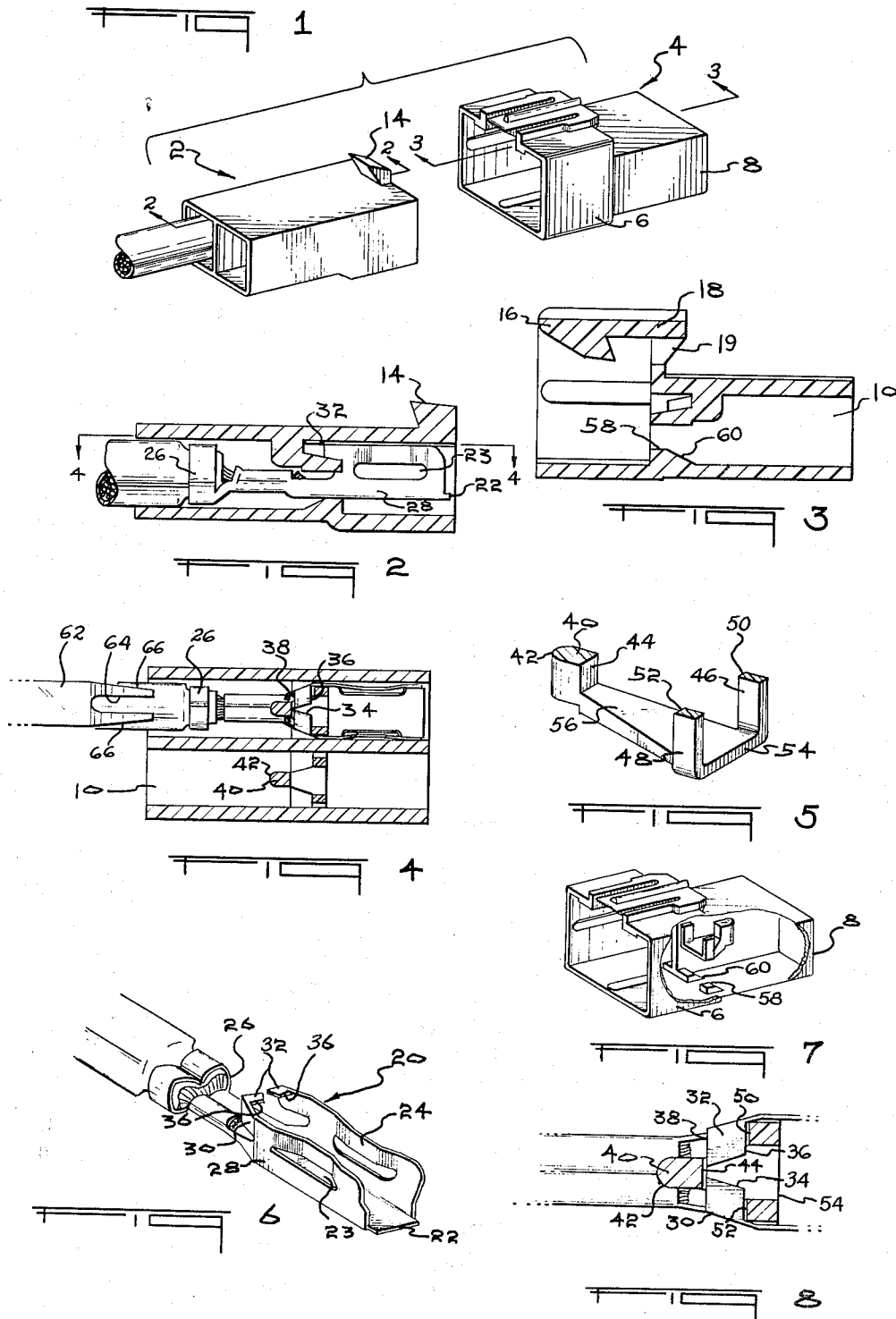


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ELECTRICAL CONNECTOR

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ELECTRICAL CONNECTOR

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This invention relates to disengageable electrical connectors and particularly to improved means for retaining contact terminals in connector housings.

An object of the invention is to provide an improved retention means for removably securing an electrical contact terminal in an insulating housing. A further object is to provide a retention means which permits removal of the contact terminal from the housing upon insertion of an extracting tool into the housing from the rearward side thereof rather than from the forward or mating side. A still further object is to provide a retention means on a contact terminal which is contained within the normal cross section of the terminal and does not have projecting arms, springs or the like. A still further object is to provide a retention means on a sheet metal terminal as an integral part thereof which takes up a minimum of space and which does not interfere with the other parts of the contact terminal such as the contact portion and the crimp portion.

