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(54) **Sealed electrical connector**

Abgedichteter elektrischer Verbinder

Connecteur électrique étanche

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Description

This invention relates to an electrical connector assembly providing sealing of plug and receptacle connectors, in particular when associated with an electronic module.

An increasing use of sophisticated electronics in vehicles, appliances, and the like has created a necessity of waterproofing and sealing against moisture that might adversely affect contact interfaces and sensitive components within electronic modules interconnected by such connector. In order to assure a proper sealing, tests have been devised where a stream of water is directed against a connector and/or an electronic module package creating pressure differentials tending to drive moisture within the connector and module. Multi-way electrical connectors are particularly vulnerable to leaking due to the numbers of cavities through which contacts and wires must be fitted and potting materials and/or individual wire seals have been attempted to provide not only moisture sealing, but which are also adequate for submersion for periods of time. An object of the invention is to provide an improved sealed connector. In particular, a sealed connector should have the possibility of sealed integrity, even when all terminal positions are not used. Further, this connector should provide the possibility of assembling the terminals into the housing, through the seal, and also provide proper alignment of the terminal therewith.

The present invention consists in an electrical connector as defined in claim 1. EP-A-0 320 249 discloses a connector according to the preamble of claim 1.

There is disclosed herein an electrical connector comprising a housing of insulative material having at least one cavity therethrough for the receipt of an electrical terminal, the connector further comprising a seal for sealing in the interior of the housing. The seal is interfacially disposed against a rear face of said housing and held there, the seal having a peripheral outer edge larger than an outer periphery of the housing, whereby said peripheral outer edge forms a peripheral seal for a hood of a mating connector, for example, an electronic module.

Embodiments of the present invention are defined in the subordinate claims.

Preferably, the seal contained in the plug is of one piece with centrally disposed apertures of diameters to tightly grip and seal the wires terminated to contacts inserted through the seal. The central housing further includes pins that assist in alignment and assembly that fit through apertures in the seal and are sealed thereby. The rear cover of the plug includes, on one side, a retention lance that can be pressed in by the thumb of an operator upon the plug being joined with a receptacle, the lance containing a latching surface that engages a surface positioned on the side of the receptacle extending from a surface of the electronic module interconnected by the connector of the invention. The receptacle in-

cludes a hood that is essentially box-like that extends over the outside of the front cover of the plug and the central housing to be engaged by ribs on the plug seal, multiple ribs being used for a redundancy of sealing. The plug latch serves to assure a proper polarization of the plug and receptacle during assembly and further polarizing ribs are employed in the plug to facilitate an initial proper insertion prior to engagement of the retention latch of the plug. A gasket is made to surround the receptacle and engage surfaces on the module to seal the receptacle to the module and additionally, lugs on the receptacle housing are made hollow to receive individual seals through which fastening screws are extended to join the receptacle to the module.

Typically, the receptacle half and gasket with fasteners would be applied to the module with the terminals thereof interconnected to circuit boards within the module and such module installed as for example, in a vehicle, with the plug portion of the connector connected to cable and to the harness of the vehicle added thereafter in final assembly. A hood may be employed, covering over the wires of the plug half of the connector for protection of such wires.

An embodiment of the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a perspective showing an electronic module, connector, and plug removed therefrom aligned for installation to interconnect a cable of wires to the module,

Figure 2 is a view of the receptacle of the connector, Figure 3 is a view of the plug fully assembled,

Figure 4 is a view of the connector shown in Figure 3 with the contact and wire and parts of the plug in a preassembled condition,

Figure 5 is a view showing the parts of the plug fully disassembled,

Figure 6 is a side, sectioned view of the connector of the invention mated to the circuit board of a module,

Figure 7 is a side, partially assembled view of a portion of the connector and module,

Figure 8 is a view of the portions of the connector shown in Figure 7 in a closed condition, and

Figure 9 is a side, sectioned view of the seal of the connector.

Referring now to Figure 1, an embodiment of the invention is shown in the form of a connector assembly 1a comprised of a plug 4 and a receptacle 2 for plug 4. Additionally shown is a receptacle 3 which would be utilized with a plug connector of a larger size, essentially like plug 4. The invention contemplates a variety of sizes of multi-way connectors, plug 4 being for a six-way or six-wire connector, receptacle 3 being for an 18-position plug connector, not shown. As can be seen, the receptacle portion of connector 1a includes lugs 13 extending

from the sides of the receptacles and retention devices 6 associated with each of the receptacles that function in a manner to be described. As also can be seen in Figure 1, the plug and receptacle connector 1a is associated with an electronic module 1b that may be taken to include sensitive electronic circuits and devices that must be protected from moisture and in certain cases, from total submersion of the module. The connector, including plug and receptacle, has as its purpose the interconnection of a harness, including wires such as 17, carrying signal and power to and from the module. The plug and receptacle are, as will be described, made moisture and waterproof.

Figure 2 shows the receptacle apart from the electronic package to include plastic hoods 3a, and within each of the hoods, a number of contacts 10 arranged in rows extending from the interior 8 of the hoods to a pin contact header 7 with the ends of the contacts formed into posts 11 bent at right angles to extend through a printed circuit board carrying electronic devices and circuits and residing within the module 1b. The connector includes a mounting ear 12 on each side that attaches to the printed circuit board and holds the receptacles relative thereto. Additionally included is a relatively thick elastic gasket 15 extending around the receptacles and utilized in conjunction with the package of the module to seal the receptacle relative to the module. Figure 2 shows the mounting ears 13 in more detail relative to a screw for mechanically mounting on the outside of the module as shown in Figure 1. Also shown in Figure 2 are polarizing ribs 28a extending on the inside of hoods 3a and intended to provide for a polarization of the plug that is made to include recesses or projections positioned to preclude an insertion of the wrong connector.

Figure 6 shows the above mentioned relationship of the gasket 15 to portions of the module, and portions of the receptacle to effect a peripheral sealing. Also shown in Figure 6 is the printed circuit board 35 of the module in relation to the posts 11.

Figure 3 shows the plug 4 of the connector including wires 17 and a retention latch 5 that cooperates with the retention devices 6 mounted on top of the module. The view in Figure 3 is of an assembled plug, Figure 4 showing the plug partially assembled with a contact 18 terminated to wire 17 prior to insertion of the contact within the plug. To be noted in Figure 4 are the polarized cavities 23 that cause an orientation of the contact when inserted in the plug. Figure 5 shows the plug fully disassembled and including a rear cover 19, a seal 21 containing a series of cavities or apertures 30 and ribs 29 on its outer periphery. Adjacent seal 21 is a central housing 20 that includes cavities 22a that align with the cavities 23 of the rear cover to receive contacts inserted therein. Seen projecting from central housing 20 are retaining and guide pins 24 that fit through seal 21 and into the rear housing in the manner shown in Figure 7. The central housing further includes arms extending forwardly, arms 25 that serve to retain a front cover 16.

