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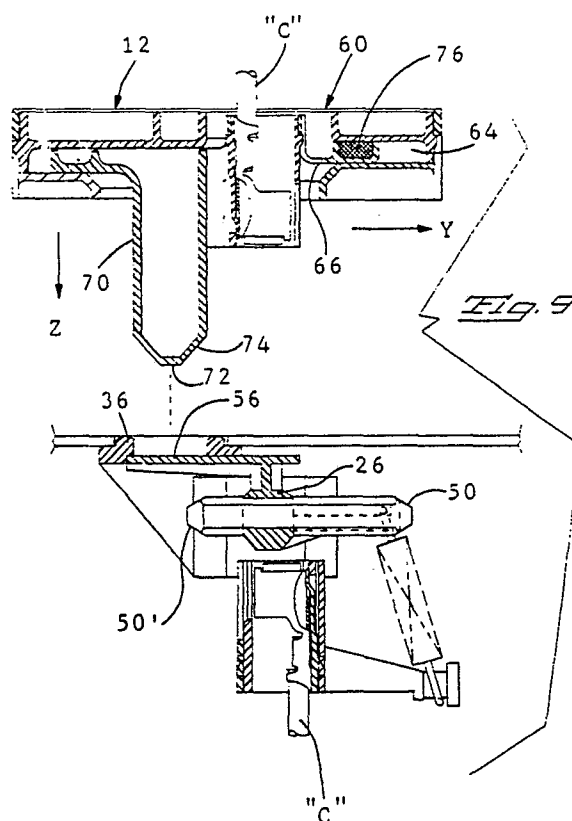
71 Applicant: **AMP INCORPORATED**  
**P.O. Box 3608 470 Friendship Road**  
**Harrisburg Pennsylvania 17105(US)**

72 Inventor: **Bonfand, Philippe**  
**228, Rue de Charenton**  
**F-75012 Paris(FR)**  
Inventor: **Person, François**  
**13, Rue Clairefontaine**  
**F-95320 St. Leu la Foret(FR)**

74 Representative: **Klunker . Schmitt-Nilson .**  
**Hirsch**  
**Winzererstrasse 106**  
**D-8000 München 40(DE)**

54 **Hinged door connector.**

57 This invention relates to an electrical connector of the type having plug and socket components (10,12) where one such component (10) is fixed and the other component (12) is movable into engagement therewith. Features of such connector include means (64,76,70,74) for adjusting the lateral position of one component to the other, means (26,56,70) to cause rotational movement of electrical tabs (50,50') from a remote position to an exposed position suitable for electrical contact during engagement of the components (10,12), and means (100) to cause a reverse rotational movement of said tabs (50,50') during disengagement of said components (10,12).



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## HINGED DOOR CONNECTOR

The present invention is directed to an electrical connector of the type having plug and socket components, where one such component is fixed and the other is movable into engagement therewith. More particularly, this connector is designed to provide a simplified electrical connection for use with an automotive door. Heretofore it was necessary to either pass a part of a flexible electrical harness through a window in the bodywork, or to provide spring-biased tabs projecting from the door.

The connector of this invention avoids the necessity of providing a direct interconnection means between the movable parts, i.e. hinged door and body frame, by utilizing an electrical connector of the type composed of plug and socket components, where one of said components is fixed and the other component is movable generally in a Z-direction into alignment and engagement therewith. The socket component consists of a row of side entry receptacles, whereas the plug component consists of a row of tabs receivable in said receptacles, where said plug component is pivotal in response to the engagement of said components. A feature of this connector is the provision of the adjustability of one of said components within the X-Y plane to ensure such alignment.

U.S. Patent No. 4,528,429 teaches an electrical switch-plug assembly for use with a household electrical appliance, of the cordless variety. Briefly, the assembly incorporates a movable baffle, which baffle is responsive to movement during engagement and disengagement of such assembly components. The present invention avoids the complexities of such an assembly and achieves this by a combination of components in which the electrical connections are not exposed during periods of non-engagement thereof.

The features of this invention will become more apparent from the description which follows, particularly when read in conjunction with the accompanying exemplary drawings in which, for convenience, one major component shall be described as fixed, and the other major component as movable:

FIGURE 1 is a bottom-front perspective view of the assembled component secured to the automobile body, or fixed component, according to the preferred embodiment of this invention.

FIGURE 2 is a top-rear perspective view of the assembled component illustrated in Figure 1.

FIGURE 3 is a top-front perspective view of the component of Figure 2, except that the pivotal contact mechanism has been removed therefrom.

FIGURE 4 is a sectional view taken along

line 4-4 of Figure 2.

FIGURE 5 is a side view, the remote of the component shown in Figure 4.

FIGURE 6 is a perspective view of a side entry receptacle suitable for use in the major components of this invention.

FIGURE 7 is a front view of the second major component of this invention, and matable with the component illustrated in Figures 1 and 2.

