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C. J. ADAMS

2,477,849

CONTACT FOR MULTIPLE CONNECTORS

Filed Nov. 12, 1946

2 Sheets-Sheet 1

Fig. 1.

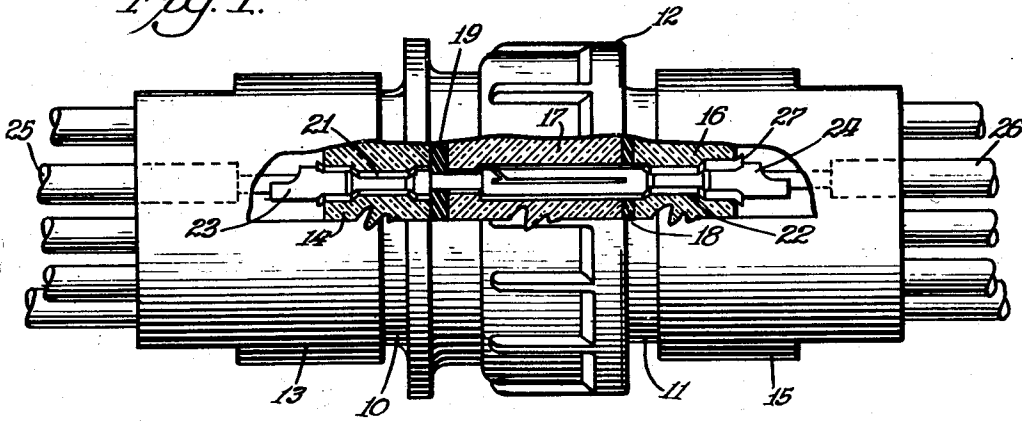


Fig. 2.

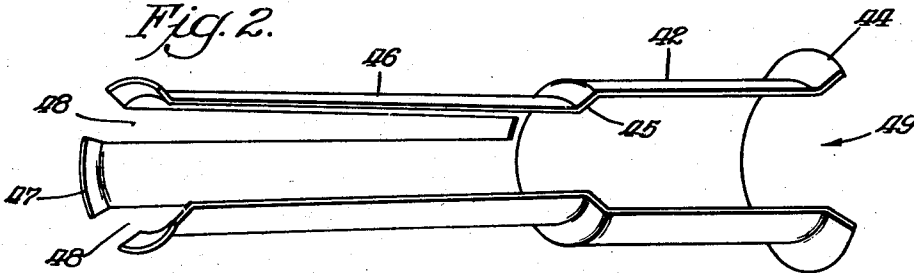


Fig. 3.

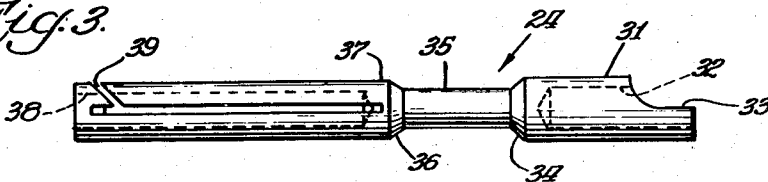
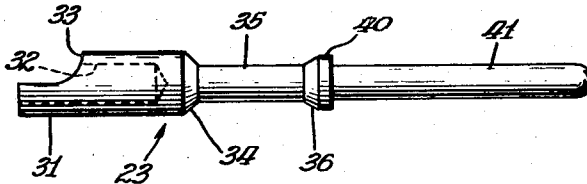


Fig. 4.