These and other objects of the invention are achieved in a preferred embodiment thereof comprising a contact terminal having an intermediate channel-shaped portion from the opposite sidewalls of which a pair of arms extend rearwardly and slightly convergently towards the terminal axis. Flanges in the form of ears are provided on each of these arms and project transversely of the terminal axis towards each other, each of these ears having a transverse leading edge adjacent to the arm from which it extends and an adjoining tapering leading edge portion which tapers towards the terminal axis and rearwardly of the terminal. The contact terminal is formed by conventional die stamping and forming methods of stripped metal such as a conventional 70-30 brass so that the arms have a degree of resilience and can be elastically deformed outwardly for purposes of insertion or removal from a dielectric housing. The cavity in the insulating housing in which the terminal is contained has a first retaining boss projecting from its wall and defining a forwardly facing shoulder which engages the trailing edges of the above-mentioned ears when the terminal is in position. An additional pair of bosses are provided in the cavity forwardly of the first retaining boss and have rearwardly facing shoulders which engage the leading edges of the retaining ears so that after insertion, the contact terminal can not be moved forwardly or rearwardly in the housing of the cavity. Initial insertion of the contact terminal into the housing cavity is accomplished by merely pushing the terminal through the cavity until the tapered leading edges of the ears engage the first boss which spreads them apart with accompanying resilient deflection of the arms of the terminal. After the ears have passed the first boss, they spring inwardly towards each other until the leading edges engage the rearwardly facing shoulders of the second bosses and the trailing edges engage the forwardly facing shoulder of the first boss as described above.

In the drawing:

FIGURE 1 is a perspective view showing a matable pair of connector housings in accordance with the invention.

FIGURES 2 and 3 are views taken along the lines 2-2 and 3-3 of FIGURE 1.

FIGURE 4 is a view taken along the lines 4-4 of FIGURE 2 and illustrating the manner in which the contact terminals are retained in the insulating housing.

FIGURE 5 is a fragmentary perspective view showing the retaining bosses which are disposed in the cavities in the connector housing and integral with the connector housing.

FIGURE 6 is a perspective view of a contact terminal in accordance with the invention.

FIGURE 7 is a perspective view with parts broken away showing the interior of a cavity of a connector housing.

FIGURE 8 is an enlarged fragmentary view showing the retaining ears of the terminal and the retaining bosses in the housing.

A preferred embodiment of my invention comprises an electrical connector assembly consisting of a plug portion 2 and a socket portion 4 which has a generally rectangular rearward end 8 and an enlarged forward or mating end 6 for the mating end of the plug. One or more cavities 10 extend through each of the connector parts and contact terminals 20 (FIGURE 6) are disposed in the cavities so that upon engagement of the parts the terminals will be engaged with each other. In the drawing, contact terminals are shown in only some of the cavities in order to clearly show the interior form of the cavities.

Plug 2 has an upstanding lug 14 on its upper side for engagement with the hooked end 16 of a latch arm 18 integral with the socket 4. The housings 2, 4 may be of any suitable insulating material which is relatively firm although its properties should be such that the integral latch arm 18 can be deflected in a clockwise direction to permit engagement and disengagement of the plug and socket member. In the disclosed embodiment the latch arm is integral with the body of the socket member through struts 19 which are deformed when the rearward or rightward end of the latch arm is depressed. A relatively firm nylon, for example, has been found to be a satisfactory material for the housing shown.

The electrical contact terminal shown is of the general type described and claimed in my copending application, Serial Number 70,533, filed November 21, 1960, for Electrical Connector and now Patent Number 3,083,545. Contact terminals of this type comprise a generally channel-shaped contact portion 22, the sidewalls of which are provided with axially extending slots 23. Intermediate the ends of this contact section of the terminal, the sidewalls are inwardly displaced as shown at 24 by a distance such that two of the terminals can be nested within each other with the lower portions of the sidewalls of one terminal received between the inwardly displaced sections 24 of the other terminal as fully explained in my above-mentioned patent. The rearward end of the terminal has a crimp portion generally indicated at 26 by means of which it is secured to both the conducting core of the wire and to the insulation thereof in order to achieve both an electrical connection and a mechanical connection between the wire and the contact terminal. The retention means on the terminal for retaining it in its insulating housing 2 or 4, which constitutes the instant invention, is provided between the forward contact end of the terminal and the crimp portion and will now be described.

