

[54] **ELECTRICAL RECEPTACLE AND CONNECTOR**

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[51] Int. Cl. **H01r 9/08**

[58] Field of Search **339/262 R, 262 P, 256 R, 339/258 R, 258 S, 259, 255 R, 95 R, 95 D, 223, 242, 217 R, 217 S**

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[57] **ABSTRACT**

The present invention relates to a self-locking receptacle type electrical contact as well as to a protective electrically insulating connector housing for such contact. A salient feature of the present invention is that the electrical contact is self-locking when received over a post-type electrical contact. Another salient feature of the invention is that the protective housing may be manually displaced with respect to the receptacle type contact for positively unlocking the contact from the post-type contact, allowing withdrawal of the receptacle type contact therefrom.

7 Claims, 8 Drawing Figures

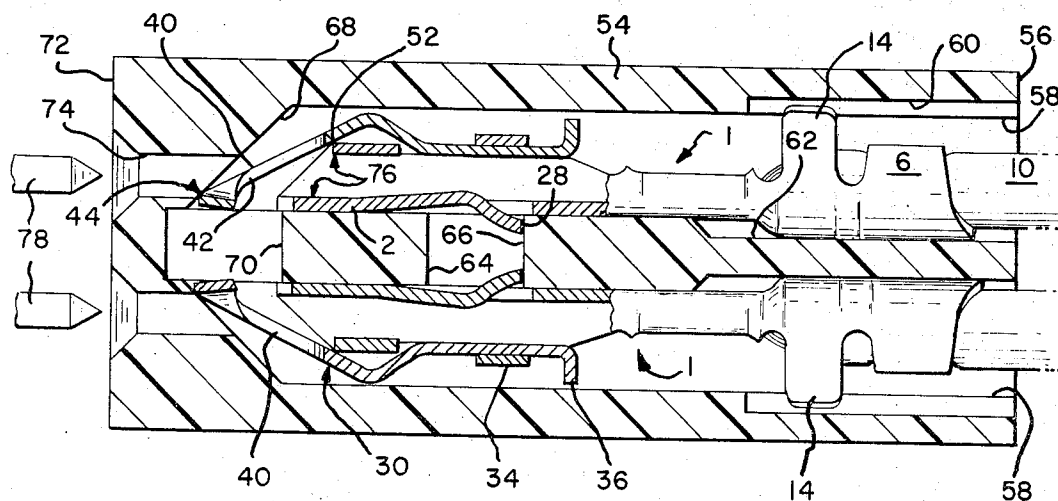


Fig. 1

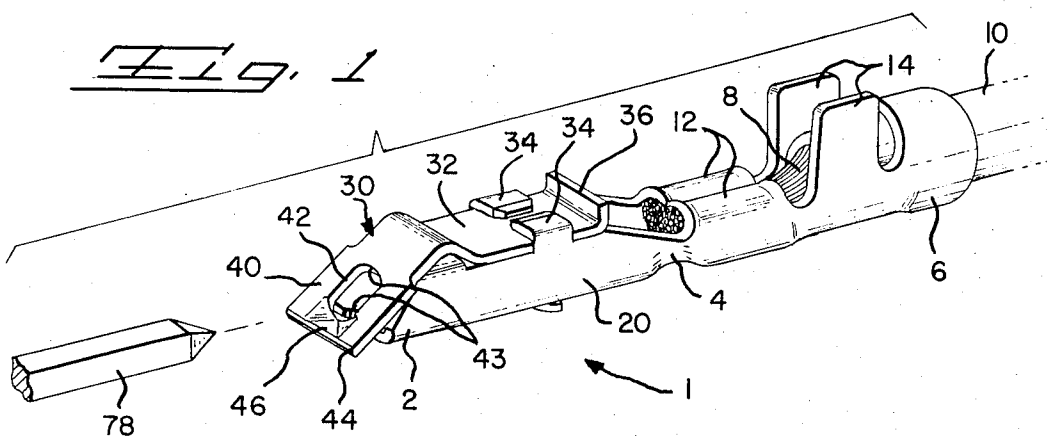


Fig. 2

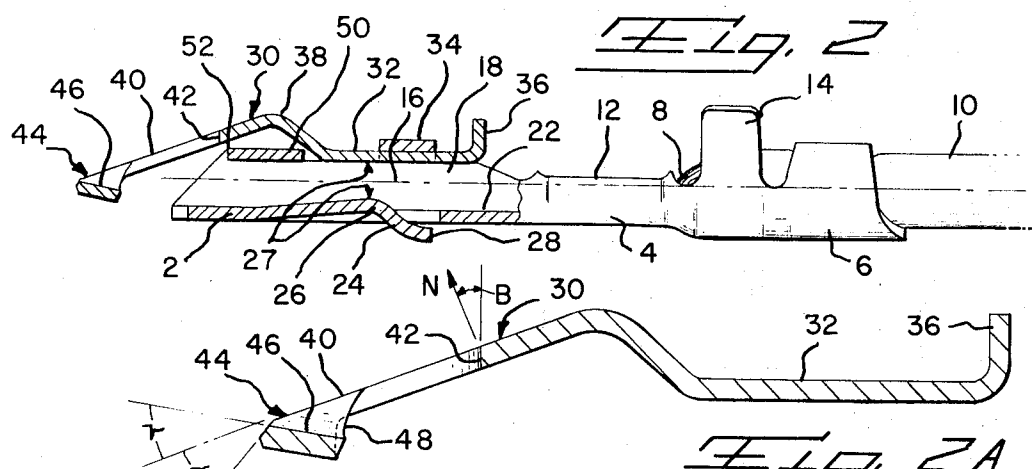


Fig. 2A

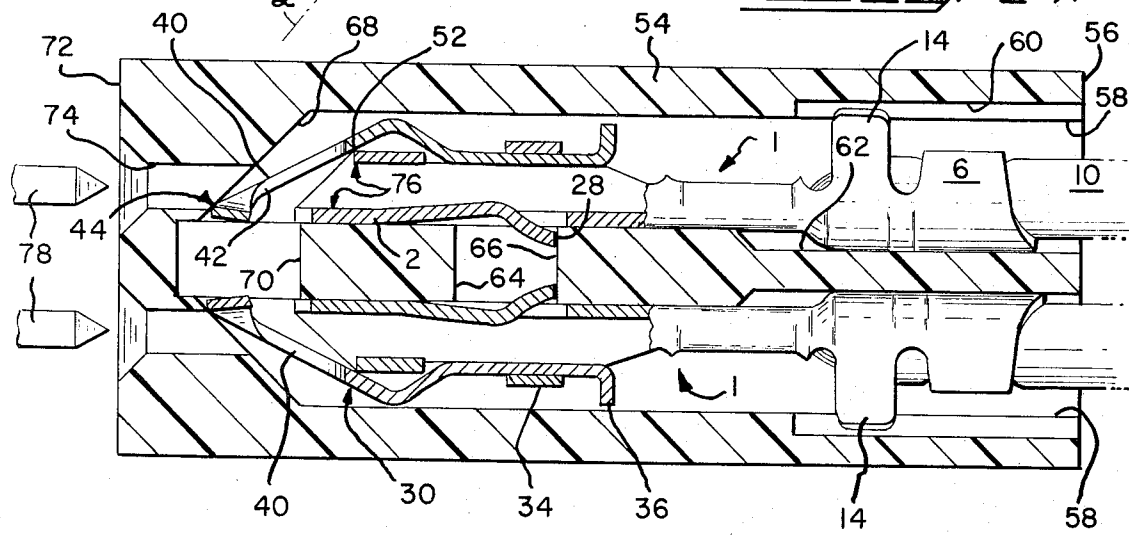


Fig. 3

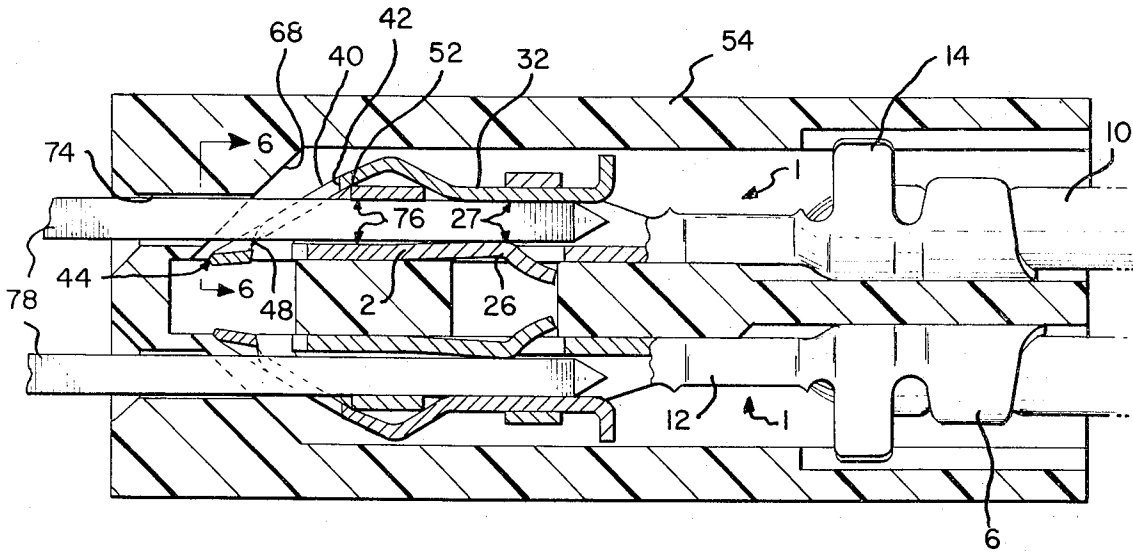


Fig. 4

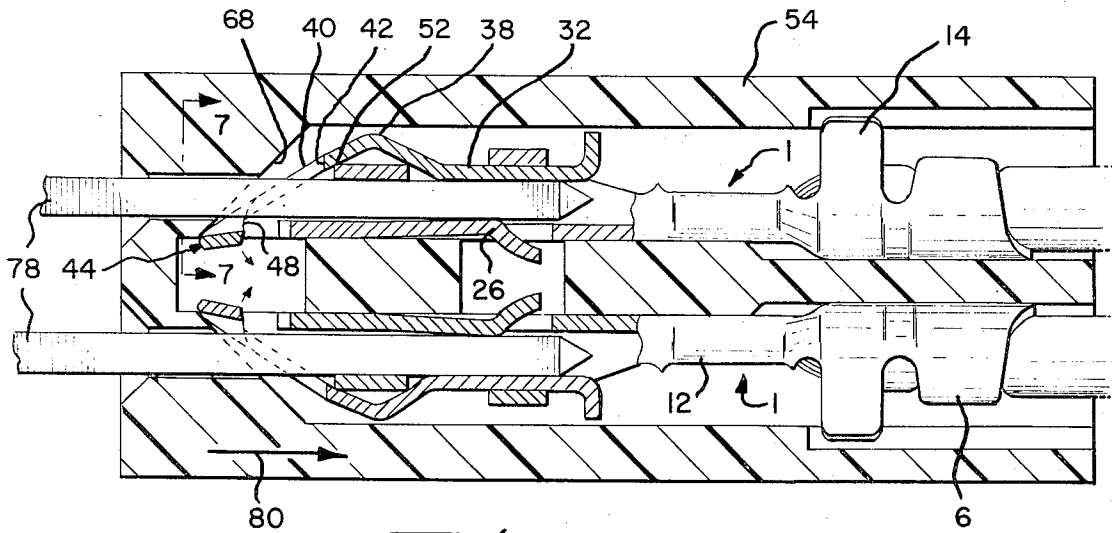


Fig. 5

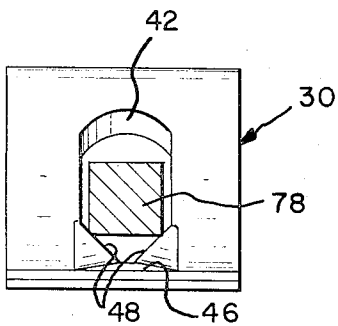


Fig. 6

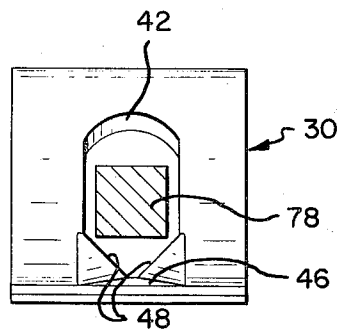


Fig. 7

ELECTRICAL RECEPTACLE AND CONNECTOR

The present invention relates to a self-locking receptacle type electrical contact as well as to a protective electrically insulating connector housing for such contact. A salient feature of the present invention is that the electrical contact is self-locking when received over a post-type electrical contact. Another salient feature of the invention is that the protective housing may be manually displaced with respect to the receptacle type contact for positively unlocking the contact from the post-type contact, allowing withdrawal of the receptacle type contact therefrom.