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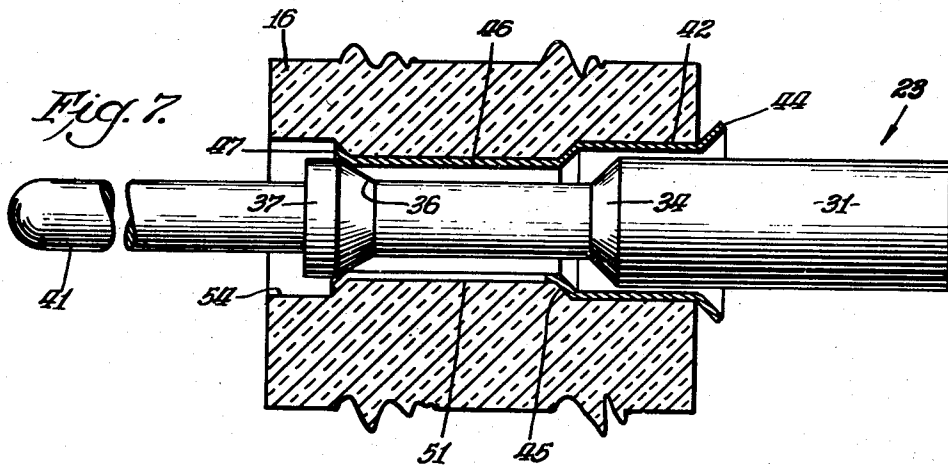
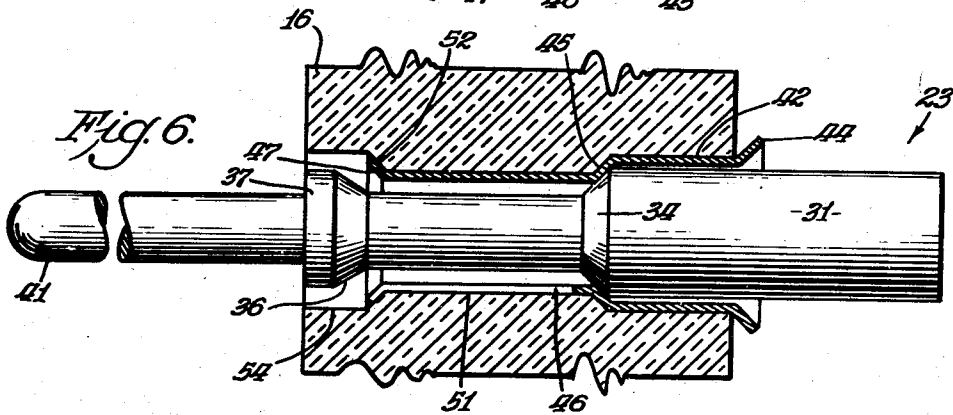
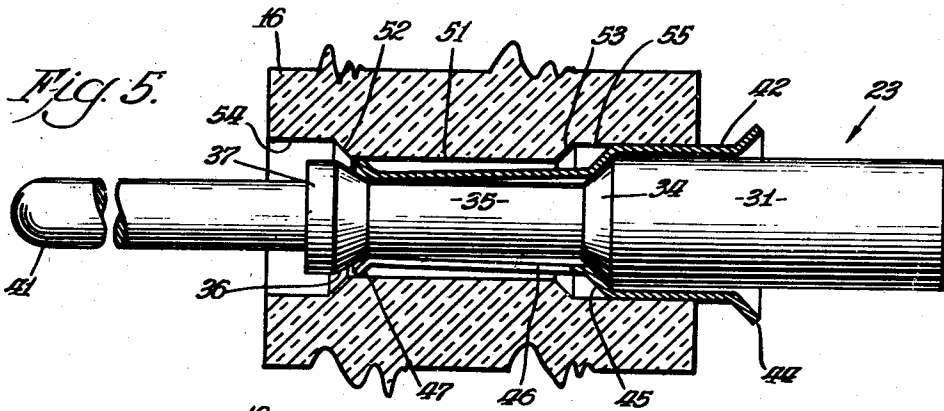
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2 Sheets-Sheet 2



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# UNITED STATES PATENT OFFICE

2,477,849

## CONTACT FOR MULTIPLE CONNECTORS

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10 Claims. (Cl. 173—328)

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This invention relates to a lock in device and is specifically directed to multiple connectors wherein the individual contacts are of the push-in type, become automatically locked in place, and yet remain free to rotate and readily removable for servicing, substitution and the like.