Carried on the arms 25 is a front pawl 33 and a series of retention steps 26. Note that the ends of retention lances 36 extend away from the forward face of the central housing as do the front pawl and retention steps. The front cover 16 includes cavities 22b aligned for receiving the contacts 18, and in the side, a two-step slot 27 that contains locking teeth 34 and a bridge 33a that holds the outside of the cover mechanically.

Figure 9 shows the seal 21 including cavities 30 with interior ribs 38 that seal the wire and ribs 40 that seal the retention pins 24. To be noted are the exterior ribs 29 that fit inside a hood 8 of the rear housing and are deflected to provide a rear seal, note Figures 6 and 7 to see the position of the seal relative to retaining pins 24 and contacts 18 as terminated to wires 17. The cavity 30 includes a sealing diaphragm 39 at one end that is ruptured to fit tightly around the wire 17 once the contact is pushed through the seal. The retention pins 24 hold the two housing parts 19, 20 together, and are sealed by the ribs 40 (Figure 9).

Referring back to Figure 4, the plug 4 may be seen in a preassembled condition such that the various covers and housings are held together with the cavities in alignment to receive a contact 18 inserted therethrough. Note that the pawl 33 resides half way within the two-step slot 27 and that the retention steps 26 are engaged with a rear edge surface of the slot portion 27a. In this position, contacts may be inserted as shown in Figure 4, through the aperture 23, by using the polarized feature 23a, and into the position shown in Figure 7. If the contacts are not fully seated within the front housing, the ends of the retention lances 36 will be held outwardly, resting against the forward portions of contact 18 to stub against the rear face of the front cover and preclude a final assembly of the plug. If the contacts are properly seated, the contact retention lances 36 will be in the position shown in Figure 6 with the forward surfaces extending radially into the contact against a rear surface thereof to preclude back out and in such position, allow the forward cover to be axially displaced relative to the central housing from the position shown in Figure 7 to the position shown in Figure 8, at which time the retention step 26 will engage an interior locking tooth 34 proximate the two-step slot 27. With the plug assembled in the condition of engagement shown in Figure 8, the plug can now be inserted into a receptacle to reside as indicated in Figure 6.

Figure 6 also shows the use of a boot 34 that serves to protect the wires 17 and the rear part of the plug. Note that the boot 34 includes a forward lip that engages a slot 32a extending around the rear of the rear cover. Note also that the rear cover includes a recess 32b that allows an optional addition of potting material to pot the wires 17 and the rear of the connector to provide for applications wherein the entire module and connector assembly must be immersed under water for some period of time. The invention contemplates uses wherein the seals discussed are adequate for all intended uses and

applications wherein the seals need to be assisted by potting, and as shown in Figure 7, the addition of an additional seal 13a that seals the self-tapping screw 13b located in the mounting ear 12 of the receptacle.

In practice, the various cover and housings of plug and receptacle can be molded of engineering plastic having suitable mechanical strength and dielectric qualities with the seals and gaskets made of suitable resilient materials. It should be apparent from the foregoing description that the invention includes several aspects relating to sealing and to assuring a proper contact seating. Proper contact seating is particularly important in sealed connectors but has uses apart from such connectors and sealing has uses apart from proper contact seating structures.

Claims

1. An electrical connector (4) comprising a housing (20) of insulative material having at least one cavity (22a) therethrough for the receipt of an electrical terminal (18), having a wire (17) trailing therefrom, the connector (4) further comprising a seal member (21) for sealing an interior of said housing (20) by forming a seal with the trailing wire (17), wherein said seal (21) is interfacially disposed against a rear face of said housing (20) and held there; characterized in that said seal (21) has a peripheral outer edge larger than an outer periphery of said housing (20), said peripheral outer edge being for forming a peripheral seal with a hood (3) of a mating connector.
2. A connector as claimed in claim 1, characterized in that said seal (21) has a plurality of ribs (29) along said outer peripheral edge for sealing contact against an inner surface of a mating connector.
3. A connector as claimed in claim 1 or 2, further characterized by a rear cover member (19) which is placed against said seal (21).
4. A connector as claimed in claim 1, 2 or 3, characterized in that the rear cover (19) includes a hood portion (31) which is spaced from and surrounds said peripheral edge of said seal (21).
5. A connector as claimed in claim 1, 2, 3 or 4 characterized in that said housing (20) has retention pins (24) which project through said seal (21), and into said cover portion (19), retaining said rear cover (19) and front housing portion (20) together.
6. A connector as claimed in any one of claims 1 to 5, characterized in that said rear cover (19) has a rear plate portion which is pressed against said seal.
7. A connector as claimed in any one of claims 1 to 6, characterized in that said rear cover (19) has apertures (23) therethrough, which are polarized (23a) for the receipt of terminals (18).
8. A connector as claimed in any one of claims 1 to 7, characterized in that the seal (21) has cavities (39) that include a series of ribs (38) for sealing with said wires (17).
9. A connector as claimed in any one of claims 1 to 8, characterized in that the seal (21) includes a thin rupturable diaphragm (39) penetrated by the electrical terminal (18) upon insertion.
10. A connector as claimed in any one of claims 1 to 9, characterized in that means (36) are operable to preclude mating of the connector with the mating connector unless the terminals are properly seated in the housing (20).
11. A connector as claimed in claim 10, characterized in that the connector further includes a front cover (16) telescopically receivable upon the housing (20) to define the terminal receiving cavities (23) wherein resilient means (36) are provided on the housing (20) that are adapted to be driven transversely relative to the cavity by a partially inserted terminal (18) and allowed to move inwardly upon proper seating of the terminal (18) such that telescopic closure of the housing (20) and the forward cover (16) is responsive to a proper terminal seating.
12. A connector as claimed in claim 11, characterized in that means (27,33) are included for holding the housing (20) and the front cover (16) in a first position relatively displaced apart prior to seating of said terminals (18) and a second position relatively axially displaced together upon proper seating of said terminals (18).
13. A connector as claimed in claim 12, characterized in that resilient retention arms (36) extend from the central housing (20) to preclude movement of said housing (20) and said cover (16) relatively together prior to a proper seating of said terminals (18).