By way of example only, the present invention is particularly suited for making plug-in and pull-out electrical connections to terminal posts mounted on a panel board. Such a use is particularly described in U.S. Pat. No. 3,186,076, the patent describing a typical panel board as having a plurality of terminal posts mounted in a prearranged pattern relatively close to one another. Such posts are selectively interconnected by wire lengths electrically and mechanically secured to selected terminal posts by wire wrapping connections or clip-type terminations. The primary function of the post-type terminals is to provide locations for permanent electrical connections of the wires thereto. However, it is often desirable to provide temporary or otherwise removable electrical connections at the same locations. For example, it is often desirable to connect electrical testing equipment directly to such locations defined by the terminal posts in order to check electrical continuity at such locations. Also it is desirable to utilize the post-type terminals for plugging in other electrical equipment which is to be associated with the panel board. The receptacle contact according to the present invention is readily adaptable for such temporary or plug-in electrical connections directly to the terminal posts. More specifically, any desired number of receptacle contacts according to the present invention may be arranged in a connector housing according to the pre-arranged pattern of the panel board terminal posts. The selected receptacle contacts may then be simultaneously plugged into the panel board by receiving corresponding terminal posts therein. The receptacle contacts are self-locking onto the corresponding terminal posts to prevent their inadvertent removal therefrom. However, when it is desired to remove the receptacle contacts, the connector housing may be manually pulled by an operator, causing the housing to forcibly unlock each of the receptacle contacts from the corresponding posts. Accordingly, the present invention is especially suited for making self-locking, but readily removable plug-in type interconnections to terminal posts which are generally elongated and of generally constant cross section.

By way of another example, the present invention is well suited for making electrical connections to post-type terminals. In the prior art, electrical wires are terminated to post-type terminals which are fixedly mounted in plastic connector housing. Typically the posts are designed for plug-in insertion within corresponding receptacle type contacts contained within a mating plastic connector housing. The post terminals may be designed with cross sections either square, rectangular or of conic section. However, the posts must be provided with smooth external surfaces in order to reduce the amount of friction which would resist inser-

tion of the posts within the receptacle type contacts. The smooth surfaces provide however a disadvantage. It is very difficult for the receptacle contacts to latch or lock onto the smooth surfaced terminals. Thus, it has heretofore been difficult to design self-locking receptacle contacts for receiving and latching to smooth surfaced pin terminals. Accordingly, the mating connector housings had to be specially designed with mating latching mechanisms to prevent inadvertent unplugging of the receptacle type contacts from the pin terminals. Another problem associated with plug-in type interconnections is that if self-locking receptacle contacts were to be designed, it would be difficult to unplug the posts from the locked receptacle contacts, when only a temporary interconnection was desired. The present invention accordingly relates to a receptacle type contact which may be received with a low insertion force over a post-type terminal, the receptacle type contact being self-locking but readily unlocked from the post type terminal for removal from the pin terminal.

It is therefore an object of the present invention to provide an electrical receptacle type contact which is pluggable with a relatively low insertion force over a post type terminal, which is self-locking to the post type terminal and which is readily unlocked for disengagement from the post type terminal.

Another object of the present invention is to provide a self-locking receptacle type contact in combination with a protective insulating housing wherein slidable displacement of the housing over the contact positively unlocks and allows removal of the contact from an elongated post type terminal.

Other objects and many attendant advantages of the present invention will become apparent upon perusal of the following detailed description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is an enlarged fragmentary perspective of a preferred embodiment of a contact according to the present invention with parts illustrated in exploded configuration to illustrate the details thereof;

FIG. 2 is an enlarged elevation of the preferred embodiment illustrated in FIG. 1 with parts partially broken away and with parts illustrated in section to illustrate the details thereof;

FIG. 2a is an enlarged elevation in section illustrating the details of a portion of the preferred embodiment illustrated in FIG. 2;

FIG. 3 is an enlarged fragmentary elevation in section illustrating the preferred embodiment of the contact illustrated in FIG. 1 together with a protective insulation housing therefor;

FIG. 4 is an enlarged fragmentary elevation in section illustrating the preferred embodiment as shown in FIG. 3 and further showing a locking feature according to the present invention;

FIG. 5 is an enlarged fragmentary elevation of the preferred embodiment illustrated in FIG. 3 and further illustrating operation of the unlocking feature of the present invention;

FIG. 6 is an enlarged fragmentary section taken along the line 6—6 of FIG. 4; and

FIG. 7 is an enlarged fragmentary section taken along the line 7—7 of FIG. 5.

