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(54) **ELECTRICAL CONNECTOR**

ELEKTRISCHER VERBINDER

CONNECTEUR ELECTRIQUE

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(72) Inventor: **LEE, Hyoung, Ku**
Songpa-ku Seoul (KR)

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(74) Representative: **Barnard, Eric Edward et al**
Brookes Batchellor 102-108 Clerkenwell Road
London EC1M 5SA (GB)

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(73) Proprietor: **BERG ELECTRONICS**
MANUFACTURING B.V.
5222 AV's-Hertogenbosch (NL)

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US-A- 4 580 867

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates in general to an electrical connector, and more particularly to a wire-trap electrical connector and for directly receiving and latching a plurality of cable leads without soldering.

Description of the Prior Art

[0002] Fig. 1 shows a prior art connector including a main body 51 and an operating member 62 which is detachably coupled to the main body 51. The main body 51 is provided at its upper section with a plurality of cable lead receiving holes 61 which receive individual cable leads and are separated from each other by a plurality of vertical partitions 52. In order to detachably mount the operating member 62 on the main body 51, the main body 51 has an elastic stopper 55 as well as a guider 57 on each side end thereof. The operating member 62 has a gripe 69 and an insert 64 on each side end thereof. Each of the insert 64 is inserted into a corresponding receiving hole 60 of the main body 51. At this time, the operating member 62 is reliably prevented from an accidental separation from the main body 51 by a stop protrusion 67 and an auxiliary protrusion 68. A pair of protrusions 67 and 68 is provided on the outer surface of each insert 64 of the operating member 62. In addition, a plurality of terminals 53 is upwardly inserted into the corresponding lead receiving holes 61 of the main body 51.

[0003] Fig. 2 is a cross sectional view along the section line I - I of Fig. 1 of the prior art connector, which is provided with the cable leads 72. A lead 72 of cable 71 inserted into the connector is reliably positioned by an elastic part 59 of a corresponding terminal 53 as well as by a corresponding projections 66 of the operating member 62. In order to place the cable leads 72 at a predetermined position, the cable leads 72 are inserted into the connector before the projections 66 and the terminal 53 are inserted into the main body 51. After the cable lead insertion, the projections 66 of the operating member 62 are inserted in order to fixedly support the cable leads 72 at their predetermined position with respect to the main body 51. Finally, the terminals 53 having individual elastic parts 59 are inserted from the bottom into a terminal inserting hole 54 of the main body 51 so as to fixate the cable leads 72 at their predetermined position in cooperation with the projections 66 of the operating member 62. At this time, each of the inserted terminals 53 is prevented from accidental separation from the main body 51 since an elastic projection 58 of the terminal 53 is elastically engaging a corresponding recess 61a formed on an inner surface of a side wall of the main body 51.

[0004] Fig. 3 shows a side view of the prior art connector in which the inserts 64 of the operating member 62 are received by the main body 51. When the inserts 64 of the operating members 62 are fully received in the receiving hole 60 of the main body 51, the upper end of the auxiliary protrusion 68 is latched by the elastic stopper 55 of the operating member 62 so that the operating member 62 is reliably prevented from the upward movement to separate separation from the main body 51.

[0005] However, the prior art connector has a undesirably large gap between the terminals 53 and the side wall of the main body 51 such that the terminals 53 are apt to be bent. Another problem of the prior art connector is that the lower section of the main body 51 where the terminals are inserted is wildly open so that the terminals may be accidentally separated from the connector. Furthermore, the contact area of each terminal with a corresponding cable lead is relatively small so that a desired contact of the terminal with the cable lead may not be achieved when the connector is used in an environment where vibration frequently occurs.

SUMMARY OF THE INVENTION

[0006] It is, therefore, an object of the present invention to provide an electrical connector which overcomes the aforementioned problems

[0007] According to the invention there is provided an electrical connector comprising:

- a main body including: an upper region extending between exterior side end surfaces;
- a plurality of lead receiving holes in the upper region for receiving individual cable leads;
- a larger opening provided in the upper region of said main body in order to downwardly receive a terminal a guideway and a stop protrusion provided on each side end surface of said main body, said guideway having a stopper at its upper section and
- a separate operating member detachably coupled to said main body the operating member including:
 - an insert guide and a locking guide provided on each side of said operating member in locations corresponding to the side end surfaces of the main body, each guide at each side of the operating member being of elongate independent cantilevered form, each locking guide having a locking shoulder at its lower end and being moveable in a plane generally parallel to each side end surface of the main body so that, when said operating member is downwardly inserted into said main body, said locking shoulder of said operating member locates in a first position below said stop protrusion, and when said operating member upwardly moves with respect to said main body, said locking shoulder moves in said plane to locate in a second position below said stopper, thus preventing inadvertent separation of said operating member from said main body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of a prior art electrical connector.

