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(54) **Electrical terminal and connector incorporating the same.**

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The file contains technical information submitted after the application was filed and not included in this specification

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Description

This invention relates to electrical terminals incorporating elongate dual beam contacts, and to connectors containing a plurality of such terminals for mating with pin contacts.

Beam contacts have been widely used in applications involving circuit board edge connectors and pin connectors. In edge connector applications, many of the available structures have involved the technique of preloading the beams for the purpose of reducing circuit board insertion forces. For example, US-A 3 464 054 discloses a connector block having contact members pretensioned against a wall for reducing the force of inserting an insulative substrate into an elongated channel. In another example, US-A 3 671 917 discloses a connector housing in which flanges on each of the terminals are held apart by an overhanging lip portion so as to preload the terminals for receiving a male pin contact. In a further example, US-A 3 646 500 discloses a terminal in which elastic leg portions engage respective flanges of a housing and tabs extending from the leg portions make contact with a male pin.

The use of dual beams at one end of a terminal is disclosed in US-A 3 665 375. Such terminals, as shown in Figs. 1 and 2 therein, have been used with edge board connectors.

US-A 3 944 313 discloses a Y-shaped contact in which a pair of projections serve to bring the ends of a pair of arms into contact with one another. US-A 3 027 534 discloses a dual beam terminal having central portions which constitute the contact surfaces and having mutually opposed convexly rounded abutment surfaces which engage one another to impart a degree of resilient pre-loading to the beams in the absence of the corresponding male pin.

In recent years there has been an increase in the sizes of pin fields in microcircuit applications. This has given rise to a demand for reduced insertion forces in pin connector technology. One usage involves integrally molded elongate plastics ledges in the side walls of the connector housing which preload dual beam terminals by spreading the beams apart when the terminals are inserted into housing cavities. A prime disadvantage of this system, however, is that the beams are easily damaged by the plastic ledges upon insertion into the cavities. In addition, the system does not adequately allow for non-standard pin position. Thus, a poor contact is sometimes obtained when, because the terminal is immobilized by the plastics ledges, the terminal cannot accommodate an off-set or misaligned pin.

Accordingly the present invention provides an elongate electrical terminal having a contact at each end, at least one of said contacts comprising a pair of longitudinally disposed beams adapted for making contact with a male pin, wherein means are provided for holding the beams in a spring-loaded, preloaded spaced-apart condition so as to reduce the insertion force required to engage a male pin with said terminal, characterised in that the beams are held in said spaced-apart condition by means of stand-off tabs provided at the side edges of each beam, each tab being formed by being bent inwardly so as to lie at an angle of substantially 90° to the plane in which the respective beam lies and being arranged for abutment with the opposed tab on the other beam.

In this manner a low insertion force interconnection may be achieved between the beams and a male pin contact.

The invention further provides a connector which comprises a terminal housing having a plurality of terminal cavities with elongate electrical terminals contained therein, each said terminal having a contact at each end, one of said contacts of each terminal comprising a pair of longitudinally disposed beams for making contact with a male pin, each beam having stand-off tabs provided at the side edges of each beam, each tab being formed by being bent inwardly so as to lie at an angle of substantially 90° to the plane in which the respective beam lies and being arranged for abutment with the opposed tab on the other beam.

In a preferred embodiment of such a connector each terminal therein has an insulation piercing contact at the end opposite the dual beam contact end. The insulation piercing contact portion of each terminal protrudes from its respective terminal cavity for electrical interconnection with an insulated wire. A contact block mates with the terminal housing at the end of the housing from which the insulation piercing contacts protrude. The contact block has parallel slots extending laterally across its mating surface adapted to hold insulated wires for interconnection with the protruding contacts. A strain relief shroud fits over the contact block and latches to the terminal housing to complete the fully assembled connector. In one end of the terminal housing are apertures for receiving pins which extend from a male pin field. Each aperture includes a lead-in area to one of the cavities inside for prepositioning a pin for interconnection with the terminal contained therein.

The advantages of this preferred connector and its corresponding terminal are numerous. Although the insulation piercing end of the terminal is secured to a wire carried on the contact block, the dual beam end of the terminal is free to float within the housing cavity. Thus compensation is automatically made for offset or misaligned pins in the pin field. The latter mechanism also lowers the potential for damage to plated contact surfaces of the beams which is often incurred as a result of such off-positioned pins.