FIGURE 8 is a right side view of the major component shown in Figure 7.

FIGURES 9 and 10 are partial sectional views, exploded therefrom to show a premating relationship, illustrating certain internal details of the respective components.

The invention, to be described herein, comprises an electrical connector of the type composed of plug and socket components 10,12, where one of said components is fixed and the other component is movable into alignment and engagement therewith. It should again be noted that either major component may be fixed while the other is movable, that is, one is fixed to the automobile body, and the other fixed to the door and movable into alignment and engagement with the automobile body component.

The plug component 10, which for purposes of illustration shall be considered the fixed component, is illustrated in Figures 1-4. Such component comprises a "U" shaped housing 14, having a major recess 15 communicating with plural openings 16 in the base 18 thereof, whereby conductors (not shown) are brought into and terminated to receptacles. At each end of housing 14, there is provided a smaller recess 20, containing vertical slots 22, and a flange 23. Each such flange contains a fastener hole 25 for recessing in and securing to the automobile body. The purpose of the smaller recesses 20 is to receive and secure the pivotal member 26. That is, as best seen in Figures 1 and 3, the recess 20 contains a pair of laterally disposed vertical slots 22 to slidably receive end members 28 of pivotal member 26, which end members seat on bottom wall 29 (Figure 3).

Disposed along the upper portion of housing portion 14 is a shelf portion 32 in which there is defined an elongated opening 34 having an up-raised flanged portion 36 outlining such opening. The function of such flange shall become more apparent hereinafter.

The pivotal member 26, intermediate end members 28, in its preferred embodiment is an inverted "L" (see the cross section of Figure 4), where the vertical leg 40 consists of a fixed lower portion 42 seated within recess 15, and a pivotal

upper portion 44. As seen in the bottom-front perspective of Figure 1, the lower portion 42 is provided with a plurality of vertical openings 46 communicating with a like plurality of receptacle receiving cavities, whereby male tabs may enter such openings for engagement with a female receptacle therein. This relationship will become more apparent with a discussion of the receptacle of Figure 6 and the operation of the connector of this invention.

In the upper portion 44 of vertical leg 40 there is included a plurality of pivotal, oppositely disposed male tabs 50,50', which correspond in number to the vertical openings 46. From Figure 2 it will be noted that the pivoting action of upper portion 44 is achieved by journals 52 in the respective end members 28.

The horizontal leg 54 of pivotal member 26 is an elongated plate 56, fixed to and movable with upper portion 44, which in a first or connector disengaged position underlies, designated by the numeral 60, the flange portion 36 surrounding a portion of opening 34. While the pivotal movement of upper portion 44 will be described later, it may be noted at this point that such movement is achieved by means which act against elongated plate 56.

Such pivotal movement, achieved by the mating socket component 12 with the plug component, will now be described with particular reference to Figures 7 and 8, and the upper drawings in Figures 9 and 10. The socket component 12 comprises a housing 60 which is attached 62 to the movable portion of the automotive body, such as a door. Internally of said housing 60 is a peripheral slot 64, a portion of which is shown in Figures 9 and 10, for receiving a socket housing 66. The socket housing 66 contains a plurality of slots 68, each having a cavity 70 for receiving therein a side entry receptacle, such as shown in Figure 6. The ends 72 of socket housing 66 are each provided with a slot 74 within which there is formed a friction member 76, such as a pad. While the purpose thereof is to limit the relative movement of the socket housing 66 within the slots 64, there nevertheless is sufficient play to allow the socket housing 66 to adjust and realign itself in the X-Y plane to insure proper alignment between the mated components 10,12.

A further feature of the socket component 12 is the provision of a protuberance bar 70 directed toward the plug component 10. Such bar, when the plug and socket components are brought into mating engagement, contacts and depresses elongated plate 56, which by the continued mating movement will cause pivotal member 26 to rotate bringing the respective male tabs 50,50' into their corresponding side entry receptacles (Figure 6). The protuberance bar 70, at its end 72 and along the length thereof, is tapered 74 to facilitate the entry of the

bar 70 through the opening 34. More precisely, as the bar 70 approaches the plate 56, and if there is any misalignment, the tapered end 72 will first contact flange portion 36 which in turn will cause the socket housing to adjust a sufficient amount to permit the bar to pass flange portion 36 and depress plate 56.

Heretofore, reference has been made to a side entry receptacle, the type of female receptacle illustrated in Figure 6. In a preferred embodiment of this invention, the socket housing 66 and the lower portion 42 are each provided with a like plurality of a side entry receptacle 80. The receptacle 80, typically formed from a sheet metal blank, as is well known, is comprised of a wire connecting portion 82 and a box-like receptacle portion 84, where the latter portion consists of a pair of opposing side walls 86 turned toward each other to form a tab receiving slot 88 therebetween. The end most portion 90 of each side wall 86 is bent 92 so as to form a converging opening 94 for easy insertion of a male tab 50,50'. In any event, electrical connection to the receptacle 80 is by means of a conductor C crimped to wire connecting portion 82, see Figure 9.