In the type of devices with which this invention is concerned, conduits or flexible cables are connected to each other by fittings including a pair of connecting pieces each having a multiplicity of contacts carried on insulating mounting elements and soldered to the several conductors of the cable. The contacts are arranged to be connected to corresponding contacts in the mating connector in a plug-in manner. Connectors of this general description are widely used in many types of electrical apparatus, but certain difficulties have been encountered due to the fact that in a connector having a large number of contacts the very close physical proximity of the contacts makes it difficult to solder or crimp the individual wires of the cable in position. Also, when once soldered or crimp, it becomes difficult to inspect the individual joints and to locate any faulty connection that may exist or trace any short circuit that may have developed. It has been previously recognized that important advantages would flow from the provision of some type of contact that could be secured to the conductor before being positioned in the mounting piece of the connector and could thereafter be pushed into position, and while certain efforts have been made to provide a device of this general character those devices heretofore devised have been subject to certain disadvantages that have rendered them impractical for commercial manufacture and unsatisfactory in actual use.

It is the general aim of the present invention to provide a push-in contact for a multiple connector that is at once simpler to manufacture and more satisfactory to use than those heretofore known, so that the obvious advantages of this type of structure may be utilized without sacrifice of the simplicity and positiveness of operation of connectors utilizing conventional contacts.

To this end, it is one of the principal objects of the present invention to provide a push-in type of contact for multiple connectors, designed and constructed so that it may be assembled or disassembled in the connector quickly and easily, without the use of tools.

A further object resides in the provision of a push-in contact characterized by a simple, sturdy and rugged construction of the contacts and locking devices, so that they are capable of with-

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standing long continued service and considerable abuse without requiring replacement or repair.

A further object of the invention resides in the provision of a simple type push-in contact for a multiple connector, together with a mounting element for the contacts wherein the individual parts are shaped to eliminate any necessity of any complicated coring of the mounting element, so that both the contacts and the molded parts in which they are mounted are well suited to economical methods of manufacture.

A further object of the invention consists in providing a type of push-in contact which will remain freely rotatable within the mounting pieces. One result of such a construction is that any twists or kinks in the lines attached to the contacts are free to release themselves automatically and other advantages of this type of construction are obvious.

The foregoing objects are accomplished in the present disclosure by the provision of a push-in type of connector which includes a number of pairs of mated contacts, each provided with a neck portion of reduced diameter terminating in outwardly flared ends. The individual contacts are arranged to be locked in position in the mounting elements of the connector by a simple split sleeve, snapped in position over the neck of the individual contact and before it is slipped into the cavity in the element.

A present preferred embodiment of the invention is illustrated in the drawings attached to and forming a part of this specification. In the drawings

Figure 1 is a side elevational view of a multiple connector with portions thereof being broken into sections to illustrate the relationship of the contact elements to the main structure of the connector.

Figure 2 is a perspective view of a locking sleeve as contemplated by this disclosure.

Figure 3 is a side elevational view of one of the female contacts.

Figure 4 is a side elevational view of one of the male contacts.

Figure 5 is enlarged cross-sectional view through the cavity in the contact mounting piece showing one position the contact and locking sleeve assume when being inserted or removed from the mounting piece.

Figure 6 is a cross-sectional view, similar to Figure 5, showing a second position; and

Figure 7 is a cross-sectional view similar to Figure 5, showing the position the parts assume when

the contact is locked against removal from the mounting element.

The connector illustrated in Figure 1 includes two separable sections 10 and 11 arranged to mount the male and female contacts respectively, so that they may be plugged in to each other at will and secured together by a threaded coupling ring 12. The portion of the connector in which the male contacts are mounted includes a metal shell 13 housing a mounting element 14 which may be formed of moulded plastic, ceramic material, or other suitable insulating substance. The portions of the connector in which the female contacts are mounted include the shell 15 and a mounting element formed of front and rear pieces 16 and 17 separated by a rubber washer 18. A similar washer 19 is positioned between the faces of the pieces 17 and 14 in order to seal these surfaces against the entrance of moisture from any external source.

