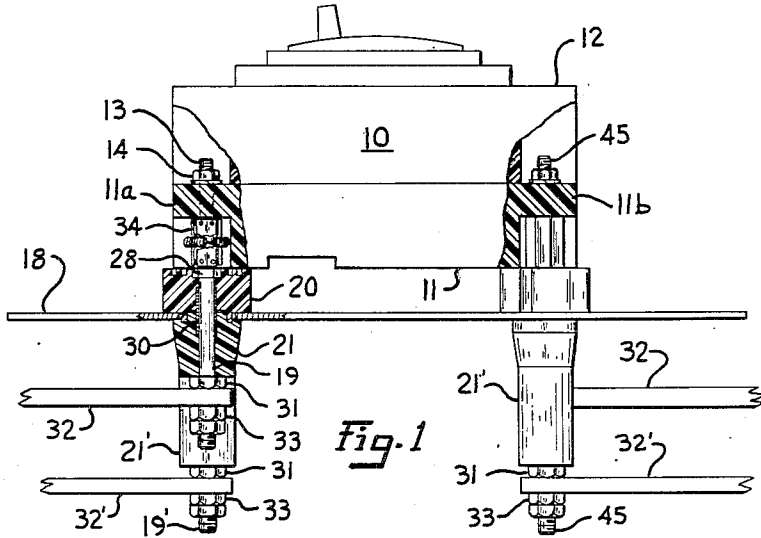


Fig. 1

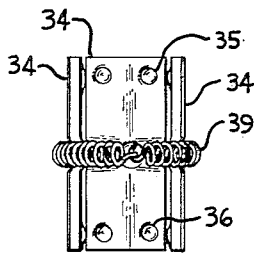


Fig. 2

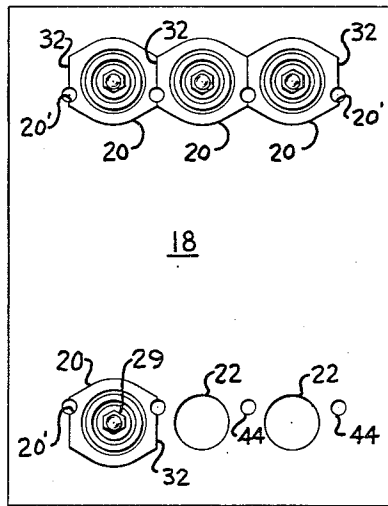


Fig. 4

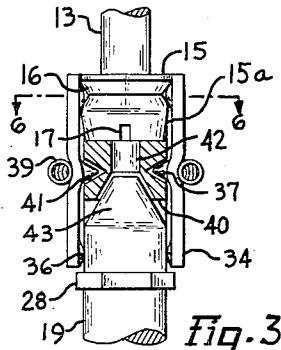


Fig. 3

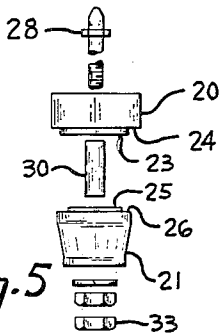


Fig. 5

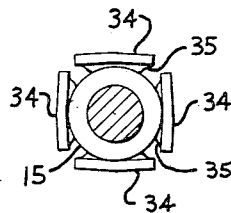


Fig. 6

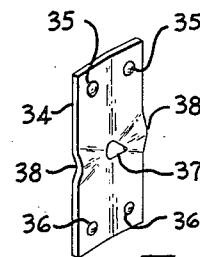


Fig. 7

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## PLUG-IN CONNECTOR

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2 Claims. (Cl. 339-255)

My invention relates to electrically connecting means of the plug-in type and particularly to plug-in connecting means adapted to connect two axially aligned conductive studs.

My invention more specifically relates to an improvement in detachable stud connecting means such as disclosed in Patent 2,490,514 issued December 6, 1940, to J. A. Favre and assigned to the same assignee as the present invention, and informally referred to in the trade as "tulip-type" connectors.