With more particular reference to FIG. 1 of the drawings, there is illustrated generally at 1 a preferred embodiment of a receptacle type electrical contact according to the present invention. The contact is similar

in some respects to that contained in U.S. Pat. application Ser. No. 982,742, filed Nov. 25, 1970. More specifically, the contact 1 includes a generally channel shaped portion 2, a transition portion 4 and a wire barrel portion 6. As shown with reference to FIGS. 1 and 2, the terminal is of low profile with the component parts 2, 4 and 6 being generally in alignment rather than of offset configuration as in the contact of the co-pending application. A multi-strand electrical conductor 8 partially protrudes from its encircling insulation covering 10 and is received generally internally of the channel shaped transition portion 4. The transition portion 4 includes a pair of integral ears 12 which are generally curled over and crimped into mechanical and electrical contact over the strands of the conductor 8. In such fashion the conductor 8 is electrically and mechanically connected to the receptacle type contact 1. To provide an insulation support, the wire barrel portion 6 is crimped into mechanical encircling engagement on the insulation layer 10 of the conductor. Disposed generally between the contact portions 4 and 6 are a pair of generally rectangular ears 14 which protrude and extend generally laterally of the contact longitudinal axis generally indicated at 16, which, as shown in FIG. 2, generally bisects vertically the receptacle portion 2 of the contact 1. As shown with reference to FIGS. 1 and 2, the receptacle portion 2 is generally of elongated channel shape defined by a pair of spaced parallel sidewall portions 18 which are generally rectangular in configuration and which are integral with a connecting bottom wall or base portion 22. A tang or first resilient spring tab 24 is struck out, for example by a stamping operation, from the bottom wall 22. As shown in FIG. 2, the spring 24 includes a medial portion 26 thereof formed so as to protrude into the interior of the channel shaped receptacle 2 in order to define a reduced throat area internally of the receptacle 2 and located generally offset in a direction laterally of the longitudinal axis 16 of the channel portion 2. In addition, the terminal end 28 of the spring 24 is formed so as to protrude externally of the base 22 for a purpose to be described hereinafter. With further reference to FIGS. 1 and 2, the channel portion 2 is made into an enclosed receptacle by the provision of a second spring generally indicated at 30. As shown the spring 30 includes a substantially planar medial portion 32 supported on each of the sidewalls 18 and 20. The medial portion 32 forms one of the sides of the enclosed configuration receptacle and also forms one of the sides defining the laterally offset restricted throat area 27. The medial portion 32 is secured on the channel shaped portion 2 by a pair of ears 34, each of which is integral with a corresponding sidewall 18 or 20 and which is clinched in overlying relationship on the medial portion 32. An edge margin 36 of the spring 30 which is adjacent to the medial portion 32 is generally folded into a flange portion extending at an angle with respect to the planar medial portion 32. Such folded flange portion serves as a stiffener for preventing any buckling of the planar medial portion 32, especially during clinching of the ears 34 and during the operation of the spring 30 in a manner to be hereinafter described. Yet with reference to FIGS. 1 and 2, the spring 30 includes another arcuately bent or formed portion 38 immediately adjacent to the planar medial portion 32. The spring 30 includes a nose portion 40 which is of generally planar configuration and which is integral

with and generally contiguous with the arcuately bent portion 38. The nose portion 40 is provided with an elongated aperture 42 therethrough. The aperture is provided with arcuate ends 43 as shown in FIG. 1. One of the arcuate ends is adjacent an elongated tip margin 44 of the nose portion 40. As shown the tip 44 is formed with a dished configuration as shown at 46, the dish portion 46 intercepting one of the ends 43 of the aperture 42 for a purpose to be described hereinafter.

Details of the nose configuration will be explained by reference to FIG. 2a which shows a greatly enlarged cross section of the spring 30. As shown in FIG. 2a, the tip margin 44 is chamfered for example by swaging to an angle Alpha of about 30° in order to remove any sharp edges which might interfere with the operation of the spring 30 in a manner to be described hereinafter. In addition, the elongated aperture 42 provided in the nose 40 is formed for example by punching at an angle Beta of about 15° with respect to the Normal N of the planar nose 40. The dished configuration 46 is provided by bending a portion of the nose 40 extending between the aperture 42 and the tip 44, to an angle Gamma of about 29° with respect to the planar surface of the nose 40. Such dished portion 46 thus provides, as shown in FIGS. 2a, 6 and 7, a pair of opposed generally mutually inclined biting edges 48 which appear to be of converging configuration and forming respective margins defining the periphery of the elongated aperture 42. The biting edges 48 are also inclined with respect to the planar nose 40 by virtue of extending between and interconnecting the dished portions 46 and the nose portion 40. The biting edges 48 are relatively sharp and appear to have a chamfered configuration because of the aperture 42 being formed at an angle with respect to the Normal. In effect, the edges 48 are chamfered to provide cutting edges.