Patentansprüche

1. Elektrischer Verbinder (4) mit einem Gehäuse (20) aus isolierendem Material mit mindestens einem sich dort hindurch erstreckenden Hohlraum (22a) zur Aufnahme einer elektrischen Anschlussklemme (18), mit einer nachfolgenden Ader (17), wobei der Verbinder (4) weiterhin ein Abdichtelement (21) zum Abdichten eines Innenraums des Gehäuses (20) durch Bilden einer Dichtung mit der nachfol-

genden Ader (17) umfaßt, wobei die Dichtung (21) schnittstellenmäßig an einer rückwärtigen Fläche des Gehäuses (20) angeordnet ist und dort gehalten wird; dadurch gekennzeichnet, daß die Dichtung (21) einen äußeren Umfangsrand aufweist, der größer ist als ein Außenumfang des Gehäuses (20), wobei der äußere Umfangsrand zur Bildung einer Umfangsdichtung mit einer Haube (3) eines Gegenverbinders bestimmt ist.

2. Verbinder nach Anspruch 1, dadurch gekennzeichnet, daß die Dichtung (21) entlang dem äußeren Umfangsrand mehrere Rippen (29) zur abdichten der Kontaktierung einer Innenfläche eines Gegenverbinders aufweist.

3. Verbinder nach Anspruch 1 oder 2, weiterhin gekennzeichnet durch ein rückwärtiges Abdeckelement (19), das gegen die Dichtung (21) plaziert ist.

4. Verbinder nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die rückwärtige Abdeckung (19) ein Haubenteil (31) enthält, das vom Umfangsrand der Dichtung (21) beabstandet ist und diesen umgibt.

5. Verbinder nach Anspruch 1, 2, 3 oder 4, dadurch gekennzeichnet, daß das Gehäuse (20) Arretierstifte (24) aufweist, die durch die Dichtung (21) und in das Abdeckteil (19) ragen, wobei sie die rückwärtige Abdeckung (19) und das vordere Gehäuseteil (20) zusammenhalten.

6. Verbinder nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die rückwärtige Abdeckung (19) ein rückwärtiges Plattenteil aufweist, das gegen die Dichtung gedrückt wird.

7. Verbinder nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß durch die rückwärtige Abdeckung (19) Aperturen (23) gehen, die für die Aufnahme von Anschlußklemmen (18) codiert (23a) sind.

8. Verbinder nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß die Dichtung (21) Hohlräume (30) aufweist, die zum Abdichten mit den Adern (17) eine Reihe von Rippen (38) enthalten.

9. Verbinder nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Dichtung (21) eine dünne zerreißbare Membran (39) enthält, durch die die elektrische Anschlußklemme (18) beim Stecken dringt.

10. Verbinder nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß Mittel (36) betätigt werden können, um das Zusammenstecken des Verbinder

mit dem Gegenverbinder auszuschließen, es sei denn, die Anschlußklemmen sitzen richtig im Gehäuse (20).

11. Verbinder nach Anspruch 10, dadurch gekennzeichnet, daß der Verbinder weiterhin eine vordere Abdeckung (16) enthält, die sich teleskopartig auf dem Gehäuse (20) aufnehmen läßt, um die die Anschlußklemmen aufnehmenden Hohlräume (23) zu definieren, wobei an dem Gehäuse (20) elastische Mittel (36) vorgesehen sind, die so ausgelegt sind, daß sie durch eine teilweise gesteckte Anschlußklemme (18) quer zum Hohlraum getrieben werden und sich bei richtigem Sitz der Anschlußklemme (18) nach innen bewegen können, so daß der teleskopartige Verschluß des Gehäuses (20) und der vorderen Abdeckung (16) auf einen richtigen Sitz der Anschlußklemme reagiert.

12. Verbinder nach Anspruch 11, dadurch gekennzeichnet, daß Mittel (27, 33) zum Halten des Gehäuses (20) und der vorderen Abdeckung (16) in einer ersten Stellung, in der sie vor dem Einsetzen der Anschlußklemmen (18) relativ voneinander weg beabstandet sind, und in einer zweiten Stellung, in der sie bei richtigem Sitz der Anschlußklemmen (18) axial relativ aufeinander zu versetzt sind, enthalten sind.

13. Verbinder nach Anspruch 12, dadurch gekennzeichnet, daß sich elastische Arretierarme (36) vom mittleren Gehäuse (20) weg erstrecken, um vor einem richtigen Sitz der Anschlußklemmen (18) eine Bewegung des Gehäuses (20) und der Abdeckung (16) relativ aufeinander zu auszuschließen.

Revendications

1. Connecteur électrique (4) comprenant un boîtier (20) en matériau isolant traversé d'au moins une cavité (22a) pour la réception d'une borne électrique (18), présentant un fil conducteur (17) traînant depuis celui-ci, le connecteur (4) comprenant en outre un organe d'étanchéité (21) pour rendre étanche un intérieur dudit boîtier (20) en formant un joint d'étanchéité avec le fil conducteur (17) traînant, ledit joint d'étanchéité (21) étant disposé en interface contre une face arrière dudit boîtier (20) et maintenu à cet endroit; caractérisé en ce que ledit joint d'étanchéité (21) possède un bord périphérique extérieur plus grand qu'une périphérie extérieure dudit boîtier (20), ledit bord périphérique extérieur permettant de former un joint d'étanchéité périphérique avec un capuchon (3) d'un connecteur d'accouplement.