The mounting element 14 includes a plurality of contact cavities 21 and the rear mounting piece 16 of the element includes matching cavities 22 of similar formation. The male contacts 23 are secured in the mounting element 13 and corresponding female contact 24 are secured in the rear piece 16 of the other element. The front piece 17 of the second element in which the female contacts are carried is cored to surround the contacts so that the contacts are completely housed within the element. Each of the male contacts 23 is soldered to the end of one of the flexible conductors 25 and each of the female contacts 24 is similarly joined to a corresponding flexible conductor 26. Both the male contacts 23 and the female contacts 24 include a sleeve 31 having a central bore 32 to receive the end of one of the flexible wire conductors of the cable and, if desired, these sleeves may have one side cut away as indicated at 33 to facilitate soldering the wire to the contact. The forward end of the sleeve 31 terminates in a conic frustum 34, which tapers inwardly at an angle of about forty-five degrees to a cylindrical neck portion 35. The opposite end of the neck portion 35 terminates in a conic frustum 36, and a cylindrical head 37. The angle of taper of the frustum 36 may be varied within limits, but an angle of thirty degrees gives good results. The cylindrical head of the female contact 24 is of considerable length and is drilled at 38 and slotted at 39 to provide a spring pressed contact adapted to be engaged by a cylindrical pin of the male contact. The cylindrical head 40 of the male contact is quite short, but the contact includes a pin 41 extending outwardly from the head 40 to make electrical contact with the mating female contact. It is to be noted, however, that the locking portions of the two contacts, that is, the neck portions 35 and outwardly flared conic frustums 34 and 36, are identical in each of the contacts. It follows that they may be locked in position in their mounting elements by locking sleeves of identical size, shape and design.

The locking sleeves consist of small sheet metal stampings adapted to be snapped around the neck of each of the contacts to secure the individual contacts in position in the cavities of the mounting elements, as illustrated in Figures 5, 6 and 7. Each locking sleeve includes a cylindrical portion 42 dimensioned to surround the sleeve 31 of one of the contacts and provided with an outwardly flared flange 44. The opposite end of the sleeve 42 tapers inwardly at 45 to terminate in a split sleeve 46 dimensioned to

surround the reduced neck portion 35 of one of the contacts, but of a length slightly less than the neck portion. The outer end of the split sleeve 46 includes a flange 47 which flares outwardly at a forty-five degree angle. The sleeves may be formed in any desired number of segments, but satisfactory performance is accomplished by the provision of three equally spaced segments separated from each other by slots 48, with one side completely open as indicated at 49 so that the locking sleeve may be snapped in position over the neck 35 and sleeve 31 of any one of the contact elements.

The individual cavities of the mounting elements 14 and 16 may be identical, and while these cavities may be formed with separate slots to receive the individual segments of the locking sleeve 42, it is simpler and more convenient to form them with a cylindrical center portion 51 terminating at each of its ends in outwardly flared conical portions 52 and 53 extending to the somewhat larger cylindrical portions 54 and 55 respectively. It is to be noted that the cylindrical portion 51 is of slightly greater diameter than the cylindrical head 37 of either the male or female type of contact so that the head of a contact may be passed through the cavity 51 to insert the contact in position.

The position the several parts assume when the contact is being inserted is illustrated in Figure 5. Examination of this figure will reveal that when the sleeve 42 has been snapped in position over the neck 35 and sleeve 31 of one of the contacts, the split sleeve 46 is of such length that the outwardly extending flared portions 47 at the extreme end of the sleeve assume a position just short of the frustum 36, so that when the contact and locking sleeve are inserted from the right hand side of the mounting piece as viewed in the drawings and moved toward the left, the flange portions 47 will engage the tapered surfaces 53 of the cavity and the split sleeve will be flexed inwardly so that the assembly can slide in through the cylindrical portion 51 of the cavity as shown. When the contact and locking sleeve are fully inserted as shown in Figure 6, the resilient nature of the split sleeve will spring the individual segments outwardly to bring the flared flange portions to a position flat against the outwardly flared conical surfaces 52 of the cavity. It will now be seen that the split sleeve functions to reduce the effective diameter of the central portion 51 of the cavity to a dimension somewhat less than the cylindrical head 37 of the contacts, so that if the contact is forced to the right as viewed in the drawings (Figure 7) the outwardly flared surface of the frustum 36 will engage the inner surfaces of the flange portions 47 of the sleeve. This automatically wedges the locking sleeve in the position shown, and the contact is positively held in the cavity.