Fig. 2 is a cross sectional view along the section line I - I of Fig. 1 of the prior art connector showing that a main body is coupled to an operating member.

Fig. 3 is a side view of the prior art connector showing that an insert of the operating member is inserted in the main body.

Fig. 4 is an exploded perspective view of an electrical connector in accordance with the present invention.

Fig. 5 is a cross sectional view of the connector taken along the section line I - I of Fig. 4, Showing a main body coupled to an operating member.

Fig. 6 is a plan view of a connector terminal of Fig. 5.

Fig. 7 is a side view of the connector of the present invention, showing that the operating member is coupled to the main body.

Fig. 8 is a bottom view of the connector of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0009] Fig. 4 shows one embodiment of an electrical connector in accordance with the present invention. The connector includes a main body 1 and an operating member to which is detachably coupled to the main body 1. The main body is provided at its upper section with a plurality of lead receiving holes 4 which receive individual cable leads and are separated from each other by a plurality of vertical partitions 2. In order to detachably mount the operating member 10, having a plurality of projections 13, on the main body 1, a stopper 8 is formed on the upper section of a guider 9 which is provided at each side end of the main body 1. The main body 1 also includes stop protrusions 12a which is formed on each side end surface of the main body 1. The operating member 10 has an insert guide 14 and a locking guide 15 on each side end thereof. The locking guide 15 of the operating member 10 is provided at its distal end with a locking shoulder 12 for engaging the stopper 8 of the guider 9 of the main body 1 so as to prevent the operating member 10 from accidentally or undesirably separating from the main body 1. The main body 1 also has a large opening at its upper section where a plurality of terminals 3 having individual elastic parts is downwardly inserted into the main body 1 along individual terminal guide grooves 6 of the main body 1. In order to prevent the inserted terminals 3 from unde-

sirably separating from the main body 1, the main body 1 has at its side wall with the same number of holes 7 as that of the terminals 3. Each of the holes 7 of the main body 1 receives an elastic projection 17 of a corresponding terminal 3 which will be described with reference to Figure 5.

[0010] Fig. 5 is a cross sectional view along the section line II - II of the connector of Fig. 4. A lead 26 of a cable 24 is inserted into the connector and accurately positioned on its place by an elastic part 18 of a corresponding terminal 3 as well as by a corresponding projection 13 of the operating member 10. In order to position the cable leads 26 at these positions, the cable leads 26 are inserted into the connector before the projections 13 of the operating member 10 are not inserted in the main body 1. After each of the cable leads is inserted into the connector, the corresponding projections 13 of the operating member 10 are inserted in order to fixedly support the cable leads 26 at a desirable position by urging the cable leads against the corresponding terminal 3. Each terminal 3 having the elastic part 18 is also inserted into the main body 1 through a terminal inserting hole provided on the upper section of the main body 1. The main body 1 has a terminal inserting slot 27 where a lower shoulder of a corresponding terminal 3 is seated so as to prevent a downward movement of the terminal 3 with respect to an undesirable separation from the main body 1. The elastic projection 17 of the terminal 3 is latched in a corresponding elastic projection receiving hole 7 of the main body 1 so that the terminal 3 is prevented from undesirably moving in an upward direction or separating from the main body 1. The bottom surface of the main body 1 except for the terminal inserting slots 27 is closed. The main body 1 is provided at its bottom section with a bending part 16, which is adapted for supporting the terminal 3 at a predetermined angle. The main body is also at its top section with a recess 20 for allowing the elastic part 18 of the terminal 3 to be smoothly pushed backwards towards the recess 20 when the cable lead 26 is inserted into the connector.

[0011] Fig. 6 shows a plan view of the terminal 3 including the lower shoulder 21, the elastic projection 17 and the elastic part 18.

[0012] As shown in Fig. 7, when the operating member 10 is inserted in the main body 1, the locking shoulder 12 of the locking guide 15 of the operating member 10 is latched by the stop protrusion 12a of the main body 1. Even when the operating member 10 is accidentally moved upwardly from the main body 1, the locking shoulder 12 of the locking guide 15 is caught by the stopper 8 formed on the upper section of the guider 9 of the main body 1, so as to prevent the accidental separation of the operating member 10 from the main body 1.

[0013] Fig. 8 shows the bottom surface of the main body 1, which is closed except for the terminal inserting slots 27 and a depressed portion of the bending part 16 which is adapted for supporting the terminal 3 angled at

a predetermined angle.

[0014] As described above, according to the present invention, a plurality of terminals inserted in the main body of the connector is in close contact with an inner surface of a side wall of the main body so as to substantially prevent the terminals from being bent as well as from accidentally separating from the main body. In addition, according to the current invention the contact area of each terminal with a corresponding cable lead is substantially larger than the prior art connector so that a desired contact between a terminal and a corresponding cable lead is maintained even when the connector is substantially vibrated.