In addition, since each terminal contains its own preloading feature, there is no necessity for cooperation between the terminal and housing projections or other housing parts. Hence, the aforementioned damage experienced by inserting beam terminals into cavities containing plastics ledges is avoided. Moreover, pin surface con-

tamination is also avoided because the pins have no plastic ledges to rub against. Thus, a more reliable contact is achieved, particularly in applications involving repeated withdrawals and insertions.

Finally, more reliable manufacturing conditions are also achieved, since only the terminal tolerance must be controlled, rather than the multiple tolerances of terminal and housing. As a result, the space between the beams and the commensurate preloading forces are closer to desired values.

Some embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Fig. 1 is an elevation view of two terminals of this invention attached to primary and secondary carrier strips;

Fig. 2 is a side view of one of the same terminals after detachment from carrier strips;

Fig. 3, 4, and 5 are alternate embodiments of terminals of this invention; and

Fig. 6 is an exploded perspective view of a connector of this invention which contains a plurality of the terminals of Figures 1 and 2.

One embodiment of the dual beam terminal of this invention is depicted in Figures 1 and 2. In Figure 1, two of the terminals 10 are shown attached to primary and secondar carrier strips 12 and 14. The second carrier strip 14 is used for retention of rigidity during manufacturing and plating steps to avoid bending the terminals out of axial alignment. Figure 2 depicts a side view of one of the terminals after detachment from the carrier strips. The terminal is detached at dotted lines 16 and 18 (Figure 1) by blanking.

The terminal is elongate and has a dual beam contact 20 at one end and a contact 28 at the other end. In this particular embodiment, contact 28 is an insulation displacement contact. The contacts are separated by a neck portion 25 which allows for flexure of the dual beam end relative to the other end of the terminal 10 when used in a connector of this invention. The dual beam contact is defined by two opposing spring arms (alternately called beams) 22 which are spaced apart for receiving a male pin contact. Laterally opposed stand-off tabs 24 extend symmetrically from the edges of each beam 22, one of the two tabs on one beam butting against one of the tabs on the opposing beam. The two beams 22 are spring loaded toward each other, as so held by the tabs, to present a preloaded contact for low insertion force mating with a pin contact. For proper connection, the tabs must spread the beams less than the width of the pin contact to be inserted.

The terminal may be stamped from flat metal sheets of copper nickel alloy, phosphor-bronze, or other suitable electrical conductive material, formed into final shape by successive die steps, then plated with nickel and/or gold (or other desired plating metals). Preferably, the terminal remains attached to the primary and secondary carrier strips throughout both forming and plating steps.

Pre-loading of the beams 22 is achieved during manufacture. The beams extend from segment 26 of the terminal 10. After the stamping but prior to forming, all elements of the terminal 10, including the segment 26, the beams 22 and tabs 24 lie flat in the same plane. The tabs 24 are then bent inwardly 90°, and the beams 22 are bent inwardly 5 to 15° along dotted line 27 toward segment 26. Segment 26 is then formed into a "U", during which the tabs 24 of respective opposing beams come into contact and the beams 22 become elastically deformed, or, as described in the art, pre-loaded.

By way of example, the contact 28 of terminal 10 may be either a second dual beam contact, a crimp contact, or a wire wrap tail as shown in Figures 3, 4, and 5, respectively. Obviously, other useful contacts are amenable as well. However, for use in one form of connector of this invention, a redundant insulation displacement contact 28 is provided. The insulation displacement contact (IDC) contains bifurcated tines 30 designed to pierce through insulation to make electrical contact with an insulated wire. The tines 30 extend from a second U-shaped segment 32 of the terminal. The latter segment is conveniently formed into a U at the same time that segment 26 is so formed. Locking detends 34 protrude from segment 32 for securing the terminal in a connector housing cavity as explained hereinafter. It will be noted that in the plane of Figure 1, the center line of the IDC contact 28 is slightly offset from that of the dual beam contact 20. This configuration provides advantages which relate to the use of the terminal 10 in one form of connector of this invention, as also explained hereinafter.