With reference to FIGS. 2 and 3, when the spring 30 is assembled on the receptacle portion 2, the receptacle portion 2 has a generally rectangular planar strap portion 50 extending between the sidewalls 18 and 20 and provided with an edge margin 52 bridging between the sidewalls 18 and 20 and disposed generally under the planar nose portion 40 of the spring 30. The portion 50 may be fabricated integral with the receptacle portion 2 in a manner for example shown by the above referenced U.S. Pat. application Ser. No. 982,742.

By reference to FIG. 3, taken in conjunction with FIGS. 4-7, utilization of the contact 1 will be described more in detail. As shown in FIG. 3, there is provided a housing 54 of electrical insulation material provided at one end 56 thereof with a pair of generally rectangular elongated cavities 58 each containing therein a corresponding contact 1. FIG. 3 thus illustrates an exemplary protective housing of insulation material especially suited for receiving a pair of contacts according to the present invention. It should be understood that the housing may be fabricated to accept only one contact or any number of contacts as desired merely by repeatedly duplicating the internal cavity structure which will now be explained in detail. By way of explanation, only one of the internal cavity structures needs to be explained in detail, since the other cavity is merely a duplication and further explanation thereof is unnecessary. With reference to FIG. 3, the exemplary internal cavity 58 is provided with an internally grooved portion 60 communicating with the housing end 56 providing clearance for and slidably receiving

therein the flanges 14 of the contact 1. In addition, the internal cavity 58 is internally enlarged as shown at 62 for receiving the wire barrel portion 6 therein. The internal cavity 58 is provided with a laterally extending relieved portion or opening 64 into which the spring end tip 28 protrudes. The relief 64 defines a shoulder 66 against which the spring tip 28 engages. The internal cavity 58 terminates in a bottom wall 68 which is substantially inclined with respect to the sides of the internal cavity and against which the tip 44 of the nose 40 engages. Immediately adjacent the nose tip 44, the internal cavity 58 is provided with another laterally relieved portion or opening 70 which partially receives the nose tip 44 in a manner to be explained hereinafter. Another end 72 of the housing is provided with an opening 74 of reduced cross section and generally in alignment with an entrance 76 of the receptacle portion 2 which is positioned generally fixedly internally of the cavity 58. More specifically, the contact 1 is inserted in the cavity 58. The spring end 28 will initially be resiliently deflected generally in a direction internally of the receptacle portion 2 to allow free passage of the receptacle portion 2 into the cavity 58. When the nose tip portion 44 bottoms or engages the bottom wall 68, the spring end 28 will undergo return deflection and will be received internally of the relieved portion 64 against the shoulder 66. The receptacle portion 2 will thereby be fixedly retained from longitudinal motion internally of the cavity 58. As a further feature, the tip margin 44 when in abutment against the inclined bottom wall 68 will resiliently deflect the spring portion 40 generally toward the edge margin 52 of the receptacle. This will insure that the apertured portion 42 of the spring 40 will be generally in alignment with the entrance 76 of the receptacle and the aperture 74 of the housing 54. Such action additionally further maintains the receptacle portion 2 generally in compression longitudinally and thereby prevents longitudinal motion thereof when subjected to vibration.

Operation of the present invention will be described with reference to FIGS. 4-7. As shown in the figures, each of the contacts 1 within the housing 54 receives a post type elongated electrical contact 78 therein. As shown the contacts 78 are of generally square cross section but they may be of any desired cross sectional configuration such as rectangular or of conic section. As shown in FIG. 4, the housing 54 is readily received over a contact 78, the contact being received through a corresponding aperture 74 of the housing. The contact 78 is received through the aperture 42 of the spring nose portion 40, through the entrance 76 of the receptacle 2 and into the restricted throat area 27 of the receptacle 2. The spring portion 26 resiliently biases the contact 78 against the side of the receptacle which is formed by the planar portion 32 of the spring. Thus the portion 26 of the spring resiliently biases the contact 78 into the laterally offset restricted throat 27, with the contact 78 being in electrical contact with the spring 32 and also the spring portion 26. In addition, the dished portion disposed at the angle Beta provides an entrance for receiving the contact. Upon insertion of the contact 78 internally of the receptacle portion 2, the outer surfaces of the post will drag over the biting or cutting edges 48, further deflecting the spring portion 40 against the margin portion 52, allowing the spring 40 to resiliently buckle about the margin 52 to facilitate entry and passage of the contact 78 through