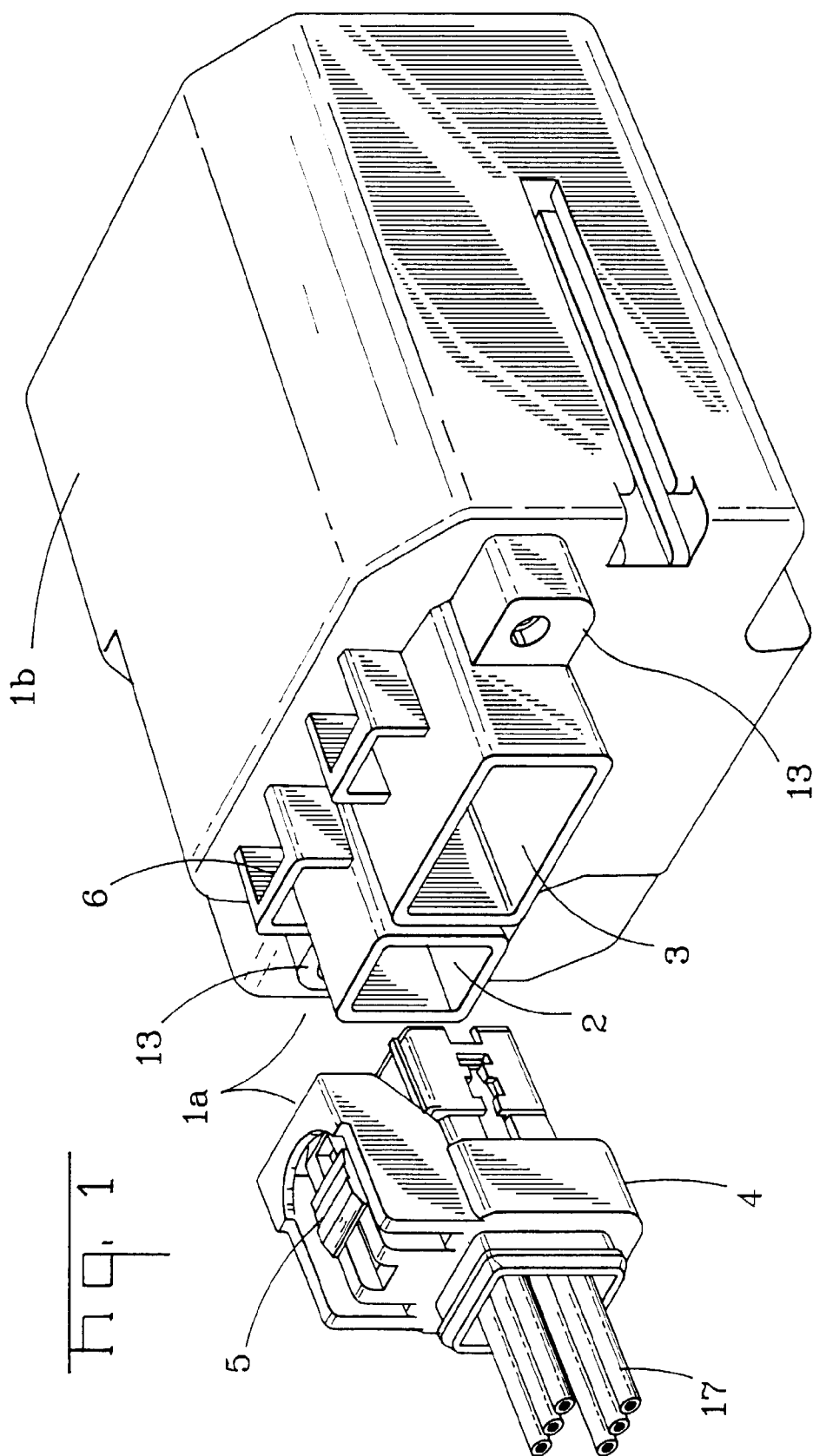
2. Connecteur selon la revendication 1, caractérisé en ce que ledit joint d'étanchéité (21) possède une plu-

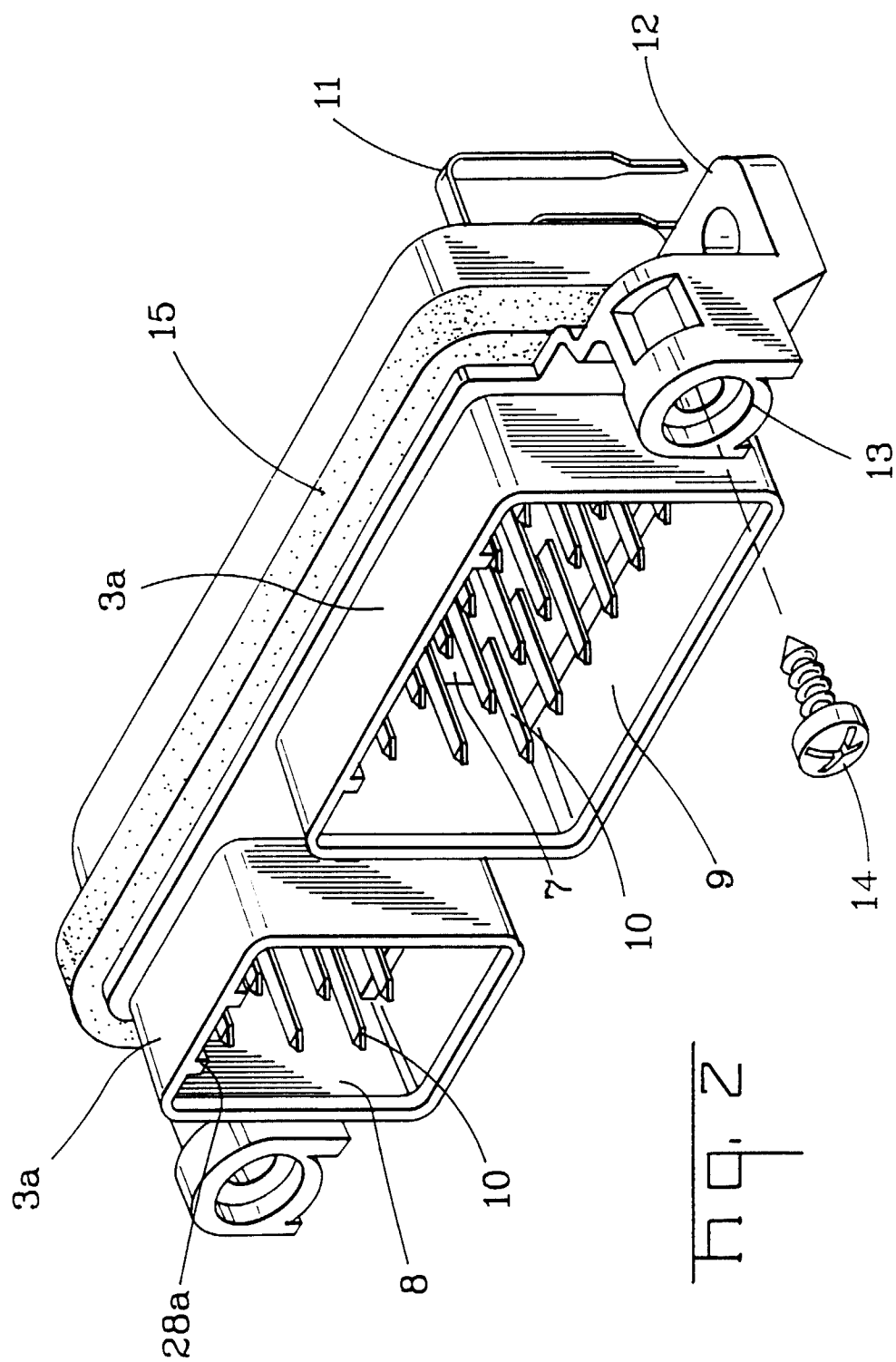
ralité de nervures (29) le long dudit bord périphérique extérieur en vue d'un contact étanche contre une surface intérieure d'un connecteur d'accouplement.