[0015] Another advantage of the present invention is that each terminal is inserted into the main body along a terminal guide groove of the main body to substantially avoid misalignment during insertion.

[0016] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope of the invention as disclosed in the accompanying claims.

Claims

1. An electrical connector comprising:

a main body (1) including: an upper region extending between exterior side end surfaces; a plurality of lead receiving holes (4) in the upper region for receiving individual cable leads; a larger opening provided in the upper region of said main body (1) in order to downwardly receive a terminal (3) a guideway (9) and a stop protrusion (12a) provided on each side end surface of said main body (1), said guideway having a stopper (8) at its upper section and a separate operating member (10) detachably coupled to said main body (1), **characterized in that**, the operating member includes:

an insert guide (14) and a locking guide (15) provided on each side of said operating member (10) in locations corresponding to the side end surfaces of the main body (1), each guide at each side of the operating member being of elongate independent cantilevered form, each locking guide (15) having a locking shoulder (12) at its lower end and being moveable in a plane generally parallel to each side end surface of the main body so that, when said operating member (10) is downwardly inserted into said main body, said locking shoulder (12) of said operating member lo-

cates in a first position below said stop protrusion (12a), and when said operating member upwardly moves with respect to said main body, said locking shoulder moves in said plane to locate in a second position below said stopper (8), thus preventing inadvertent separation of said operating member from said main body.

2. An electrical connector according to claim 1, wherein said main body (1) further includes:

a terminal guide groove provided on a side wall of said main body in order to guide insertion of said terminals (3) and a terminal inserting slot (27) provided on a bottom of said main body (1) in order to seat a lower shoulder of said terminal (3) thereon, thus to prevent a downward separation of said terminal (3) from said main body (1).

3. An electrical connector according to claim 2, wherein said bottom of said main body (1) except said terminal inserting slot (27) is closed.

4. An electrical connector according to any one of claims 2 and 3, wherein said main body (1) is provided at said side wall with a recess (20) for receiving a rear section of an elastic part (18) of said terminal (3) which is pushed backwards when a corresponding cable lead (26) is inserted into said main body (1).

5. An electrical connector according to any one of claims 2 to 4, wherein said main body (1) is provided at its lower section with a bending part (16) for bending said terminal (3) to an outward direction of said main body (1).

6. An electrical connector according to claim 1, and in the form of a wire trap connector wherein said main body (1) takes the form of a connector housing, said plurality of lead receiving holes (4) combine with said larger opening to take the form of slots and said wire trap connector has a contact terminal placed in each of said slots.

7. A wire trap connector according to claim 6, wherein each of said slots has a terminal guide groove and a contact wall, said contact terminal being placed in each of said slots along said terminal guide.

8. A wire trap connector according to claim 7, wherein said contact terminal has a fish-hook shape having a hook portion and a shaft portion, a substantial portion of said shaft portion engaging said contact wall and said hook portion has a resilient end for making an electrical contact with the cable lead (26) placed

therein.

9. A wire trap connector according to claim 8, wherein said operating member (10) is removably placed against the cable lead and said resilient end to ascertain the electrical contact between the cable lead (26) and said contact terminal. 5
10. A wire trap connector according to any one of claims 7 to 9, wherein said contact wall has a through hole for accepting said hook portion of said contact terminal. 10
11. A wire trap connector according to any one of claims 6 to 10 wherein said connector housing has a bottom wall and a bore thereon, said contact terminal exiting said connector housing through said bore. 15
12. A wire trap connector according to claim 9 or to claims 10 or 11 when appended to claim 9, wherein said contact wall further comprises a recess to provide a space for said resilient end of said contact terminal to move. 20
13. A wire trap connector according to claim 11, wherein said bottom wall has a depressed portion adjacent to said bore for said contact terminal to be bent along said depressed portion. 25

Patentansprüche

1. Elektrischer Steckverbinder mit

einem Hauptkörper (1), der einen oberen Abschnitt aufweist, der sich zwischen den äußeren Seitenendflächen erstreckt, mehreren Leitungsaufnahmelöchern (4) in dem oberen Abschnitt, die einzelne Kabelleitungen aufnehmen, einer größeren Öffnung in dem oberen Abschnitt des Hauptkörpers (1), um abwärts gerichtet einen Anschluß (3) aufzunehmen, einer Führungsfläche (9) und einem Haltevorsprung (12a), der auf jeder Seitenendfläche des Hauptkörpers (1) vorgesehen ist, wobei die Führungsfläche in ihrem oberen Abschnitt einen Anschlag (8) aufweist, und einer einzelnen Betätigungsvorrichtung, die abnehmbar mit dem Hauptkörper (1) verbunden ist, 50