Considering Figure 9 in more detail, which Figure illustrates the plug and socket components 10,12 in a premating positioning, it will be seen that as the socket component 12 moves downwardly in a mating direction, i.e. in the Z direction, if adjustment is required in the positioning of socket housing 66, the tapered end 74 first contacts flange portion 36 causing socket housing 66 to shift or realign in the X-Y plane so that proper alignment is achieved for subsequent engagement of the components. With the protuberance bar 70 suitably aligned the end 72 thereof contacts plate 56 which begins to pivot downwardly. Concurrently, the male tabs 50,50' begin to pivot into a vertical alignment whereby the male tabs 50,50' have entered into electrical contact with the respective side entry receptacles 80. In this position full electrical contact exists between the mated portions of the electrical connector hereof.

An important feature of this invention is to provide a connector, during periods of nonengagement, such as when the door is open, in which the male contacts or tabs are recessed and not exposed to damage or injury. This is achieved with the present invention by the provision of a spring 100, under tension, fixed between arm 102 secured to housing 10, and arm 104 fixed to and movable with pivot upper portion 44 (Figures 2 and 4). Optionally, a shroud or cover may be provided about the spring 100.

## Claims

1. An electrical connector of the type composed of plug components (10,12) where one of said components (10) is fixed and the other component (12) is movable into alignment and engagement therewith, which for reference purposes is the Z-direction, characterized in that at least one of said components (10,12) includes a row of side entry receptacles (80), and the other of said components (10,12) includes a like plurality of male tabs (50) receivable in said receptacles, and that a portion (26) of said fixed component (10) is pivotal in response to the engagement and disengagement of said components (10,12).

2. An electrical connector according to claim 1, characterized in that each component (10,12) includes a row of side entry receptacles (80), and that the pivotal portion (26) includes a plurality of opposed male tabs (50,50').

3. An electrical connector according to claim 1 or 2, characterized in that said movable component (12) comprises a housing (60) containing a socket housing (66) adjustable within the X-Y plane to ensure alignment and mating of tabs (50) with receptacles (80).

4. An electrical connector according to claim 3, characterized in that said socket housing (66) includes a friction mechanism (76) to control the movement within the X-Y plane.

5. An electrical connectors according to any of claims 1 to 4, characterized in that the movable component (12) includes a projection (70) which acts on an extension (56) of said pivotal portion (26).

6. An electrical connector according to any of claims 1 to 5, characterized in that means (100) are provided to cause pivotal portion (26) to return to a normal position when said components (10,12) are disengaged.