3. Connecteur selon la revendication 1 ou 2, caractérisé en outre par un organe de couvercle arrière (19) qui est placé contre ledit joint d'étanchéité (21). 5
4. Connecteur selon la revendication 1, 2 ou 3, caractérisé en ce que le couvercle arrière (19) comporte une portion de capuchon (31) qui est espacée dudit bord périphérique dudit joint d'étanchéité (21) et qui entoure celui-ci. 10
5. Connecteur selon la revendication 1, 2, 3 ou 4 caractérisé en ce que ledit boîtier (20) possède des broches de retenue (24) qui font saillie à travers ledit joint d'étanchéité (21) et dans ladite portion de couvercle (19), en retenant ensemble ledit couvercle arrière (19) et ladite portion avant du boîtier (20). 15
6. Connecteur selon l'une quelconque des revendications 1 à 5, caractérisé en ce que ledit couvercle arrière (19) possède une portion de plateau arrière qui est comprimée contre ledit joint d'étanchéité. 20
7. Connecteur selon l'une quelconque des revendications 1 à 6, caractérisé en ce que ledit couvercle arrière (19) est traversé d'ouvertures (23), qui sont polarisées (23a) pour la réception de bornes (18). 25
8. Connecteur selon l'une quelconque des revendications 1 à 7, caractérisé en ce que le joint d'étanchéité (21) possède des cavités (39) qui comportent une série de nervures (38) pour sceller lesdits fils conducteurs (17). 30
9. Connecteur selon l'une quelconque des revendications 1 à 8, caractérisé en ce que le joint d'étanchéité (21) comporte une fine membrane (39) pouvant être rompue, dans laquelle pénètre la borne électrique (18) lors de l'insertion. 35
10. Connecteur selon l'une quelconque des revendications 1 à 9, caractérisé en ce qu'un moyen (36) est actionnable pour empêcher l'accouplement du connecteur avec le connecteur d'accouplement sauf si les bornes sont correctement positionnées dans le boîtier (20). 40
11. Connecteur selon la revendication 10, caractérisé en ce que le connecteur comporte en outre un couvercle avant (16) pouvant être reçu sur le boîtier (20) de manière télescopique pour définir les cavités (23) recevant les bornes, un moyen élastique (36) prévu sur le boîtier (20) étant adapté pour être entraîné transversalement par rapport à la cavité 45

par une borne (18) partiellement insérée et pouvant se déplacer vers l'intérieur lors du positionnement correct de la borne (18), de telle sorte que la fermeture télescopique du boîtier (20) et du couvercle avant (16) soit sensible à un positionnement correct de la borne. 50

12. Connecteur selon la revendication 11, caractérisé en ce que des moyens (27, 33) sont inclus pour maintenir le boîtier (20) et le couvercle avant (16) dans une première position où ils sont écartés l'un par rapport à l'autre avant le positionnement desdites bornes (18), et une deuxième position où ils sont déplacés axialement l'un par rapport à l'autre lors du positionnement correct desdites bornes (18). 55
13. Connecteur selon la revendication 12, caractérisé en ce que des bras de retenue (36) élastiques se prolongent depuis le boîtier (20) central pour empêcher le déplacement dudit boîtier (20) et dudit couvercle (16) l'un par rapport à l'autre avant un positionnement correct desdites bornes (18).