A connector of this invention is depicted in Figure 6. The connector 40 is shown in an exploded perspective view and includes a plurality of terminals 10 of this invention. The principal connector parts are a terminal housing 50, a contact block 70 (formed in two halves 74), and a strain relief shroud 90.

The terminals 10 are supported in terminal cavities 52 of the terminal housing 50. The housing 50 contains a two-row array of apertures 54 which provide access for male pin contacts (not shown) to mate with the terminals 10 housed in each cavity 52. The apertures have beveled lead-ins 55 which afford easier entry of male pin contacts. The terminals are inserted in the latching end 56 of the housing 50. As mentioned, the center line of the IDC contact 28 is slightly offset from that of the dual beam contact 20 in the terminal plane of Figure 1. This configuration provides an offset edge 33 of segment 32 which abuts housing wall projection 53. Thus, although the dual beam end of the terminal may be inserted into a cavity 52 without interference with projection 53, the offset edge 33 abuts the projection 53, and thus restrains the terminal from further forward movement. Further securement of the terminal in the

cavity is afforded by integral locking detents 34 which extend outwardly from segment 32 to provide an interference fit within the cavity by friction contact with the walls thereof.

The latching end 56 of the terminal housing 50 contains extensions 58 with integral latching nubs 60, polarity nub 62 and polarity notch 64. The latching nubs 60 cooperate with corresponding latching cavities 92 in the strain relief shroud 90 to hold the connector assembly mated. The polarity nub 62 cooperates with polarity notch 94 in the strain relief shroud 90 to ensure that the connector will assemble in only one way, for achievement of proper electrical polarity. The polarity notch 64 on the housing 50 cooperates with the polarity nub 72 shown in the IDC half block 74 for the same purpose.

The block 70 is formed of two identical half blocks 74. These half blocks fit together in hermaphroditic fashion via nubs 78 and cavities 80 contained thereon. Prior to fitting the halves together, insulated wire 100 is inserted into wire slots 82 in block halves 74. The wire slots extend laterally over the inner faces 84 of both halves 74 and continue around over the contact faces 86 of both halves. The portions of each wire slot 82 which extend over the contact faces 86 are intersected by longitudinally disposed IDC receiving slots 88 which provide spaces which receive the bifurcated tines 30 of terminals 10 upon the mating of the block 70 with the terminal housing 50. The act of mating the latter connector parts involves the severing of insulation on wires 100 by the bifurcated tines 30. Upon the severing of insulation, physical contact of the metal wire is made with the metal tines 30 for electrical interconnection.

In Figure 6, it will be noted that the lateral position of the terminal 10 in the top row of cavities is reserved 180° from that of the terminal 10 in the bottom row. This represents the best mode for housing the terminals for two reasons. First, the use of hermaphrodictic half blocks 74 is made possible, thus requiring only one mold for making both halves. Second, both of the projections 53 can be positioned on the external walls of housing 50 rather than one of them having to be in the internal wall separating the cavity rows. The latter consideration becomes important when the distance between pin centers becomes small, e.g., 0.3 cm.

The wires 100, as utilized herein, extend from the cable 120. A strain relief shroud 90 is used to provide cable-to-housing securement for avoiding wire strain otherwise created by tensile forces on the cable 120. The shroud 90 fits over the block 70 and latches to the terminal housing 50 by the means described, after the block has been mated with the housing. A cable tie 122 (preferably made of nylon) is then used to band the shroud to the cable. The shroud 90 includes an integral tab 96 which extends over a portion of the cable periphery. The tie 122 is positioned over the tab 96 and is tightened around the cable.

The dual beam terminal of the invention and the connector which utilizes the terminal can both be used in a myriad of micro-circuit applications. The terminal may include either a crimp contact, a pin tail, a wire wrap tail, etc. It is amenable to use where pin contacts are used in achievement of electrical terminations, such as circuit boards and pin connectors. The illustrated connector is useful in various applications involving IDC contacts which terminate to pin fields. One example of the latter would be in telephonic signal systems.