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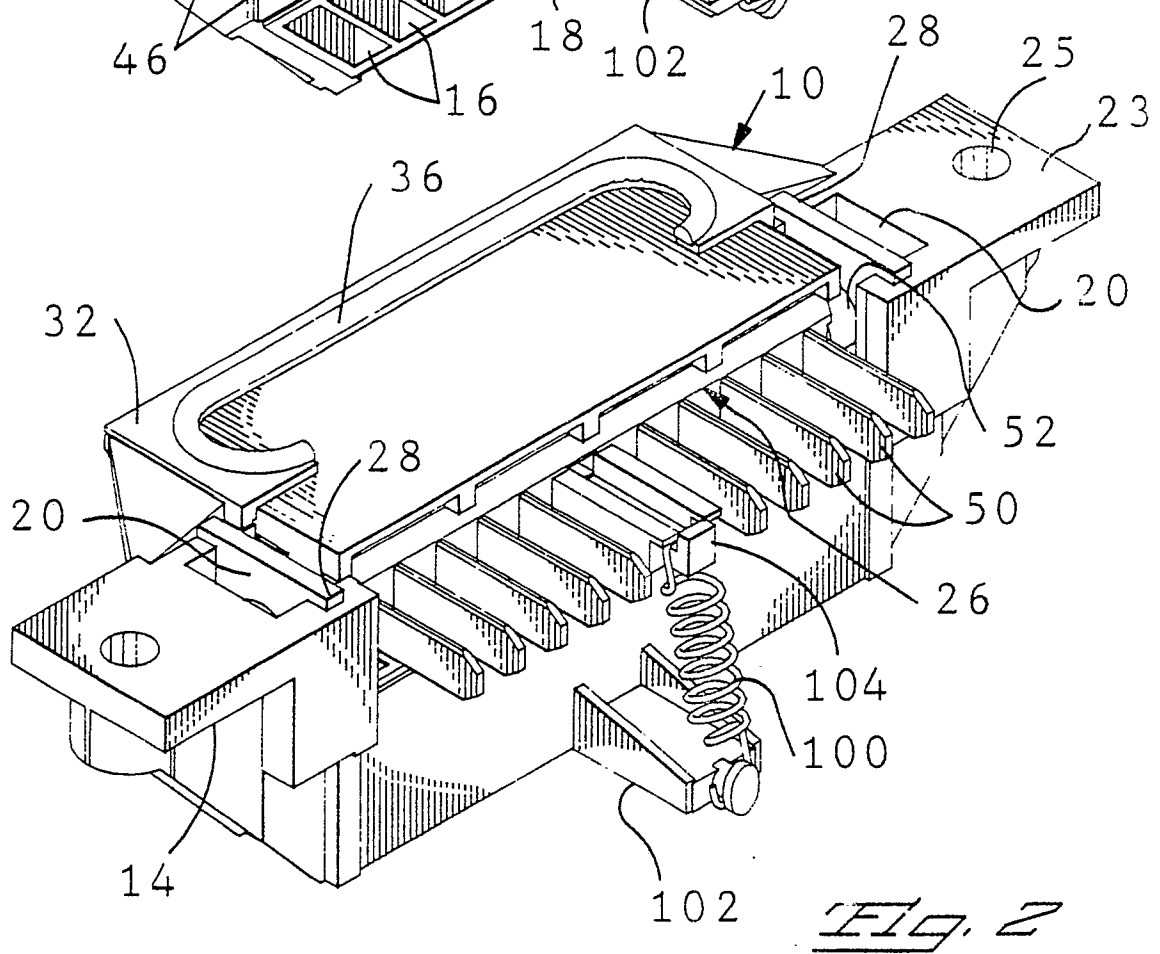
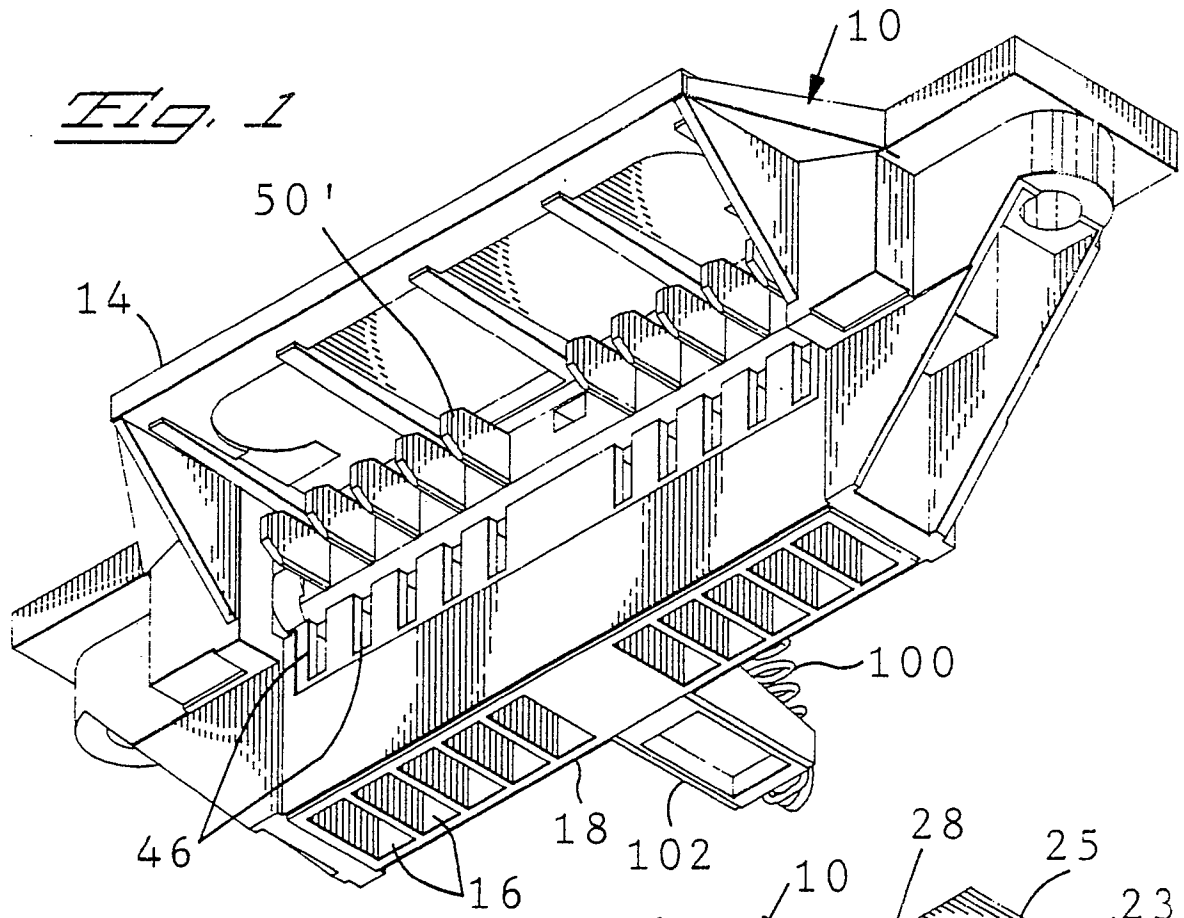