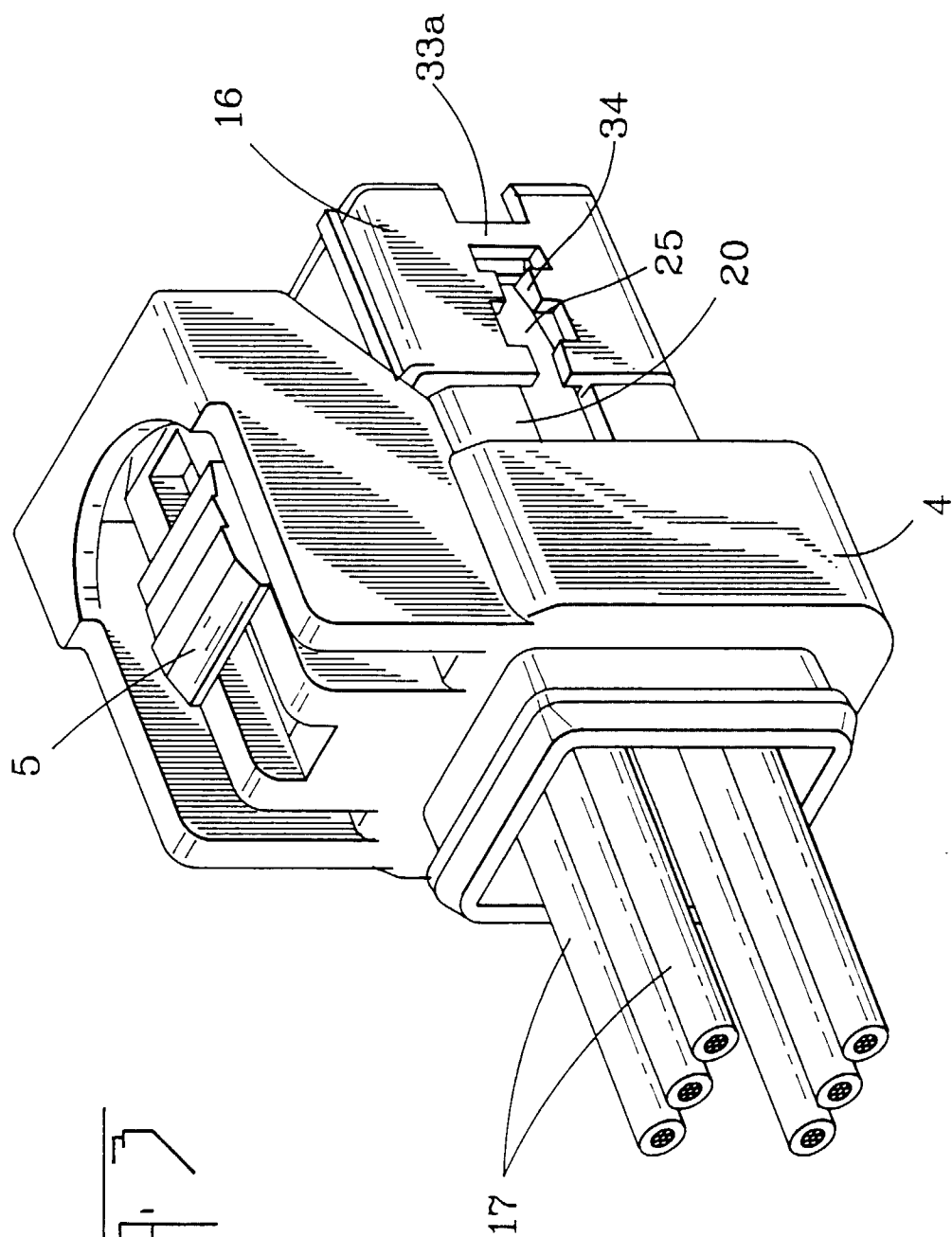
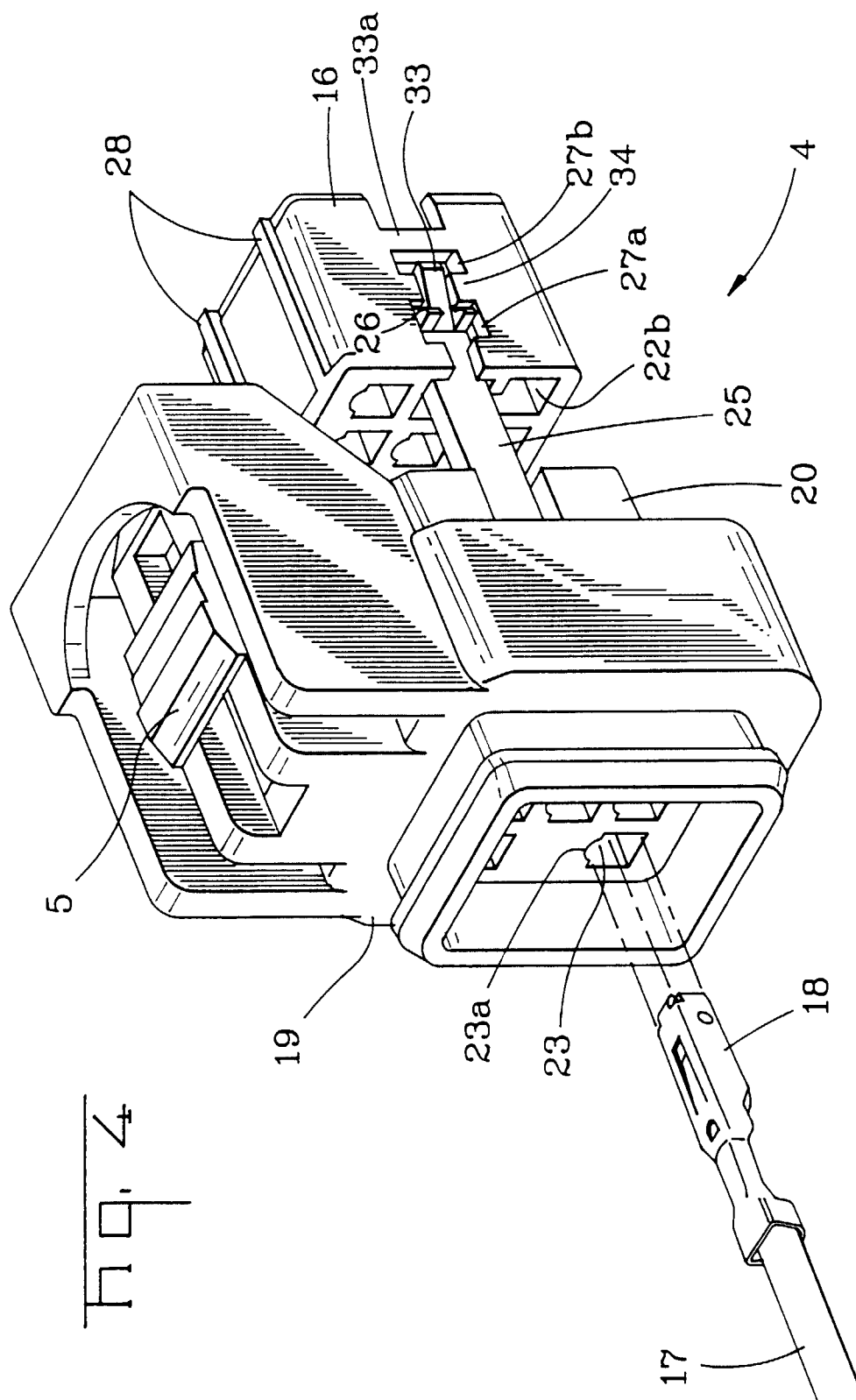