dadurch gekennzeichnet, daß die Betätigungsvorrichtung aufweist:

eine Einschubführung (14) und eine Verriegelungsführung (15), die auf jeder Seite der Betätigungsvorrichtung (10) an Stellen vorgesehen sind, die den Seitenendflächen des Hauptkörpers (1) ent-

sprechen, wobei jede Führung auf jeder Seite der Betätigungsvorrichtung einzeln ausgebildet ist und eine längliche federnde Form aufweist, wobei jede Verriegelungsführung (15) an ihrem unteren Ende eine Verriegelungsschulter (12) aufweist und in einer Ebene und im allgemeinen parallel zu jeder Seitenendfläche des Hauptkörpers so bewegbar ist, daß die Verriegelungsschulter (12) der Betätigungsvorrichtung in einer ersten Position unterhalb des Haltevorsprungs (12a) liegt, wenn die Betätigungsvorrichtung (10) nach unten in den Hauptkörper eingeführt wird, und, wenn die Betätigungsvorrichtung sich relativ zum Hauptkörper nach oben bewegt, die Verriegelungsschulter sich in dieser Ebene bewegt, und in einer zweiten Position unterhalb des Anschlags (8) liegt, wodurch die ungewollte Trennung der Betätigungsvorrichtung von dem Hauptkörper verhindert wird.

2. Elektrischer Steckverbinder nach Anspruch 1, wobei der Hauptkörper weiterhin aufweist:

eine Anschlußführungsnut, die auf einer Seitenwand des Hauptkörpers vorgesehen ist und die Einführung der Anschlüsse (3) führt, und einen Anschlußeinführungsschlitz (27), der in einem Boden des Hauptkörpers (1) vorgesehen ist und der eine untere Schulter des Anschlusses (3) am Boden festlegt, wodurch eine Trennung des Anschlusses (3) von dem Hauptkörper (1) nach unten verhindert wird. 30

3. Elektrischer Steckverbinder nach Anspruch 2, wobei der Boden des Hauptkörpers (1) bis auf den Anschlußeinführungsschlitz (27) geschlossen ist. 35

4. Elektrischer Steckverbinder nach einem der Ansprüche 2 oder 3, wobei der Hauptkörper (1) an der Seitenwand eine Vertiefung (20) aufweist, die einen hinteren Abschnitt eines elastischen Bereichs (18) des Anschlusses (3) aufnimmt, der nach hinten gedrückt wird, wenn eine entsprechende Kabelleitung (26) in den Hauptkörper (1) eingeführt wird. 40

5. Elektrischer Steckverbinder nach einem der Ansprüche 2 bis 4, wobei der Hauptkörper (1) an seinem unteren Abschnitt einen Biegebereich (16) aufweist, der den Anschluß (3) von dem Hauptkörper (1) nach außen biegt. 45

6. Elektrischer Steckverbinder nach Anspruch 1 und in der Form eines Kabeleinfangssteckverbinders, wobei der Hauptkörper (1) die Form eines Steckverbindergehäuses hat, wobei die Leitungsaufnahmelöcher (4) sich mit der größeren Öffnung vereinen und Schlitze bilden, wobei der Kabeleinfangssteckverbinder einen Kontaktanschluß in jedem der Schlitze aufweist. 55

7. Kabeleinfangssteckverbinder nach Anspruch 6, wobei jeder der Schlitze eine Anschlußführungsnut und eine Kontaktwand aufweist, wobei der Kontaktanschluß in jedem der Schlitze entlang der Anschlußführung angeordnet ist. 5
8. Kabeleinfangssteckverbinder nach Anspruch 7, wobei der Kontaktanschluß fischhakenförmig ausgebildet ist und einen hakenförmigen Abschnitt und einen Schaftabschnitt aufweist, wobei ein wesentlicher Abschnitt des Schaftabschnitts an der Kontaktwand anliegt und der Hakenabschnitt ein federndes Ende aufweist, das einen elektrischen Kontakt mit der darin angeordneten Kabelleitung (26) herstellt. 10 15
9. Kabeleinfangssteckverbinder nach Anspruch 8, wobei die Betätigungsvorrichtung (10) abnehmbar an der Kabelleitung und dem federnden Ende anliegt, um den elektrischen Kontakt zwischen der Kabelleitung (26) und dem Kontaktanschluß sicherzustellen. 20
10. Kabeleinfangssteckverbinder nach einem der Ansprüche 7 bis 9, wobei die Kontaktwand eine durchgehende Öffnung für die Aufnahme des Hakenabschnitts des Kontaktanschlusses aufweist. 25
11. Kabeleinfangssteckverbinder nach einem der Ansprüche 6 bis 10, wobei das Steckverbindergehäuse eine Bodenwand und darin eine Bohrung aufweist, wobei der Kontaktanschluß das Steckverbindergehäuse durch die Bohrung verläßt. 30
12. Kabeleinfangssteckverbinder nach Anspruch 9 oder nach den Ansprüchen 10 oder 11, wenn sie an Anspruch 9 angehängt werden, wobei die Kontaktwand weiterhin eine Vertiefung aufweist, wodurch sich ein Raum für die Bewegung des federnden Endes des Kontaktanschlusses ergibt. 35 40
13. Kabeleinfangssteckverbinder nach Anspruch 11, wobei die Bodenwand neben der Bohrung einen abgesenkten Abschnitt aufweist, damit der Kontaktanschluß entlang dem abgesenkten Abschnitt gebogen wird. 45