Claims

1. An elongate electrical terminal (10) having a contact at each end, at least one (20) of said contacts comprising a pair of longitudinally disposed beams (22) adapted for making contact with a male pin, wherein means (24) are provided for holding the beams in a spring-loaded, preloaded spaced-apart condition so as to reduce the insertion force required to engage a male pin with said terminal, characterised in that the beams (22) are held in said spaced-apart condition by means of stand-off tabs (24) provided at the side edges of each beam, each tab (24) being formed by being bent inwardly so as to lie at an angle of substantially 90° to the plane in which the respective beam lies and being arranged for abutment with the opposed tab on the other beam.

2. A terminal as claimed in claim 1 wherein said beams (22) are interconnected at the base of the contact (20) by means of a bridge portion (25) extending substantially perpendicularly to the beams (22) between mutually opposed side edges thereof so that the base part (26) of the contact (20) is generally U-shaped in transverse cross-section.

3. A terminal as claimed in claim 1 or 2 wherein the contact (28) at the end opposite said contact comprising a pair of beams is a wire insulation piercing contact.

4. A connector comprising a terminal housing (50) having a plurality of terminal cavities (52) in which elongate electrical terminals (10) are disposed, said terminals being as claimed in any preceding claim.

5. A connector as claimed in claim 4, wherein the other contact (28) of each terminal is a wire insulation piercing contact which protrudes from the terminal cavity (52); and comprising a contact block (70) formed of two half blocks (74) which are fitted together and which mate with the terminal housing at the end (56) from which the said insulation piercing contacts (28) protrude, said half blocks (74) having parallel slots (82) extending laterally across the mating surfaces thereon, said half blocks having means (82) for receiving insulated wire for lateral insertion in said slots; and a strain relief shroud (90) which fits over the contact block and latches to the terminal housing, the shroud including means (96) for the banding of said shroud to a wire cable (120).

Patentansprüche

1. Länglicher elektrischer Endkontakt (10), der einen Kontakt an jedem Ende hat, wobei wenigstens der eine (20) der Kontakte ein Paar von in Längsrichtung angeordneten Schenkeln (22) zur Kontaktbildung mit einem Kontaktstift aufweist, und wobei Einrichtungen (24) vorgesehen sind, die die Schenkel in einem federbelasteten, vorbelasteten Zustand mit Abstand halten, so dass die Einführungskraft reduziert wird, die erforderlich ist, um einen Kontaktstift in Eingriff mit dem Endkontakt zu bringen, dadurch gekennzeichnet, dass die Schenkel (22) in dem Zustand mit Abstand mit Hilfe von abstehenden Laschen (24) gehalten werden, die an den Seitenrändern jedes Schenkels vorgesehen sind, dass jede Lasche (24) dadurch gebildet wird, dass sie nach innen gebogen wird, so dass sie unter einem Winkel von im wesentlichen 90° zu der Ebene liegt, in der der zugeordnete Schenkel liegt und die so eingerichtet ist, dass sie zur Anlage an der gegenüberliegenden Lasche auf dem anderen Schenkel kommt.

2. Endkontakt nach Anspruch 1, bei dem die Schenkel (22) an der Basis des Kontakts (20) mit Hilfe eines Brückenabschnitts (25) untereinander verbunden sind, der im wesentlichen senkrecht zu den Schenkeln (22) zwischen wechselseitig gegenüberliegenden Seitenrändern derselben verlaufen, so dass der Basisteil (26) des Kontakts (20) im Querschnitt im wesentlichen U-förmig ist.

3. Endkontakt nach Anspruch 1 oder 2, bei dem der Kontakt (28) an dem dem Kontakt gegenüberliegenden Ende, der ein Paar von Schenkeln aufweist, ein eine Drahtisolierung durchdringender Kontakt ist.

4. Verbinder, der ein Endkontaktgehäuse (50) aufweist, das eine Mehrzahl von Endkontakthohlräumen (52) hat, in denen längliche elektrische Kontakte (10) angeordnet sind, wobei die Endkontakte nach einem der vorangehenden Ansprüche ausgebildet sind.