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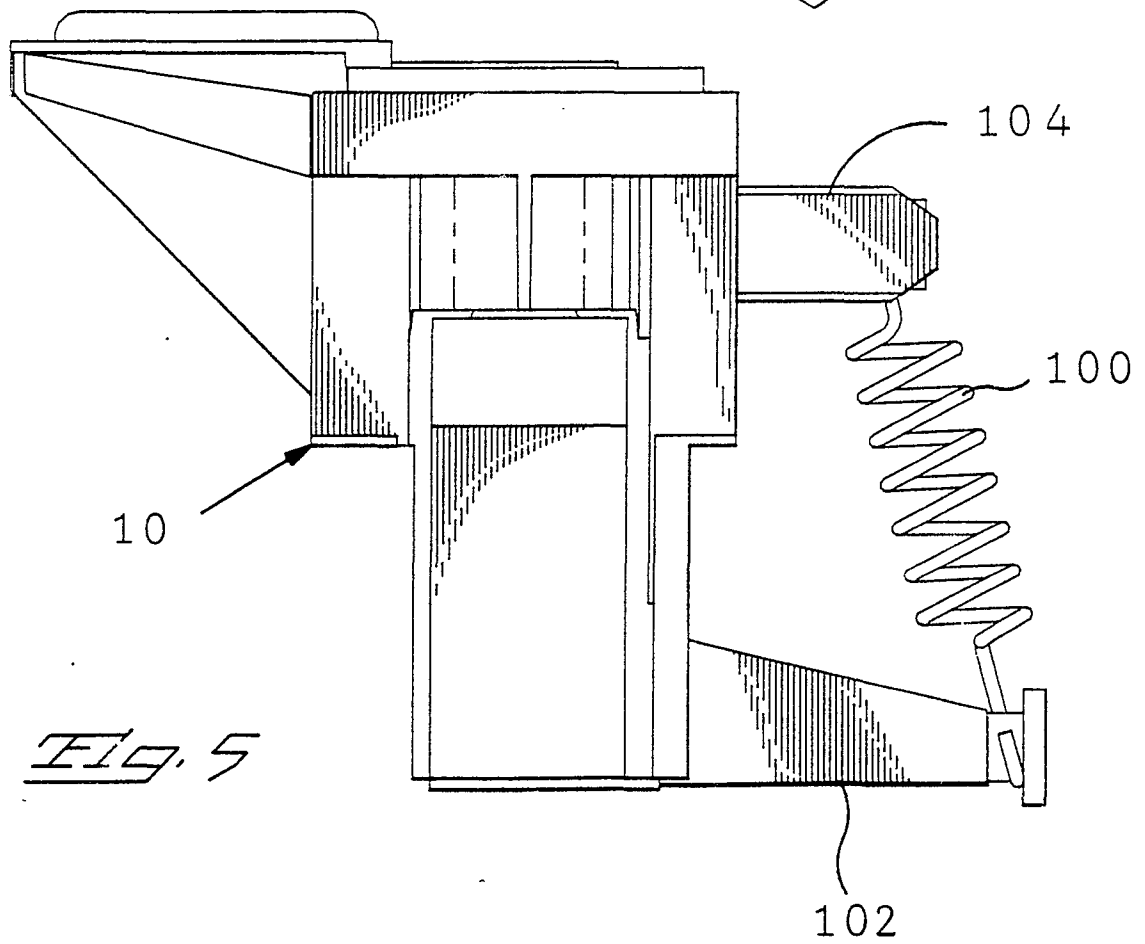