An intermediate portion 28 of the terminal has a channel-shaped cross section, the sidewalls of which have arms 30 extending from their upper ends rearwardly and slightly divergently of the terminal axis. The longitudinal upper edges of these arms 30 are provided with inwardly directed ears 32 at their extremities which project towards each other and which in the disclosed embodiment touch each other or very nearly touch each other. The leading edges 36 of these ears which are adjacent to the arms 30 extend substantially transversely and normally of the terminal axis. The leading edges then taper rearwardly of the terminal and towards the axis thereof as shown at 34, these tapering leading edge portions constituting a camming edge and the transverse leading edge

portions constituting an abutment edge as is described more fully below. The trailing edges of the ears 33 extend substantially transversely of the terminal axis to provide rearwardly facing abutment edges.

The cavity 10 is of substantially rectangular cross section and has a first integral boss 40 depending from its upper side as viewed in FIGURE 3. This boss is centrally located relative to the cavity axis and has a rearward side 42 which slopes divergently from the cavity axis to the otherwise uniform cross section of the boss as is shown in FIGURES 5 and 8. Boss 40 provides a forwardly facing shoulder 44 on its forward end for engagement with the terminal trailing edges 38 of the ears 32.

An additional pair of bosses 46, 48 are provided on the upper surface or side of the cavity 10 forwardly of the boss 40 and are of substantially rectangular cross section thereby to form rearwardly facing shoulders 50, 52 disposed on opposite sides of the axis of the cavity and on opposite sides of shoulder 44. The distance separating the plane of the shoulders 50, 52 from the plane of the shoulder 44 is substantially equal to or preferably slightly greater than the width (as measured along the terminal axis) of the ears 32 so that these ears can be received between the pairs of bosses. The lower ends of the bosses 46, 48 are integrally joined as shown at 54 and are also integral with the lower end of the boss 40 by an axially extending strap 56. This strap is molded integrally with the bosses and is inclined from the boss 40 towards the bosses 46, 48. The inclined surface on this strap is the result of preferred molding practice in that a tapered core pin is used as the mold.

In use, a connector assembly in accordance with the invention can be made by first crimping a terminal of the type shown in FIGURE 6 onto the end of a wire and inserting the terminal leftwardly in FIGURE 3 through the rearward end of the cavity until the tapered leading edge portions 34 of the ears engage the rearwardly facing surface of the boss 40. At this stage of the inserting operation, the ears will be pushed outwardly and the arms will be flexed about their ends to permit these tapered surfaces to move over the sides of the boss 40 until the trailing edges of the ears pass the shoulder 44. The arms will then spring inwardly towards each other so that withdrawal of the terminal from the cavity will be prevented by virtue of the abutting relationship between the trailing edges of the ears and the shoulder 44. Forward motion of the terminal from the position shown in FIGURE 4 is, of course, prevented by virtue of the abutting relationship of the leading edge portions 36 of the ears and the rearwardly facing shoulders 50, 52 of the bosses 46, 48.

Cavity 10 is advantageously provided with elevated surfaces 58 on the wall thereof opposite to the bosses 46, 48 which elevated surfaces merge with a ramp 60 extending to the floor of the rearward portion of the cavity. These elevated surfaces are provided for the purposes of limiting the allowable movement of the contact terminal after insertion laterally of its axis so that when the two connector parts are brought into engagement with each other, the contact terminals will be in alignment to the extent that they will properly engage with each other. In order to control the positions of the contact terminals, it is common practice to provide abutments or surfaces in the cavity to limit their movement although some such movement (commonly referred to as float) must be permitted.

A salient feature of the invention is that if the wire to which the terminal is attached should be subjected to a substantial pulling force tending to withdraw the terminal from the cavity, this pulling force will first be resisted by the boss 40 which will be subjected to a shearing stress imposed upon the forwardly facing shoulder 44 by the trailing edges of the ears. However, the boss 40 does not bear the entire load for the reason that the strap 56 is placed in tension after the boss 40 has been slightly deformed and the pulling force is thereafter resisted also

by the anchoring effect of this strap and the bosses 46, 48. The same effect takes place if the terminal is pushed towards the mating end of the housing in that the initial load applied will be borne by the bosses 46, 48 and will thereafter be borne jointly by the bosses 46, 48 and the boss 40 when the strap is tensioned. This feature of the invention permits the ears themselves and the bosses to be relatively small and assures their ability to retain the terminal in the housing even if a relatively high axial force, either a pushing force or a pulling force is applied to the terminal. The bosses are not permitted to deform by virtue of this strap arrangement to the extent such that the ears would be permitted to ride over the bosses and thereby permit escape or removal of the terminal from the housing. The ears 30 are extremely strong even though they may be quite small for the reason that they are stressed in their own planes.