5. Verbinder nach Anspruch 4, bei dem der andere Kontakt (28) jedes Endkontakts ein eine Drahtisolierung durchdringender Kontakt ist, der aus dem Endkontakthohlraum (52) vorsteht, und der einen Kontaktblock (70) aufweist, der von zwei Halbblöcken (74) gebildet wird, die zusammengefügt sind und die mit dem Endkontaktgehäuse an dem Ende (56) zusammenpassen, von dem die die Isolierung durchdringenden Kontakte (28) vorstehen, wobei die Halbblöcke (74) parallele Schlitze (82) haben, die sich seitlich über die Gegenflächen an diesen erstrecken, wobei die Halbblöcke Einrichtungen (82) zur Aufnahme von isoliertem Draht zum seitlichen Einführen in die Schlitze haben, und wobei ein Zugentlastungsmantel (90) vorgesehen ist, der über den Kontaktblock passt und sich mit dem Endkontaktgehäuse verklinkt, welcher Mantel Einrichtungen (96) zum Verbinden des Mantels mit einem Drahtkabel (120) enthält.

Revendications

1. Une borne électrique de forme allongée (10) présentant un contact à chaque extrémité, au moins un (20) desdits contacts comprenant une paire de doigts (22) disposés longitudinalement de façon à venir en contact avec une fiche ou broche mâle, des moyens (24) étant prévus pour maintenir les doigts à l'écart l'un de l'autre sous précharge élastique de manière à réduire la force nécessaire à l'introduction d'une broche mâle dans cette borne, caractérisée en ce que les doigts (22) sont maintenus à l'écart l'un de l'autre par des pattes d'écartement (24) placées sur les bords latéraux de chaque doigt, chaque patte (24) étant formée par un pliage vers l'intérieur de manière à être disposée sensiblement à 90° du plan du doigt associé et étant agencée pour être en butée contre la patte opposée de l'autre doigt.

2. Une borne conforme à la revendication 1, dans laquelle lesdits doigts (22) sont interconnectés à la base du contact (20) au moyen d'une portion étranglée (25) sensiblement perpendiculaire aux doigts (22) entre des bords latéraux en regard de ceux-ci, de manière que le segment de base (26) du contact (20) présente une section transversale sensiblement en U.

3. Une borne conforme à la revendication 1 ou 2, dans laquelle le contact (28) situé à l'extrémité opposée audit contact (20) ayant une paire de doigts (22) est un contact à perçage d'isolant de fil.

4. Un connecteur comprenant un boîtier à bornes (50) pourvu d'une multiplicité de cavité de bornes (52) contenant des bornes électriques (10) de forme allongée, ces bornes étant conformes à l'une quelconque des revendications précédentes.

5. Un connecteur conforme à la revendication 4, dans lequel l'autre contact (28) de chaque borne est un contact à perçage d'isolant qui fait saillie de la cavité de bornes (52), et comprenant un bloc de contacts (70) formé de deux demi-blocs (74) qui s'adaptent l'un à l'autre et s'assemblent avec le boîtier à bornes par leur extrémité (56) de laquelle font saillie lesdits contacts à perçage d'isolant (28), lesdits demi-blocs (74) étant pourvus de fentes parallèles (82) qui s'étendent latéralement suivant leurs surfaces complémentaires, ces demi-blocs étant munis de moyens (82) de réception d'un fil isolé pour insertion latérale dans ces fentes, et une enveloppe d'encaissement de contraintes (90) qui s'adapte par-dessus le bloc de contacts et se verrouille au boîtier à bornes, ladite enveloppe comportant un moyen (96) de réunion par serrage circonférentiel de ladite enveloppe à un câble à fils (120).