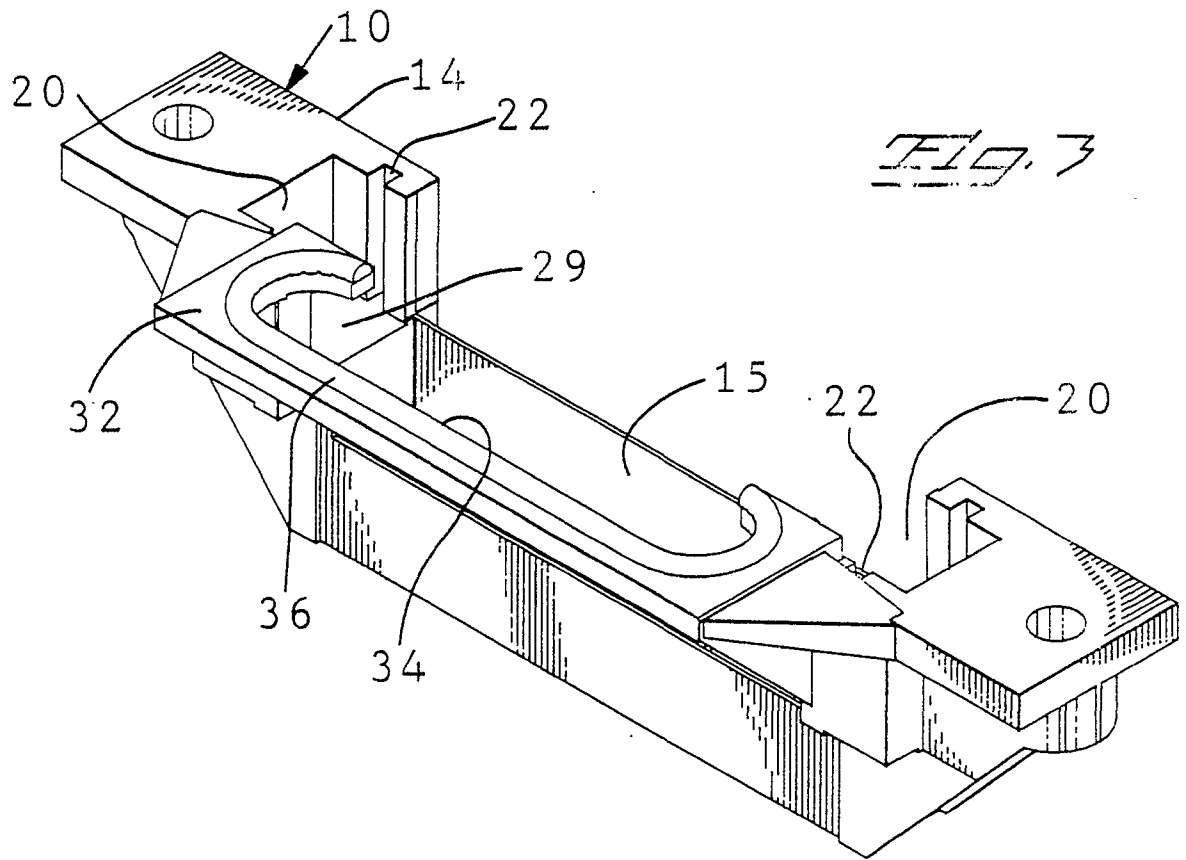
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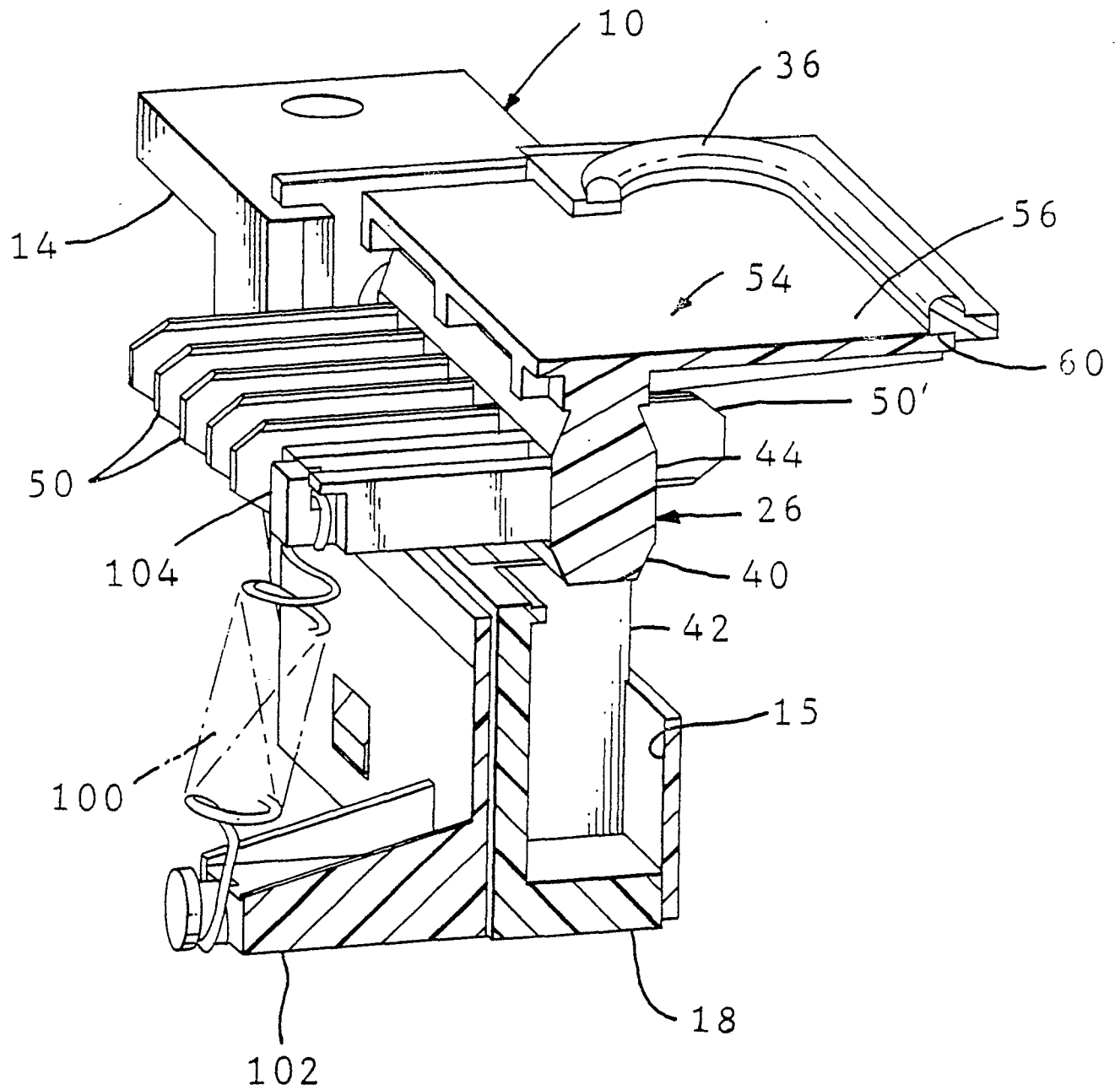