Revendications

1. Connecteur électrique comprenant :

- un corps principal (1) incluant une région supérieure s'étendant entre des surfaces d'extrémités latérales extérieures ;
- une pluralité de trous de réception de conducteurs (4) dans la région supérieure pour recevoir des fils conducteurs individuels ;

- une ouverture plus grande, ménagée dans la région supérieure dudit corps principal (1) pour recevoir vers le bas une borne (3) ;
- un passage de guidage (9) et une saillie d'arrêt (12a) ménagés sur chaque surface d'extrémité latérale dudit corps principal (1), ledit passage de guidage ayant un organe d'arrêt (8) à sa section supérieure et
- un organe d'actionnement séparé (10), couplé de façon amovible audit corps principal (1), **caractérisé en ce que** cet organe d'actionnement comprend :
- un insert de guidage (14) et un guide de verrouillage (15) prévus sur chaque côté dudit organe d'actionnement (10) en des emplacements correspondants aux surfaces d'extrémité latérale du corps principal (1), chaque guide, de chaque côté de l'organe d'actionnement, se présentant sous la forme d'un porte à faux indépendant allongé, chaque guide de verrouillage (15) ayant un épaulement de verrouillage (12) à son extrémité inférieure et étant mobile dans un plan généralement parallèle à chaque surface d'extrémité latérale du corps principal de sorte que, lorsque ledit organe d'actionnement (10) est inséré vers le bas dans ledit corps principal, ledit épaulement de verrouillage (12) dudit organe d'actionnement se positionne en une première position au-dessous de ladite saillie d'arrêt (12a) et, lorsque ledit organe d'actionnement se déplace vers le haut par rapport audit corps principal, ledit épaulement de verrouillage se déplace dans ledit plan afin de se positionner dans une deuxième position au-dessous dudit organe d'arrêt (8), en empêchant ainsi une séparation par inadvertance dudit organe d'actionnement par rapport audit corps principal.

2. Connecteur électrique selon la revendication 1, dans lequel ledit corps principal (1) comprend en outre :

- une rainure de guidage de bornes prévue sur une paroi latérale dudit corps principal pour guider l'insertion desdites bornes (3) et
- une fente d'insertion de bornes (27) ménagée sur la face inférieure dudit corps principal (1) afin de disposer dessus un épaulement inférieur de ladite borne (3), pour empêcher ainsi une séparation vers le bas de ladite borne (3) par rapport audit corps principal (1).

3. Connecteur électrique selon la revendication 2, dans lequel ladite face inférieure dudit corps principal (1) est fermée à l'exception de ladite fente d'insertion de bornes (27).