Fig. 1

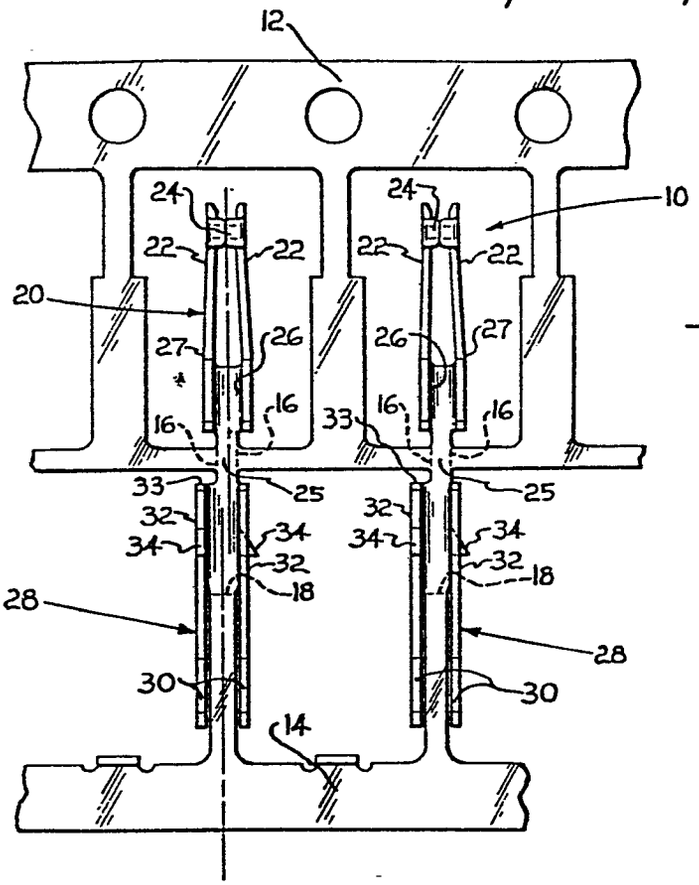
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Fig. 2

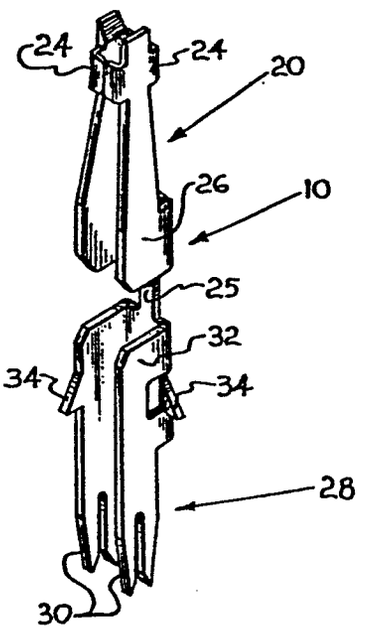
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Fig. 3