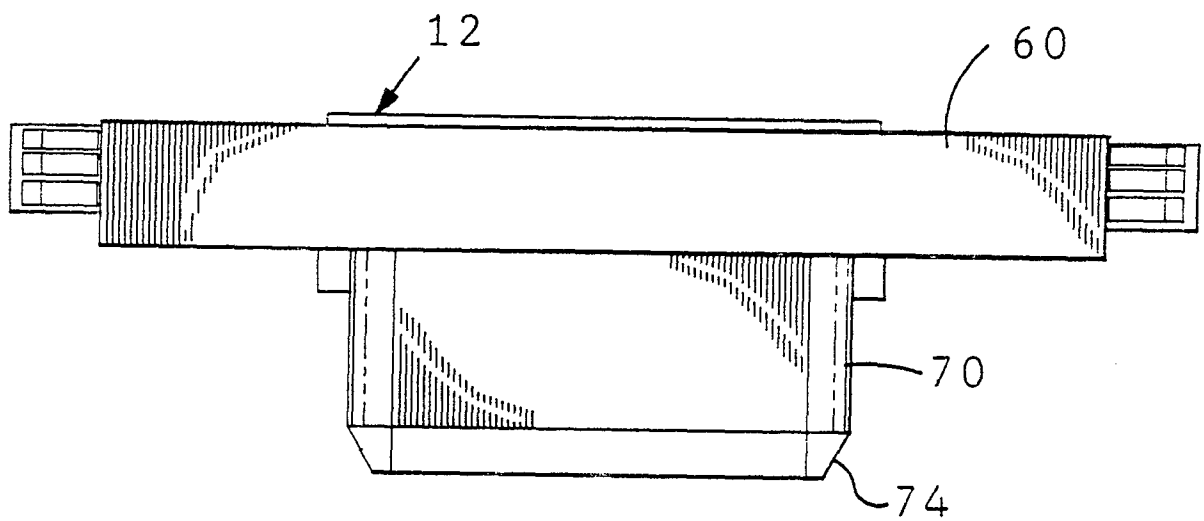
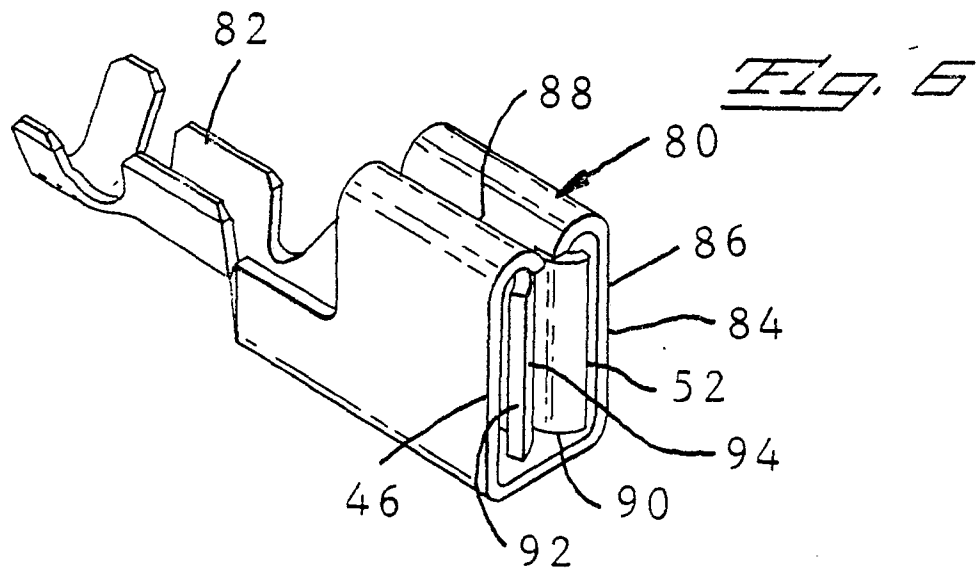
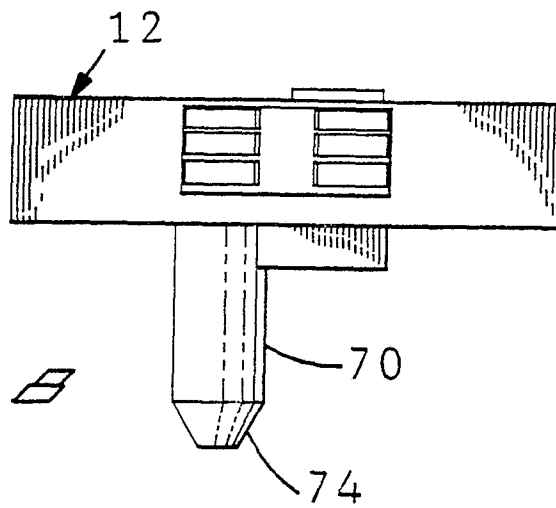