As disclosed in the aforesaid Favre patent, the prior design connector comprises a plurality of discrete detachable connector members of similar construction, each approximating a spherical section having outwardly flared end portions and adapted to be held in assembled relation by a pair of toroidal-shaped tension springs encircling the assembly at each of the flared ends.

While the prior design has functioned well and is generally satisfactory, its use has involved some inconvenience in that when the connector is detached from the studs with which it is intended to be used, its parts are subject to being easily displaced, causing the assembly to collapse and requiring reassembly of the parts, usually on one of the studs, before reconnection can be made.

It is an object of my invention to provide a detachable electrical connector for connecting adjacent ends of axially aligned conductive studs which is self-supporting when detached from said studs and not subject to being accidentally disassembled.

A further object of my invention is to provide such a connector which is relatively inexpensive to manufacture.

Another object of my invention is to provide such a connector which is adapted to be normally removably retained on one of said axially aligned studs when said studs are disconnected and which maintains itself in axial alignment with said stud in said disconnected condition.

In accordance with one important feature of my invention I provide a plurality of generally rectangular conductive sectors having a pair of contact projections at either end and a positioning projection generally centrally thereof, a supporting spacer having an annular groove in the periphery thereof for cooperation with said positioning projections and a single toroidal tension spring encircling the assembly intermediate its ends.

My invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the drawings,

Figure 1 is a side elevation view with portions broken away of a circuit breaker assembly including terminals equipped with a connector in accordance with my invention.

Figure 2 is a view on enlarged scale of the connecting means in accordance with my invention as shown in Figure 1.

Figure 3 is a view on enlarged scale of a stud assembly

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including my invention, portions of the connecting means being removed for clarity, and a portion being shown in section.

Figure 4 is a top plan view of the conductive stud mounting and insulating panel utilized in Figure 1.

Figure 5 is a view of the stud support and insulator of Figure 1, the parts being shown in exploded relation.

Figure 6 is a sectional view taken on the lines 6-6 of Figure 3, the spring being omitted.

Figure 7 is a view in perspective of one of the sectors of the connector of Figure 1.

For purposes of illustration I have shown my invention as embodied in mounting and connecting means for an electric circuit breaker. It will be understood, however, that the nature of the electrical device is immaterial and my invention may be utilized with any electrical device which it is desired to mount or connect by such means.

My invention is accordingly shown as embodied in an assembly comprising an electric circuit breaker 10 having an insulating casing comprising a base 11 and a cover 12. The circuit breaker 10 has conductive terminal studs 13 at one end electrically connected thereto and mounted on the base 11 by suitable means such as by providing the stud 13 with a threaded portion having a clamping or retaining nut 14 threaded thereon. The stud 13 passes through an aperture in a shelf portion 11a of the base 11, and has an enlarged portion 15 (see Figure 3) providing a shoulder adapted to be clamped against the base 11 by the action of the nut 14. The enlarged portion 15 of the stud 13 has an annular groove 16 therein for a purpose to be described. The enlarged portion 15 may also be provided with a screwdriver slot 17 for facilitating assembly and tightening of the stud 13 on the base 11.

The electrical device 10 is adapted to be supported on the panel 18 by suitable supporting and insulating means including conductive studs 19 and 45. In addition, the circuit breaker may be positively fastened to mounting panel 18, if desired, by suitable elongated bolts (not shown) passing through the aperture 44 in the panel 18, clearance being provided between the insulators 20 by the notches 20'. Each of the conductive studs 19 is mounted on, and insulated from, the panel 18 by insulating means including an upper insulator 20 and a cooperating lower insulator 21.