In practice, it is desirable to be able to remove any individual contact for inspection or repair and it is of great advantage to be able to accomplish such removal without the use of tools. This may be accomplished with the structure shown. The contact is first moved inwardly to the position shown in Figure 6 where the head portion 37 of the contact extends slightly beyond the outwardly flared portions 47 of the locking sleeve. The contact 23 and locking sleeve 42 may then be removed by simultaneously gripping the sleeve 31 of the contact and the flange 44 of the locking sleeve and drawing both pieces outwardly together. When this is done, the end flange 47 of

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the split sleeve 46 will ride inwardly on the conical flared portion 52 of the cavity so that the parts again assume the position shown in Figure 5. They may then be drawn outwardly to the right.

From the foregoing it will be seen that the teachings of this disclosure provide a simple, rugged and practical push-in type of contact for multiple connectors which may be repeatedly assembled or disassembled without damage to the individual parts. Further, the contact illustrated in this disclosure may be installed or removed without the use of any type of tools. In addition, the contact, when installed, is positively secured in position and is capable of withstanding any thrust incident to coupling or uncoupling of the connector.

For example, actual tests have shown that a size 16 contact crimped to a size 16 wire withstood a weight of 200 pounds dead weight without being pulled from the element. This is many times greater than the thrust incident to coupling or uncoupling the connector; the prescribed thrust being 2 pounds for a size 16 contact. Moreover, notwithstanding the fact that the individual contacts are firmly anchored, yet they are nevertheless mounted somewhat loosely, so that the individual contacts become self-aligning when the connector is coupled and any possibility of binding because of slight misalignment between the various contact elements is eliminated.

The fact that the contacts are free to rotate allows them to assume a normal position and release any kinks or twists in the conductors.

All of the foregoing advantages are accomplished by means of a structure that is relatively simple in design and extremely rugged so that it has no inherent problems of service or maintenance and so that it is well adapted to economical methods of manufacture and ideally suited to production in competition with other known types of connectors.

The exact form of the invention illustrated in the drawings and described in this specification is believed to be ideal for the purpose intended and is well illustrative of the inventive thought involved. It is recognized, however, that certain variations of mechanical design are feasible without sacrifice of all of the advantages of this disclosure and it is accordingly requested that the scope of the invention be regarded as extending to any modification or variation coming within the terms of the appended claims.

Having thus described the invention, what I claim as new and desire to protect by United States Letters Patent is:

1. In a push-in contact, the combination of a mounting element having at least one cavity comprising a cylindrical bore with outwardly extending retaining surfaces at each end thereof, in combination with a metallic contact pin having a cylindrical neck portion approximating the length of the cylindrical bore of the cavity, with an enlarged shoulder at one end and an enlarged head at the opposite end; the head being of less diameter than the bore of the cavity to permit the head to pass through the bore when the contact is inserted in the cavity; together with a retaining clip comprising a tube adapted to surround the shoulder portion on the contact pin and a split sleeve of lesser diameter adapted to surround the neck portion of the contact pin and to fit within the cylindrical bore of the cavity; the split sleeve including outwardly extending

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retaining flanges adapted to engage the outwardly extending retaining surfaces of the cavity at one end and to be engaged on their inner surfaces by the head of the contact pin, so that the flanges will be forced outwardly into engagement with the retaining surfaces of the cavity in response to a longitudinal thrust on the contact pin, and will secure the retaining clip and contact pin in position in the cavity of the mounting element.

2. In a push-in contact, the combination of a mounting element having at least one cavity comprising a cylindrical bore with outwardly flared conical surfaces at least one end thereof, in combination with a metallic contact pin having a cylindrical neck portion approximating the length of the cylindrical bore of the cavity, with an enlarged head at one end; the head being of less diameter than the central bore of the cavity to permit the head to pass through the bore when the contact is inserted into the cavity; together with a retaining clip to fit within the cylindrical bore of the cavity, the retaining clip including flanges adapted to engage the outwardly flared surfaces of the cavity and to be engaged on their inner surfaces by the head of the contact pin when said pin is moved longitudinally, so that the flanges of the clip will be forced outwardly into engagement with the flared surfaces of the cavity and will secure both the retaining clip and the contact pin in position in the cavity, together with a manual handle on the clip extending outside of the cavity to permit the clip and contact to be manually withdrawn from the mounting element.