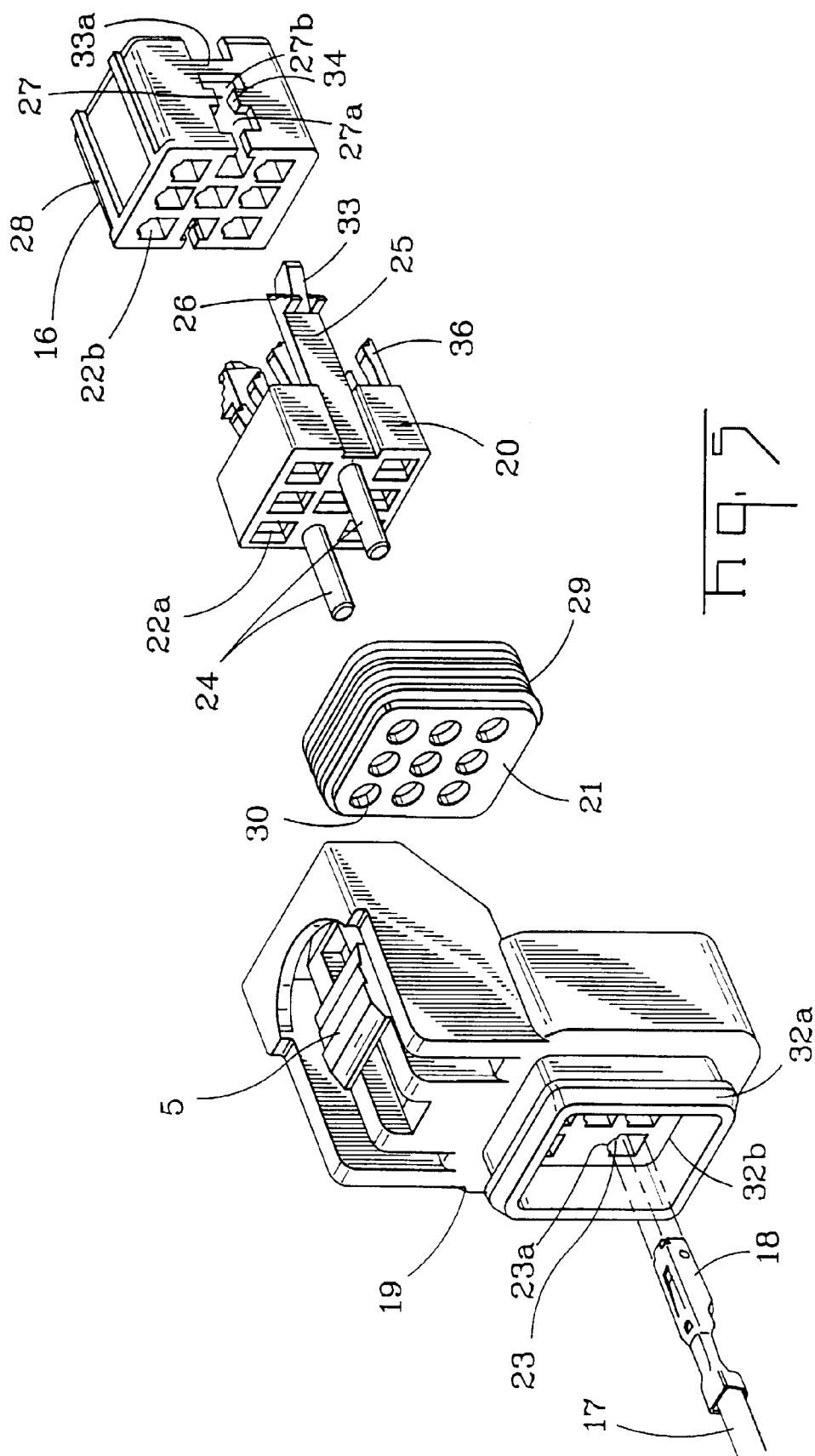
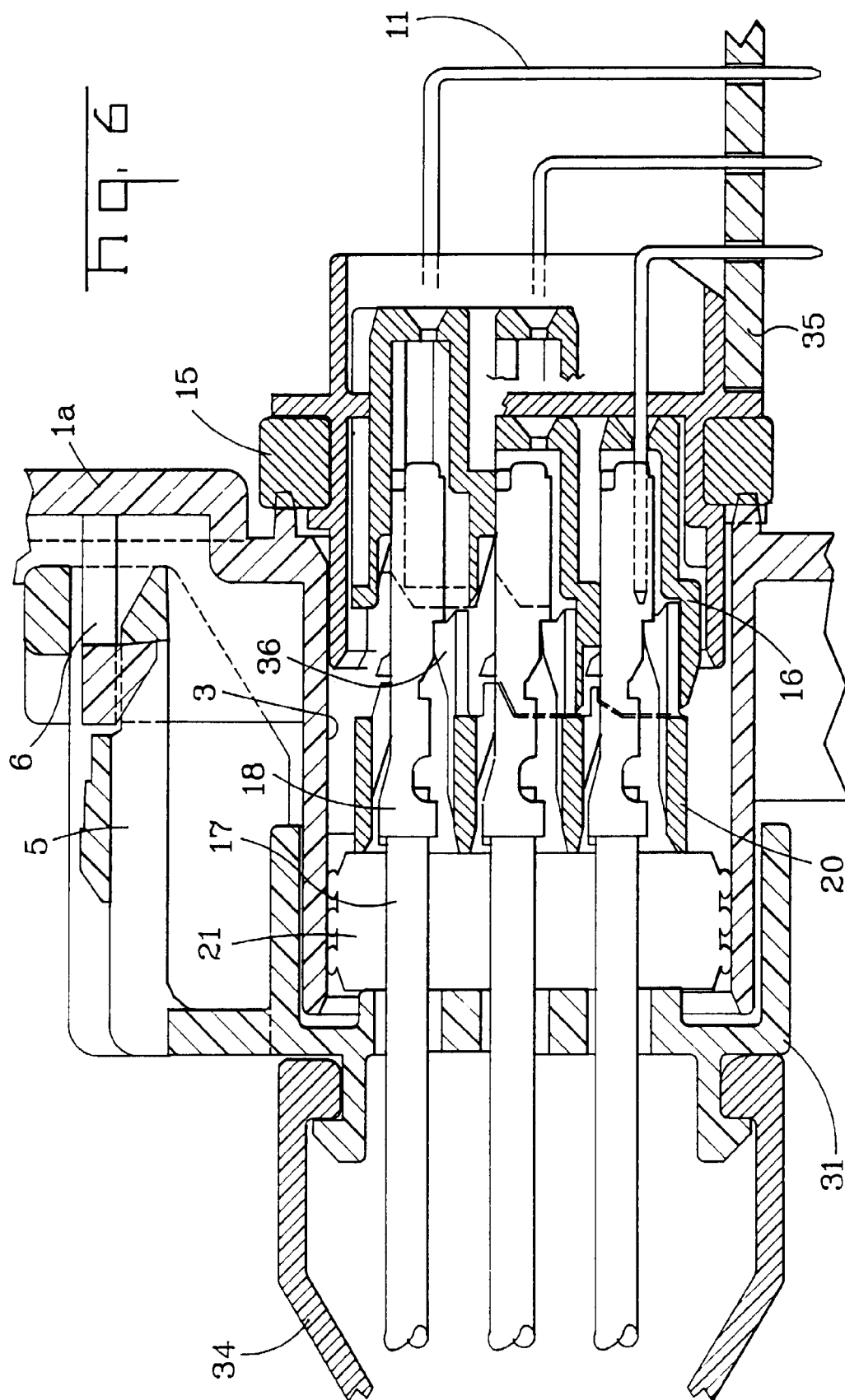