4. Connecteur électrique selon une quelconque des revendications 2 et 3, dans lequel ledit corps principal (1) est muni à ladite paroi latérale d'une cavité (20) pour recevoir une section arrière d'une partie élastique (18) de ladite borne (3) qui est poussée vers l'arrière lorsqu'un fil conducteur correspondant (26) est inséré dans ledit corps principal (1). 5
5. Connecteur électrique selon une quelconque des revendications 2 à 4, dans lequel ledit corps principal (1) est doté à sa section inférieure d'une partie de flexion (16) pour faire fléchir ladite borne (3) dans une direction vers l'extérieur dudit corps principal (1). 10
6. Connecteur électrique selon la revendication 1, et sous la forme d'un connecteur à emprisonnement de fils, dans lequel ledit corps principal (1) prend la forme d'un logement de connecteur, ladite pluralité de trous de réception de fils (4) se combine avec ladite ouverture plus grande afin de prendre la forme de fentes et ledit connecteur à emprisonnement de fils possède une borne de contact placée dans chacune desdites fentes. 15 20
7. Connecteur à emprisonnement de fils selon la revendication 6, dans lequel chacune des fentes possède une rainure de guidage de borne et une paroi de contact, ladite borne de contact étant placée dans chacune desdites fentes le long dudit guide de borne. 25 30
8. Connecteur à emprisonnement de fils selon la revendication 7, dans lequel ladite borne de contact présente la forme d'un hameçon ayant une partie en crochet et une partie de tige, une partie sensible de ladite partie de tige venant au contact de ladite paroi de contact et ladite partie en crochet ayant une extrémité élastique pour réaliser un contact électrique avec le fil conducteur (26) placé dedans. 35 40
9. Connecteur à emprisonnement de fils selon la revendication 8, dans lequel ledit organe d'actionnement (10) est placé de façon amovible contre le fil conducteur et ladite extrémité résiliente pour assurer le contact électrique entre le fil conducteur (26) et ladite borne de contact. 45
10. Connecteur à emprisonnement de fils selon une quelconque des revendications 7 à 9, dans lequel ladite paroi de contact possède un trou traversant pour accepter ladite partie en crochet de ladite borne de contact. 50
11. Connecteur à emprisonnement de fils selon une quelconque des revendications 6 à 10, dans lequel ledit logement de connecteur possède une paroi inférieure et un alésage dans celle-ci, ladite borne de contact quittant ledit logement de connecteur à travers ledit alésage. 55
12. Connecteur à emprisonnement de fils selon la revendication 9 ou une quelconque des revendications 10 ou 11 lorsqu'elle est dépendante de la revendication 9, dans lequel ladite paroi de contact comprend en outre une cavité pour procurer un espace permettant à ladite extrémité résiliente de ladite borne de contact de se déplacer.
13. Connecteur à emprisonnement de fils selon la revendication 11, dans lequel ladite paroi inférieure possède une partie pressée adjacente audit alésage afin que ladite borne de contact soit fléchi le long de ladite partie pressée.