3. In a push-in contact, the combination of a mounting element having at least one cavity with a cylindrical portion to receive a contact and a retaining clip, together with a rotatable contact comprising a round metallic pin having a reduced cylindrical neck portion and a retaining clip comprising a split sleeve surrounding the neck portion of the contact but shorter than said neck to permit relative longitudinal movement between the contact pin and the clip; together with spring-urged flanges on the ends of the split sleeve of the clip to resiliently engage the mounting element, and cam surfaces on the contact pin to hold said flanges in positive engagement with the mounting element to secure the clip and contact pin therein.

4. In a push-in contact, the combination of a mounting element having at least one cavity with a cylindrical portion to receive a contact and a retaining clip; together with a rotatable contact comprising a round metallic pin having a reduced cylindrical neck portion and a retaining clip comprising a split sleeve surrounding the neck of the contact but shorter than the neck to permit relative longitudinal movement between the contact pin and the clip; together with spring means on the clip to resiliently engage the walls of the cavity to maintain the clip in position within the cavity, manually engageable means on the clip extending outside of the cavity to permit the clip to be withdrawn against the action of said spring means, and cam surfaces on the contact pin to wedge said spring means into positive engagement with the surfaces of the cavity of the mounting element to secure the clip and contact within the cavity.

5. In a push-in contact, the combination of a mounting element having at least one cavity to receive a contact and a retaining clip; together with a contact comprising a metallic pin having

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a reduced neck portion and a retaining clip including a thin strip extending along the neck of the contact but shorter than the neck to permit relative longitudinal movement between the contact pin and the clip; together with spring means on the clip to resiliently engage the walls of the cavity to maintain the clip in position with the cavity, manually engageable means on the clip extending outside of the cavity to permit the clip to be withdrawn against the action of said spring means, and cam surfaces responsive to longitudinal thrust on the contact pin to wedge said spring means into positive engagement with the surfaces of the cavity of the mounting element to secure the clip and contact within the cavity.

6. In a push-in contact, the combination of a mounting element having at least one cavity to receive a contact and a retaining clip; together with a contact comprising a relatively long metallic pin, and a retaining clip including a thin spring portion extending along the contact pin and loosely secured thereto to permit relative longitudinal movement between the contact pin and the clip, with spring projections on the clip to resiliently engage the walls of the mounting element and cam surfaces on the contact pin to wedge said projections into positive engagement with the mounting element to secure the clip and contact pin therein.

7. In a connector including a mounting element with at least one cavity therein, the combination of a push-in contact assembly comprising a pin and a retaining clip together with means to limit the movement of the pin with respect to the clip comprising a tapered shoulder on the pin, outwardly extending retaining flanges on the clip, and means responsive to longitudinal thrusts on the pin for forcing said flanges outwardly into engagement with the walls of the cavity to secure the pin and clip in position.

8. In a connector including a mounting element with at least one cavity therein, the combination of a push-in contact comprising a single unitary metallic pin with a reduced neck portion,

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and a locking clip surrounding the neck portion; together with outwardly extending flanges on the clip and means on the contact for forcing said flanges outwardly into engagement with the walls of the cavity.

9. In a push-in contact assembly, a mounting element having at least one cavity including a cylindrical portion and outwardly flared retaining surfaces and a retaining clip adapted to be positioned within the cavity and having a split sleeve with a plurality of outwardly flared flanges adapted to engage said retaining surfaces of the cavity, together with a rotatable contact pin adapted to be positioned within the cavity; the improvement that resides in the provision of a cam surface on the pin whereby longitudinal movement of the pin will cause the cam surface of the pin to engage the flanges of the locking clip and force them outwardly against the retaining surfaces of the cavity to restrain the pin and clip against longitudinal movement.

10. In a push-in contact assembly including a mounting element having at least one cavity with an internal retaining surface, a retaining clip adapted to be positioned within the cavity to engage said retaining surface, and a contact pin adapted to be positioned within the cavity, the improvement that resides in the provision of a cam surface on the pin whereby longitudinal movement of the pin will wedge the cam surface of the pin against the clip and wedge the clip against the retaining surface of the cavity to secure the pin in the cavity.

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