The panel 18 is provided with a number of circular apertures 22 illustrated in Figure 4 and each of the upper insulators 20 has a depending circular abutment 23 on its lower face adapted to be received within the aperture 22, and adjacent flat shoulder areas 24 adapted to overlie the upper surface of the panel 18. The lower insulator 21 has a raised circular abutment 25 on its upper surface adapted to be received within a corresponding circular recess in the upper insulator 20, and has adjacent shoulder portions 26 adapted to lie against the undersurface of the panel 18. The stud 19 passes through centrally aligned apertures in the insulators 20 and 21 and is provided with a non-circular enlargement or flange 28 adapted to seat in a conforming recess 29 in the upper surface of insulator 20. A short tubular insulating sleeve 30 surrounds the stud 19 at its intermediate portion adjacent the meeting faces of the insulators 20 and 21. The stud 19 has its lower portion threaded and adapted to receive a clamping nut 31 for retaining the parts in assembled relation and in position on the panel 18.

The assembly of the stud and its associated insulating parts on the panel 18 is accomplished in the following manner. The upper insulator 20 is placed in position with its abutment 23 within the aperture 22, the stud 19 is then inserted through the upper insulator 20 from its upper surface until the enlarged portion 28 is within the recess 29, the insulating sleeve 30 is then slid onto the

stud 19 from its bottom end, the lower insulator 21 is then slid onto the stud 19 from its lower end into mating engagement with insulator 20, and lastly the retaining nut 31 is assembled on the stud 19 and tightened, thereby clamping the parts together with a portion of the panel 18 therebetween in the position shown in Figure 1.

Each of the upper insulators 20 is preferably made of a predetermined width and provided with flat side surfaces 32 adapted to abut against similar surfaces of adjacent insulators and the apertures 22 in the panel 18 are preferably made oversize with respect to the circular abutment portions 23. By this means a number of the insulators 20 may be assembled on the panel 18 and brought in side-to-side abutting relation and the dimensions of the insulator 20 thus determine the center-to-center spacing of the studs 19. The center-to-center spacing of the studs 19 is thereby not dependent upon the accuracy of the location of the holes 22 in the panel 18.

In order to connect the studs 19 to a source of power and to a power consuming device, electrical bus bar conductors 52 are provided having apertures therein for receiving the lower portions of the studs 19 which have retaining nuts 33 threaded thereon. For the purpose of "staggering" the bus bars 32 to obtain maximum electrical clearance, I may space some bus bars, such as bus bars 32', farther from the panel 18 by utilizing studs 19' of greater length, combined with lower insulators 21' of greater length.

The studs 45 are identical to the studs 19 excepting that the upper ends of the studs 19 are shorter and terminate in a plain rounded end, adapted to be connected to the studs 13 by connecting means to be described. The upper ends of the studs 45 on the other hand, are elongated and threaded and are adapted to extend through the shelf portion 11b of the breaker and make bolted connection to a conductor therein (not shown).

For connecting the circuit breaker studs 13 of the panel studs 19, I provide a generally tubular multipart electrical connector including four generally rectangular contact members 34 each having a pair of spaced contact projections 35 and 36 at opposite ends thereof and a locating projection 37 generally centrally thereof.

For the purpose of holding the elements 34 together and urging them into good electrical contact with the respective studs, I provide a toroidal-shaped tension spring 39 which encircles the assembly at the mid-section thereof and has its ends hooked together.

Each of the contact elements 34 is preferably bent slightly in a lateral direction on a line passing through the center thereof and parallel to its long edges so as to better conform to the arcuate surface of the studs 13 and 19. Each element 34 also has its edges adjacent the central portion deformed inwardly a small amount at either side to provide a retaining seat 38 for spring 39.

Contacting projections 35 and 36 serve to provide a better electrical contact between the elements 34 and the studs 13 and 19. In addition, the projections 35 are adapted to be received in the annular groove 16 in the enlarged portion 15 of the stud 13. This provides a deflatable retaining engagement which serves to hold the connector assembly in place on the stud 13 when the electrical device 10 is removed. The connector assembly may, however, be removed from the stud 13 by pulling outwardly, which causes the projections 35 to become disengaged from the groove 16 against the bias of spring 39.