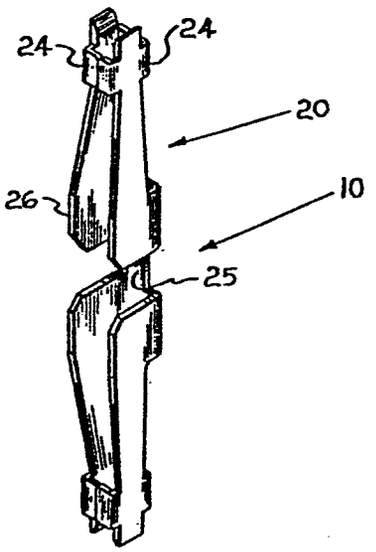


Fig. 4

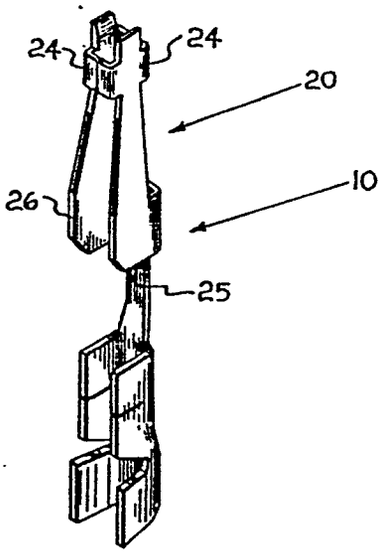


Fig. 5

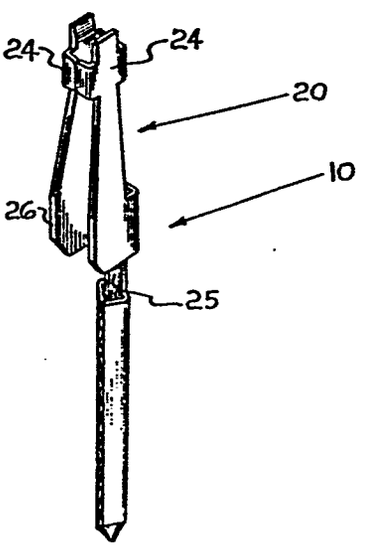
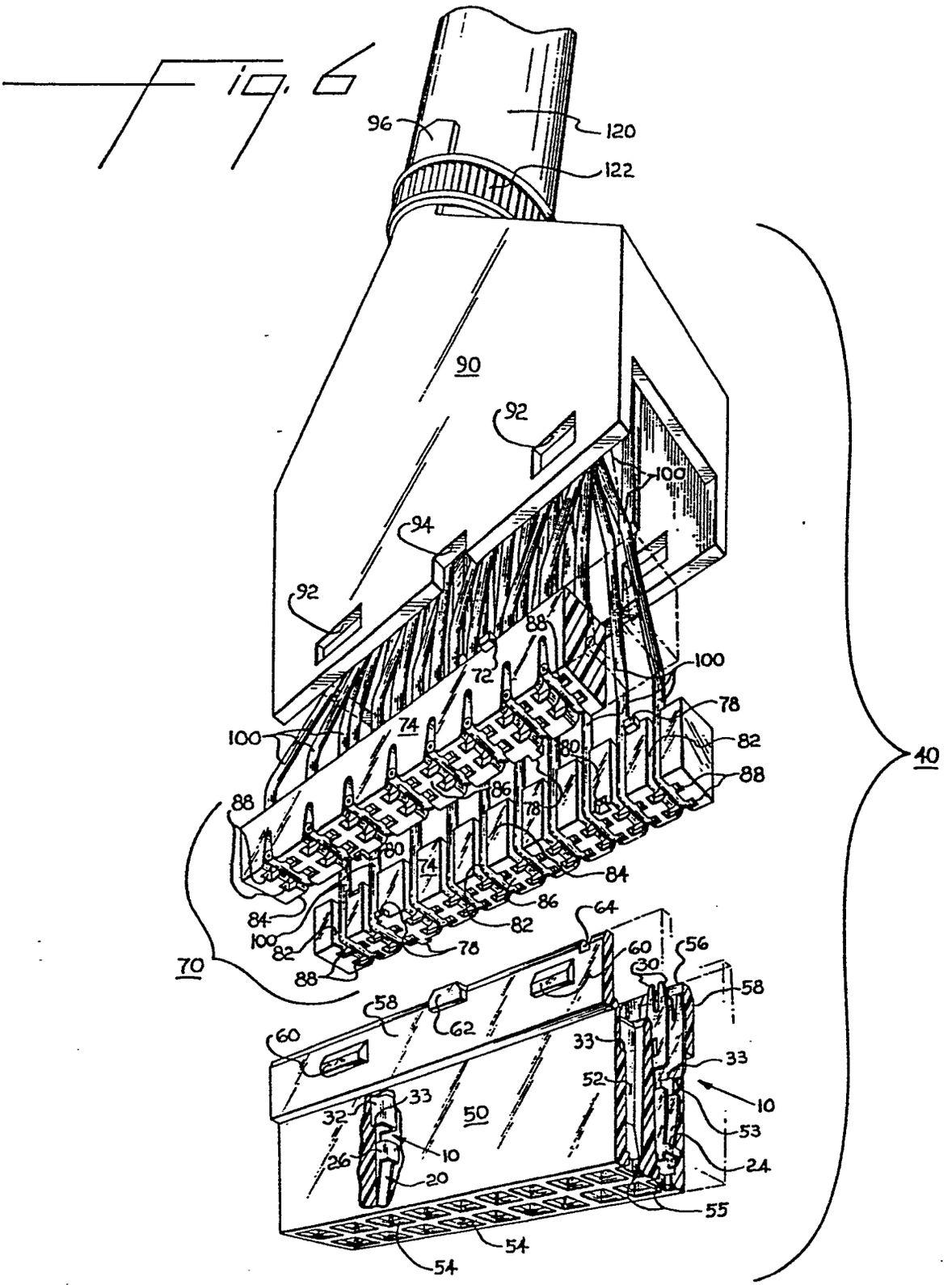


Fig. 6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