Fig. 1

PRIOR ART

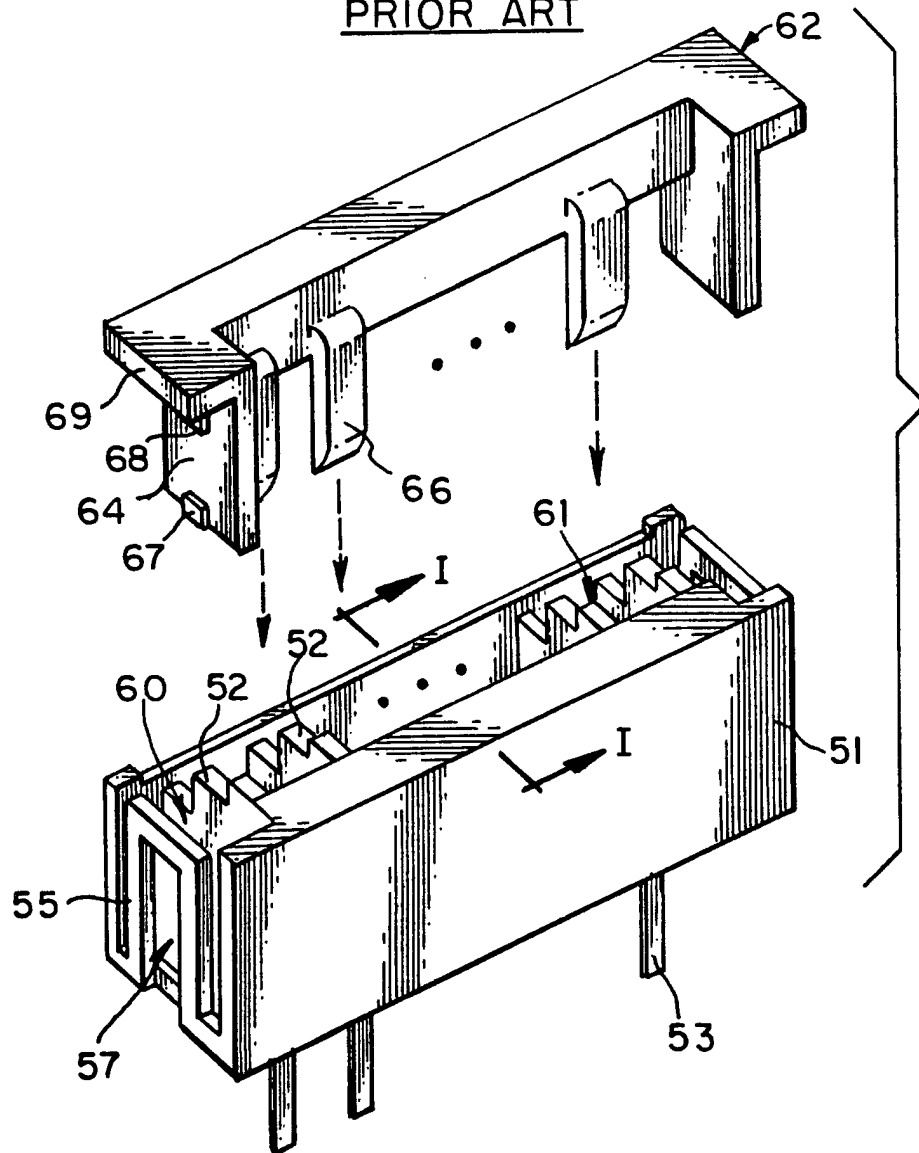


Fig. 2

PRIOR ART

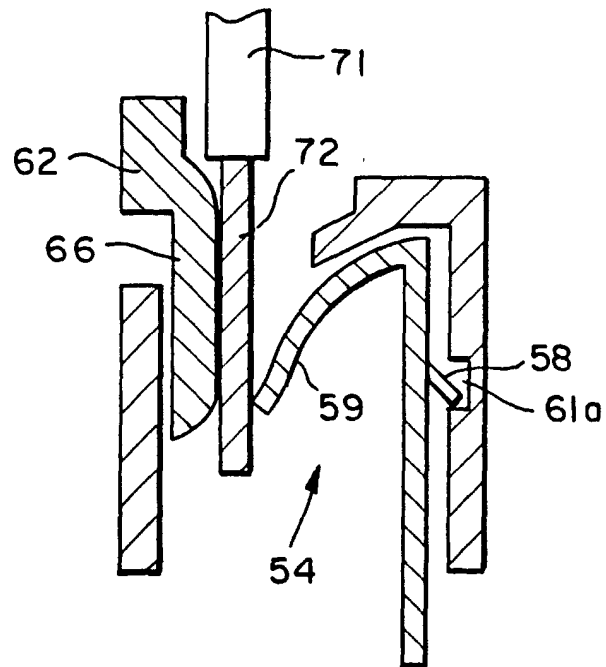


Fig. 3

PRIOR ART

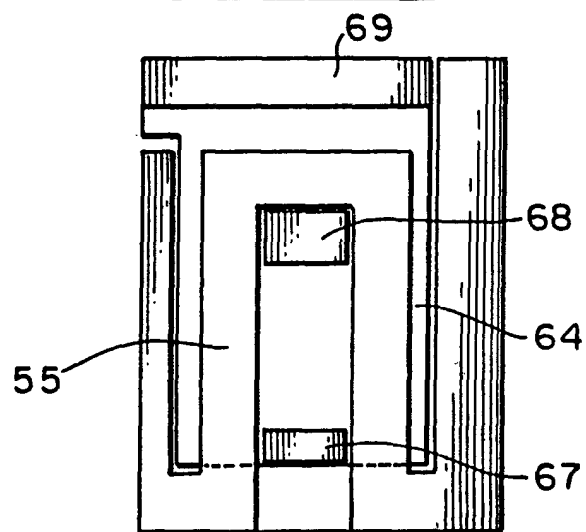


Fig. 4