the apertured portion 42 of the spring portion 40. Such deflection causes the tip margin 44 to be resiliently deflected generally away from the bottom wall 68. Once the contact 78 is fully inserted into the restricted throat area 27, the self-locking feature of the contact 1 will prevent withdrawal of the contact 78 therefrom. More specifically, since the spring portion 40 is resiliently deflected upon insertion of the contact 78, sufficient clearance is provided between the tip margin 44 and the bottom wall 68 to allow the spring portion 40 to undergo return resilient deflection, thereby causing the biting edges 48 to be resiliently biased into biting engagement on the contact 78, as particularly shown in FIGS. 4 and 6. As is characteristic of all chamfered cutting edges, the cutting or biting edges 48 allows the contact 78 to drag freely thereover in one direction during insertion. However, during motion in an opposite direction, the biting edges 48 will bite into the contact 78, thereby locking the contact 1 on the contact 78. Also, as shown in FIG. 4, the return resilient deflection of the spring 40 has a tendency to bias the contact 78 in a direction generally clockwise as shown in the figure against the resilient biasing action of the spring portion 26. However, the spring portion 26 is chosen to be relatively more stiff in resilient deflection than the spring portion 40. Thus, the spring portions 26 and 40 cooperate to resiliently bias the contact 78 against the side of the receptacle formed by the planar spring portion 32. Accordingly, FIG. 4 illustrates that the apertured spring portion 40 is located adjacent the entrance 76 of the receptacle to provide a locking or latching portion initially located adjacent the entrance 76 of said receptacle to partially restrict the entrance from entry of the contact 78. The latching portion is however resiliently deflected as described by the insertion of the contact 78.

As shown in FIG. 5, the unlocking feature of the present invention will be described in detail. As shown in FIG. 5, the housing 54 is displaced in a direction generally indicated by the arrow 80 with respect to the contact or contacts 1 therein. Such displacement may be caused by an operator grasping the housing 54 and pulling the housing to displace it in the direction of the arrow 80. Such displacement forcibly engages the inclined bottom wall 68 against the tip margin 44, deflecting resiliently the spring portion 40 into engagement against the margin 52. Such displacement is continued, thereby forcing the spring portion 40 to resiliently buckle over the margin 52 which acts as a fulcrum. Resilient deflection of the spring portion without overstressing is assured since the contact portions 38 and 40 are substantially unrestricted, thereby allowing, not only a resilient buckling, but also a pivoting action of the spring portion 40 about the margin 52. The chamfer at the angle Alpha assures that the tip margin 44 slides over and does not bite into the bottom wall 68 during forcible deflection of the spring portion 40. As shown with reference to FIGS. 5 and 7, such deflection of the spring portion 40 resiliently biases the biting or cutting edges 48 away from engagement on the contact 78. Thus, the latching portion of the contact 1 is displaced from its initial position to a second position upon the resilient deflection of said spring portion 40. The latching portion in its second position is relatively removed from the entrance of the receptacle to allow relatively unrestricted access to the receptacle entrance as shown in FIG. 7. Thus, the pulling action ex-

erted by an operator not only unlatches the contact 1 from its corresponding contact 8 but also allows removal of the housing and contact 1 from the contact 78. The latching portion, being removed from the entrance in its second position is offset from the longitudinal axis of said receptacle. More specifically, the latching portion in its second position and the restricted throat area are offset in opposite directions from the longitudinal axis 16 of the receptacle. This assures that the contact 78 is positively biased by the relatively stiff spring portion 26 against the side of the receptacle provided by the planar spring portion 32 in a direction generally away from the biting edges 48 defining the latching portion of the spring portion 40. Thus, the spring portion 26, upon resilient deflection of the spring portion 40, continues to bias the contact 78 against one side 32 of the receptacle in a direction generally away from the latching portion in its second position, thereby allowing removal of said receptacle from the contact 78 without further biting engagement of the latching portion on the contact 78.

Although a preferred embodiment of the present invention has been described and illustrated in detail, other embodiments and modifications of the present invention are intended to be covered by the spirit and scope of the appended claims, wherein:

What is claimed is:

1. In the combination of an electrically insulating housing and an electrically conducting contact retained in said housing and adapted for receipt over an electrically conducting post, the improvement comprising:

a receptacle of electrically conducting material adapted to receive an electrically conducting post therein,

a first spring means on said receptacle resiliently biasing said electrically conducting posts against one side of said receptacle,

second spring means having a latching portion bitingly engaged on said post,

said second spring means being capable of resilient deflection to a second position for disengaging said latching portion from said post,

said first spring means upon resilient deflection of said second spring means continuing to bias said post against said one side of said receptacle in a direction generally away from said latching portion, thereby allowing removal of said receptacle from said post without further biting engagement of said latching portion on said post,

said housing having an apertured portion allowing passage therethrough of said post for receipt of said post in said receptacle, and

said housing being relatively movable with respect to said receptacle for forcibly engaging said housing on said second spring means and for resiliently deflecting said second spring means to said second position.