An additional advantage of the invention is that the retaining ears 32 which constitute the entire retaining mechanism of the terminal can be easily formed by conventional die-stamping and forming methods and after forming are contained within the normal cross section of the terminal so that no projecting retaining parts (as struck-up tangs) which are susceptible to damage are on the terminal. The ears need not be formed to an extremely high degree of dimensional precision since they need not touch each other as in the disclosed embodiment but a gap can be left between the adjacent sides of the trailing edges of the ears and a clearance can remain between the ears and the shoulders 46, 48, 44.

If it is desired to remove an individual contact terminal from its housing, a blade type tool 62 is employed having a notch 64 in its leading edge and having tapered sides 66 on each side of the notch, the notch and the tapered sides being so dimensioned that the tool can enter the cavity until the tapered sides 66 engage the intermediate U-shaped portion of the terminal whereby the sidewalls of this portion can be forced apart and the terminal can be withdrawn by exerting a pulling force on the wire.

It is not essential that the abutment means comprising the shoulders 50, 52 which prevent forward motion or movement of the terminal be provided on two separate bosses connected at their extremities by the strap 54 as shown in the preferred embodiment. If desired, the space between these two bosses 46, 48 can be filled in so that the two shoulders 50, 52 become one continuous shoulder extending transversely across the cavity. The disclosed construction is, in fact, dependent upon molding practice in that it is necessary to accommodate a core pin when the housings are molded which extends along the cavity axis and up to the shoulder 44 from the right as viewed in FIGURE 2.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

I claim:

1. Disengageable electrical connector means comprising, an insulating housing having a cavity extending therethrough, a first retention boss means projecting from a wall of said cavity and having a forwardly facing retention surface extending transversely of the axis of said cavity, and a second retention boss means having rearwardly facing retention surfaces extending transversely of the cavity axis, said rearwardly facing surfaces being disposed forwardly in said cavity and said forwardly facing surface and extending transversely beyond said forwardly facing surface on each side thereof, a contact terminal in said cavity, said terminal having a pair of axially extending sidewalls in straddling relationship to said first and second boss means, and inwardly directed ears on said sidewalls projecting towards each other and extending between said forwardly and rearwardly facing

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retention surfaces thereby to restrain said terminal against forward and rearward movement.

2. A connector as set forth in claim 1 wherein said second retention boss means comprises a pair of bosses disposed one on each side of said first boss means relative to the axis of said cavity.

3. A connector as set forth in claim 1 including a tensional strap integral with the extremities of said first boss means and said second boss means thereby to distribute a thrust applied to said terminal in either axial direction among both of said boss means.

4. A connector as set forth in claim 1 wherein said terminal has a substantially channel-shaped portion, said channel-shaped portion extending forwardly in said cavity of said second retention boss means, said axially extending sidewalls being integral with and extending rearwardly from said channel-shaped portion.

5. A connector as set forth in claim 1 wherein said inwardly directed ears have opposed edges which taper rearwardly of said terminal and towards the longitudinal axis thereof, said first retention boss means having a rearwardly facing side which slopes divergently forwardly in said cavity thereby to permit insertion of said terminal into said cavity from the rearward side of said housing with elastic deflection of said sidewalls during passage of said ears past said first boss means.

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6. An electrical contact terminal which is insertable into and removable from a cavity in an insulating housing, said terminal having retention means thereon for retaining said terminal in said cavity, said terminal having a channel-shaped portion intermediate its ends, a pair of rearwardly extending arms integral with the sidewalls of said channel-shaped portion, and an ear on each of said arms, said ears extending towards each other and having tapered leading edge portions which taper rearwardly and towards the longitudinal axis of said terminal, and said ears each having adjacent leading edge portions which extend transversely of the axis of said terminal, said tapered leading edge portions of said ears functioning as camming surfaces to deflect said arms outwardly when said terminal passes a central boss in a cavity and said transverse adjacent leading edge portions functioning as abutments for engagement with other bosses in said cavity.

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