Fig. 3







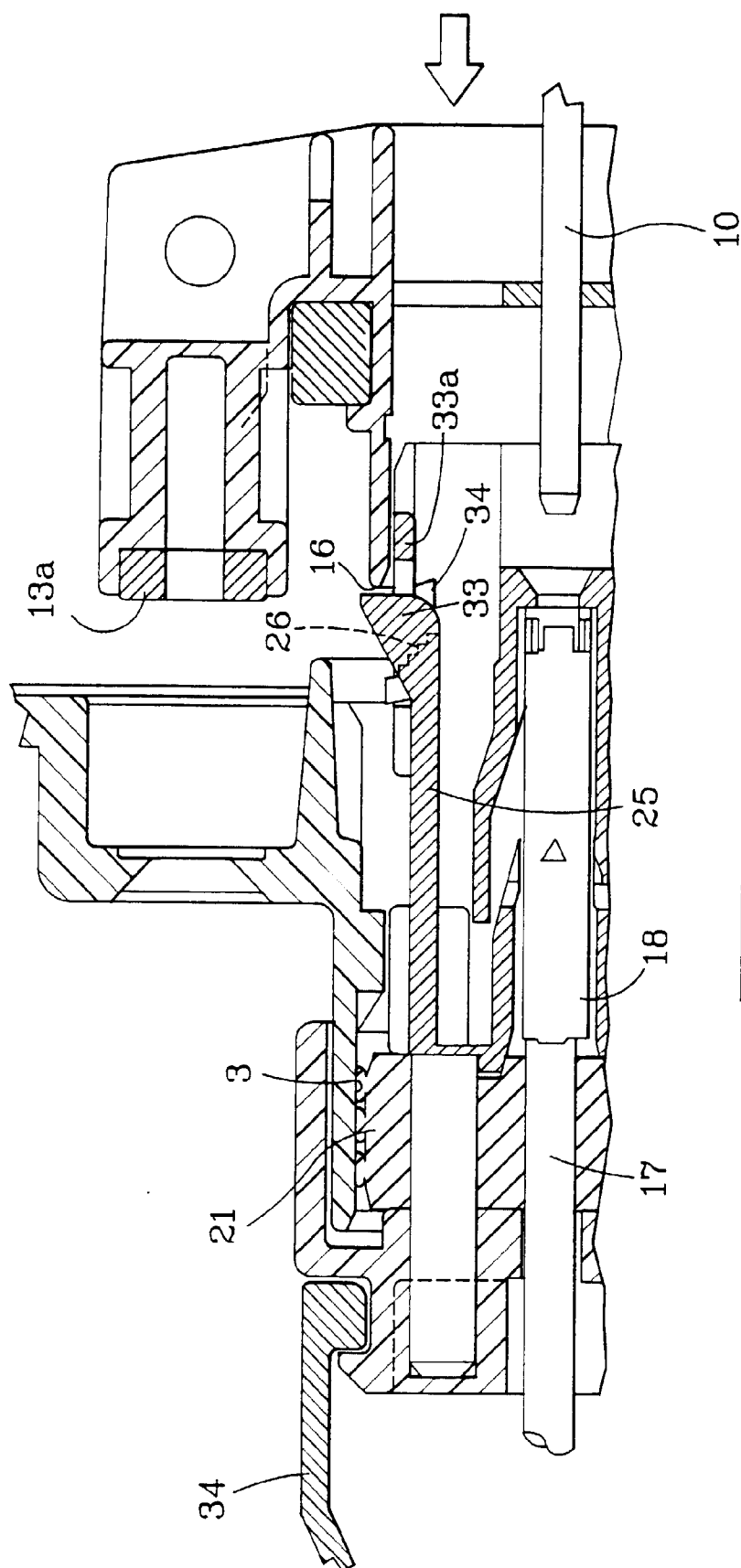


fig. 7

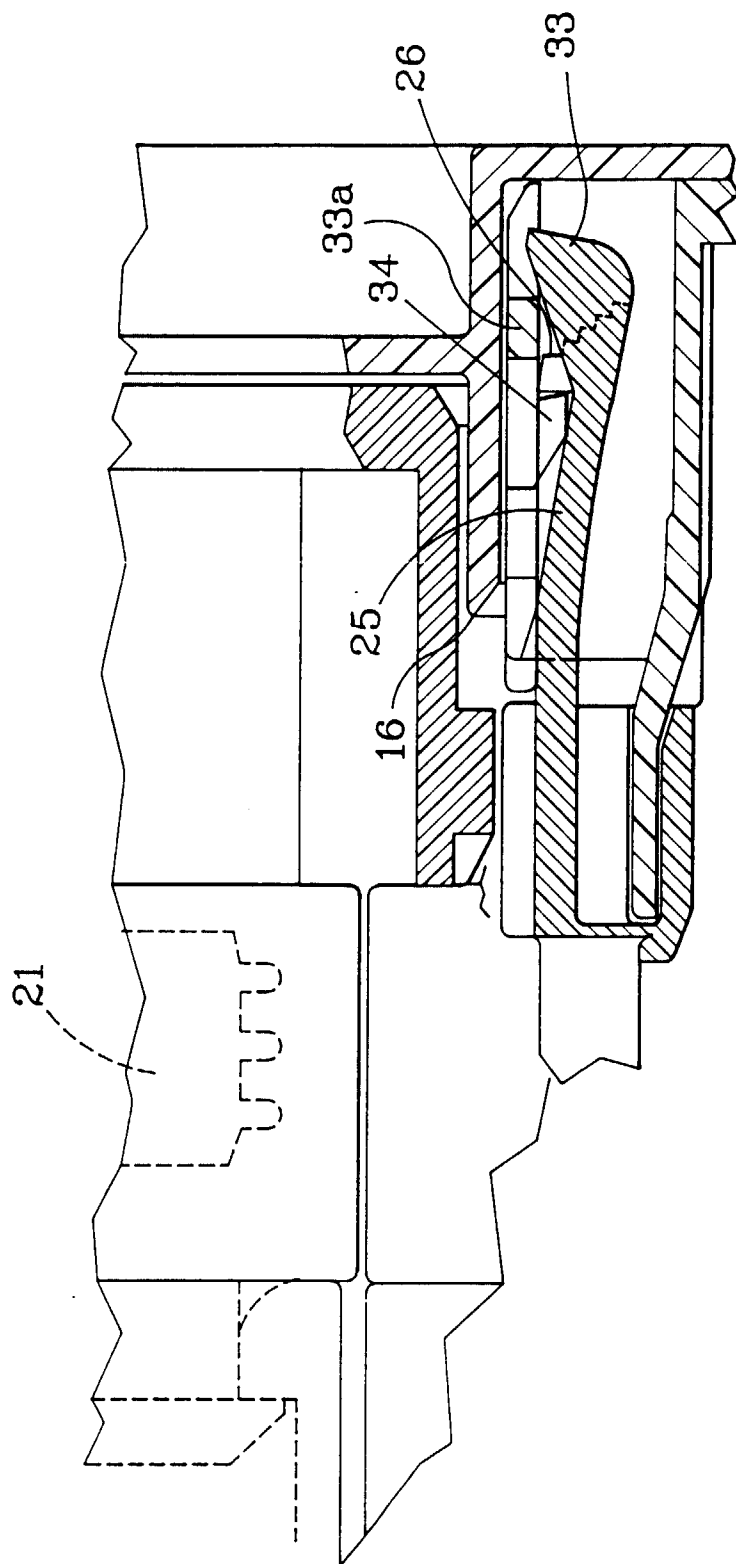


Fig. 8