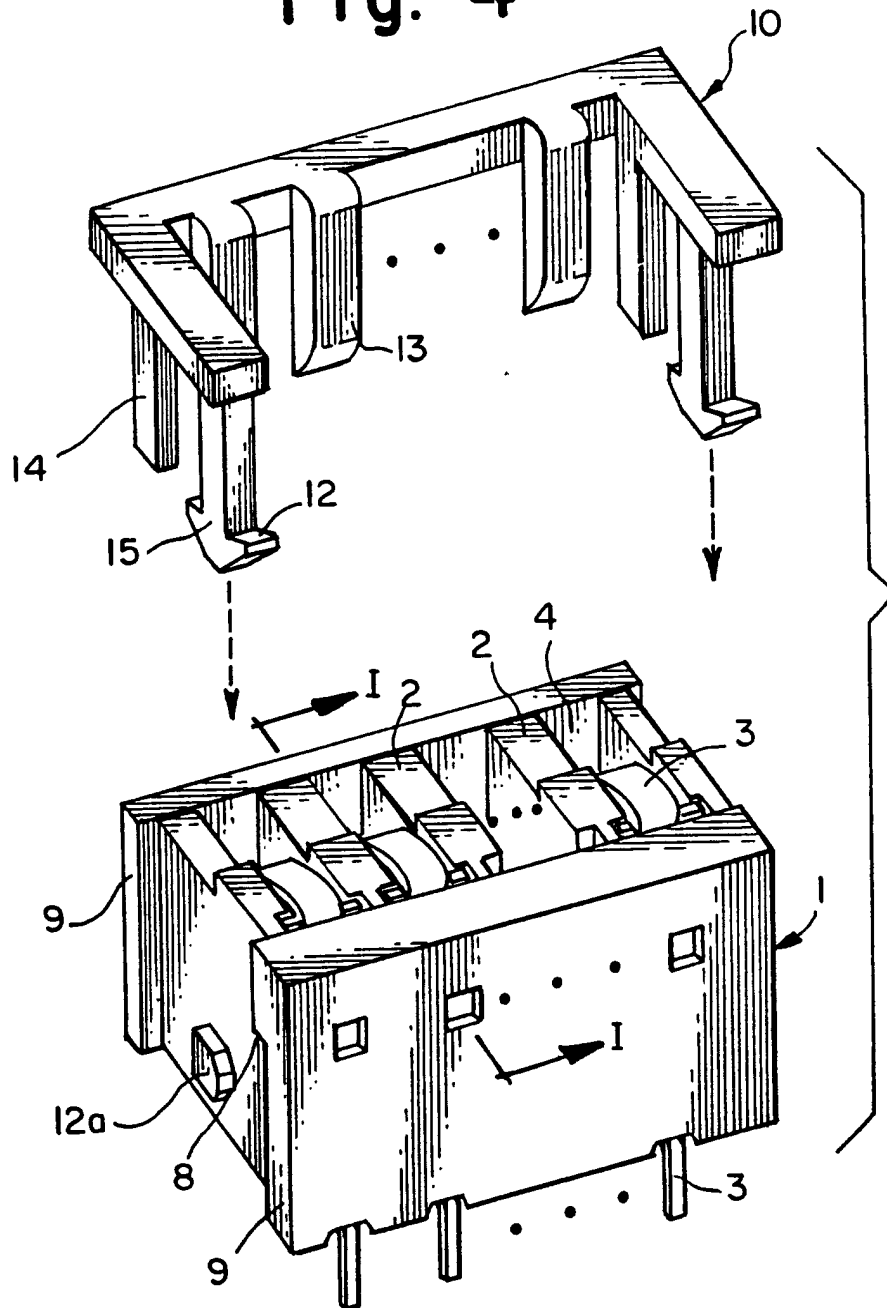


Fig. 5

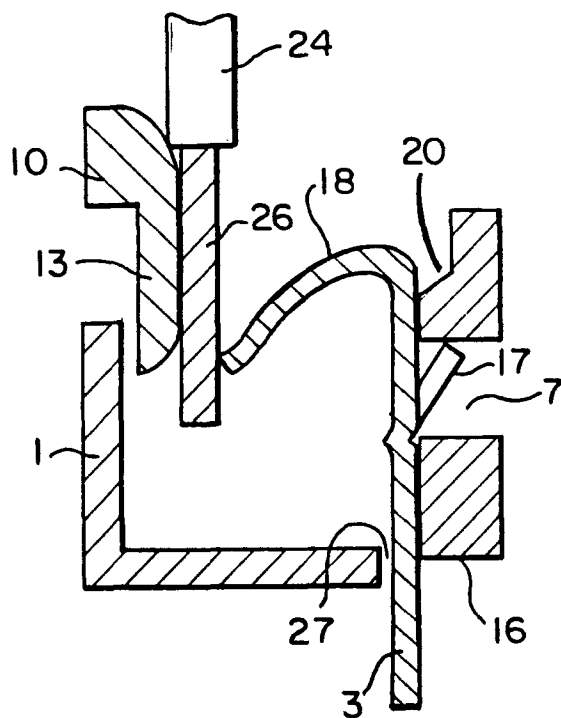


Fig. 6

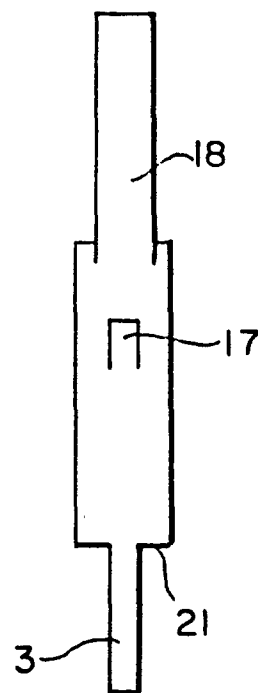


Fig. 7

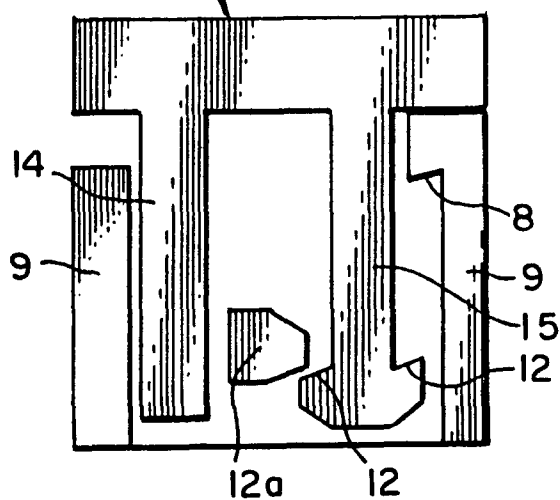


Fig. 8