In order to retain the elements 34 in assembled relative position and prevent accidental disassembly or collapse of the structure when disconnected from the studs 13 and 19, I provide a centrally located discrete spacer member 40 (Figure 3) having an annular groove 41 in the periphery thereof and a central aperture 42 having an enlarged tapered portion 43 adapted to receive the tapered end of the stud 19. While the member 40 pref-

erably is made of metal, I may utilize suitable insulating material such as molded plastic or ceramic material if desired.

The central positioning projection 37 of each of the contact elements 34 is adapted to be received in the annular groove 41 of the spacer 40. This engagement performs several functions. Because of it, the contact elements 34 are prevented from becoming longitudinally displaced relative to each other whether the connector is on or off of the studs. In addition, the engagement of projections 37 in groove 41 assists in transmitting axial thrust exerted on the connector assembly in the process of inserting the studs therein. Thus either stud 13 or 19 may engage the respectively adjacent surface of spacer 40 during such assembly and exert a force on the projections 37. The interengagement of projections 37 in groove 41 also serves to retain the spacer 40 in its proper position. It will be understood that the diameter of the spacer member 40 is made slightly less than the diameter of the contact portion of each of the studs 13 and 19, so that when in assembled condition, such as in Figure 3, the force of the spring 39 is effective to urge the contact portions 35 and 36 against the respective studs 13 and 19.

The elements 34 are relatively inexpensive to manufacture since they do not require a large amount of deformation or drawing of the material. The necessity for outwardly flaring the end portions of the element 34 is obviated by the provision of the contact projections 35 and 36 together with the tapered construction of the ends of the studs 13 and 19.

In the application illustrated, travel of the electrical device toward the mounting panel 18 is limited by engagement of the bottom of the insulating base 11 with the upper surface of the insulator members 20 thereby establishing a limit beyond which the stud 13 does not approach the stud 19 and allowing the spacer 40 to "float" therebetween in assembled position. In the absence of such limiting means, the spacer member 40 is adapted to serve as an end stop to limit the approach of the two studs.

The end of the enlarged portion 15 of the stud 13 is preferably tapered slightly at 15a as shown. This construction, together with the engagement of the contact projections 35 in the groove 16, permits the connector assembly to accommodate itself to both studs even though the studs be slightly out of axial alignment.

A self-aligning action of the connector assembly of the stud 13 when disengaged from the stud 19 is also provided by my invention. In other words, when so disassembled, the connector assembly automatically aligns itself with the axial direction of the stud 13 due to the action of the parts under the influence of the spring 39.

While I have shown a particular embodiment of my invention, it will be understood that I do not wish to be limited thereto since many modifications thereof may be made. I, therefore, contemplate by the appended claims to cover any 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 electrical connector assembly comprising a plurality of elongated contact elements having contact surfaces adjacent the opposite ends thereof and a positioning projection generally centrally thereof, said elements being arranged in generally edge-to-edge relation so as to form an assembly having a generally cylindrical configuration, toroidal tension spring means surrounding said contact elements intermediate said ends, a generally cylindrical spacer member within said assembly having a peripheral groove therein adapted to cooperate with said positioning projections to prevent longitudinal displacement of said elements relative to each other and to limit the inward collapse of said elements under the influence of said tension spring means.

2. An electrical connector assembly comprising a plu-

ality of elongated contact elements each comprising a relatively wide, thin, flat member having contact surfaces adjacent the opposite ends thereof and a positioning projection generally centrally thereof, said elements being arranged in edge-to-edge relation to form an assembly of generally cylindrical configuration, a generally cylindrical spacer member within said assembly having a peripheral groove in the outer edge thereof adapted to receive said positioning projections to prevent longitudinal displacement of said elements relative to each other and to limit

the inward collapse of said elements, and a single toroidal tension spring encircling all of said elements concentric with said peripheral groove.

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