2. A connector for removable latching engagement over a male electrical terminal, comprising:

a housing having a cavity therein for removably receiving a male terminal,

an electrically conductive receptacle in the cavity of said housing,

the receptacle having an open end for removably receiving a male terminal therein,

the receptacle having a resilient spring tab defining a narrow throat area internally of said receptacle

for engagement upon a male terminal removably receivable in said receptacle,

the receptacle having a resilient leaf spring overlying the open end of said receptacle,

the leaf spring having an aperture therein capable of receiving therethrough a male electrical terminal, said leaf spring having a chamfered edge adjacent the aperture thereof, with the chamfered edge capable of being resiliently urged by said resilient leaf spring into latching and biting engagement on a male electrical terminal receivable in the receptacle and through said aperture of the leaf spring, and said housing being movable relative to said receptacle and into engagement against said leaf spring, to resiliently deflect said leaf spring and disengage the chamfered edge thereof from a male electrical terminal removably receivable in said receptacle and to permit removal of a male electrical terminal from said receptacle and said housing without further biting engagement of said chamfered edge against a male electrical terminal removably receivable in said housing.

3. The structure as recited in claim 2, wherein, said housing includes a first shoulder portion and an inclined inner wall, said receptacle includes a protruding portion thereof disposed between said first shoulder and said inclined inner wall for limiting relative movement of said housing with respect to said receptacle, said inclined inner wall being movable into engagement on said leaf spring, upon said relative movement of said housing, to resiliently deflect said leaf spring and thereby disengage the chamfered edge of said leaf spring from said male electrical terminal.

4. The structure as recited in claim 2, wherein, said leaf spring initially is in spaced relationship from said open end of said receptacle,

said leaf spring is capable of partial resilient deflection toward the open end of said receptacle to allow the leaf spring to resiliently urge the chamfered edge thereof into biting engagement on a male electrical terminal receivable in the open end of said receptacle, and

said leaf spring being capable of resilient deflection further beyond said partial resilient deflection, upon said relative movement of said housing into engagement against said leaf spring, to disengage said leaf spring from a male electrical terminal receivable in said receptacle.

5. A connector capable of removable latching engagement on a male electrical terminal, comprising:

a housing of dielectric material,

an electrically conducting receptacle in the housing adapted for receipt over a male electrical terminal, the receptacle having an apertured leaf spring receiving therethrough a male electrical terminal for resilient latching engagement of the leaf spring on the male terminal, said housing being relatively movable with respect to the receptacle for engagement of said housing against the leaf spring to deflect the leaf spring and to disengage the leaf spring from the male electrical terminal, permitting removal of the receptacle and the housing from the male electrical terminal.

6. The structure as recited in claim 5, wherein,

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said receptacle includes a body portion of channel configuration provided with an integral spring tab and further provided with an open end, said leaf spring overlies one side of the channel configuration body portion, 5
 an end portion of the leaf spring overlying the open end of the channel configuration body portion, a portion of said spring tab protruding into the channel configuration body portion to define a reduced throat area and the spring tab resiliently engage- 10
 able upon a male terminal receivable in the open end of the channel configuration body portion, an end of said leaf spring having a chamfered edge adjacent the apertured portion thereof for resilient latching engagement on a male electrical terminal 15
 receivable in the open end of the channel configuration body portion, the end of said leaf spring being in spaced relationship from said open end of said channel configura- 20
 tion body portion and capable of being resiliently deflected toward the open end configuration of

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said channel configuration body portion to disengage the chamfered edge of the apertured portion from the male electrical terminal, said spring tab being maintainable in protruding relationship within the channel configuration body portion to bias the male electrical terminal into said reduced throat area and away from the chamfered edge of the apertured portion, permitting withdrawal of the male electrical terminal from the receptacle without undesired engagement of the male electrical terminal against the chamfered edge of the apertured portion.
 7. The structure as recited in claim 6, wherein, said housing includes an internal wall portion adjacent the end of said leaf spring, the housing being movable relative to said receptacle for engaging the internal wall portion against the end of said leaf spring and for deflecting the leaf spring toward the open end of said channel configuration body portion.

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