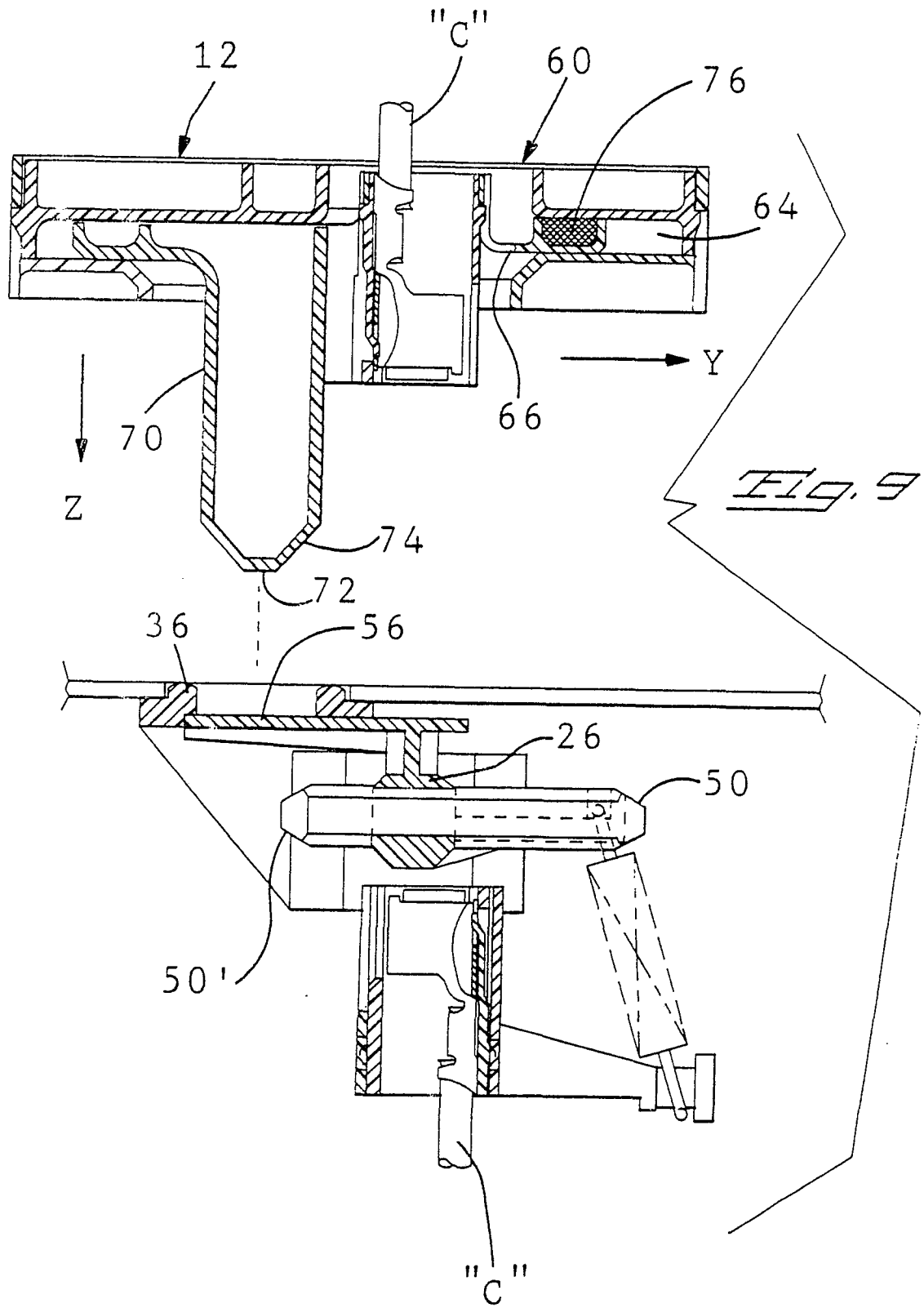
Fig. 4

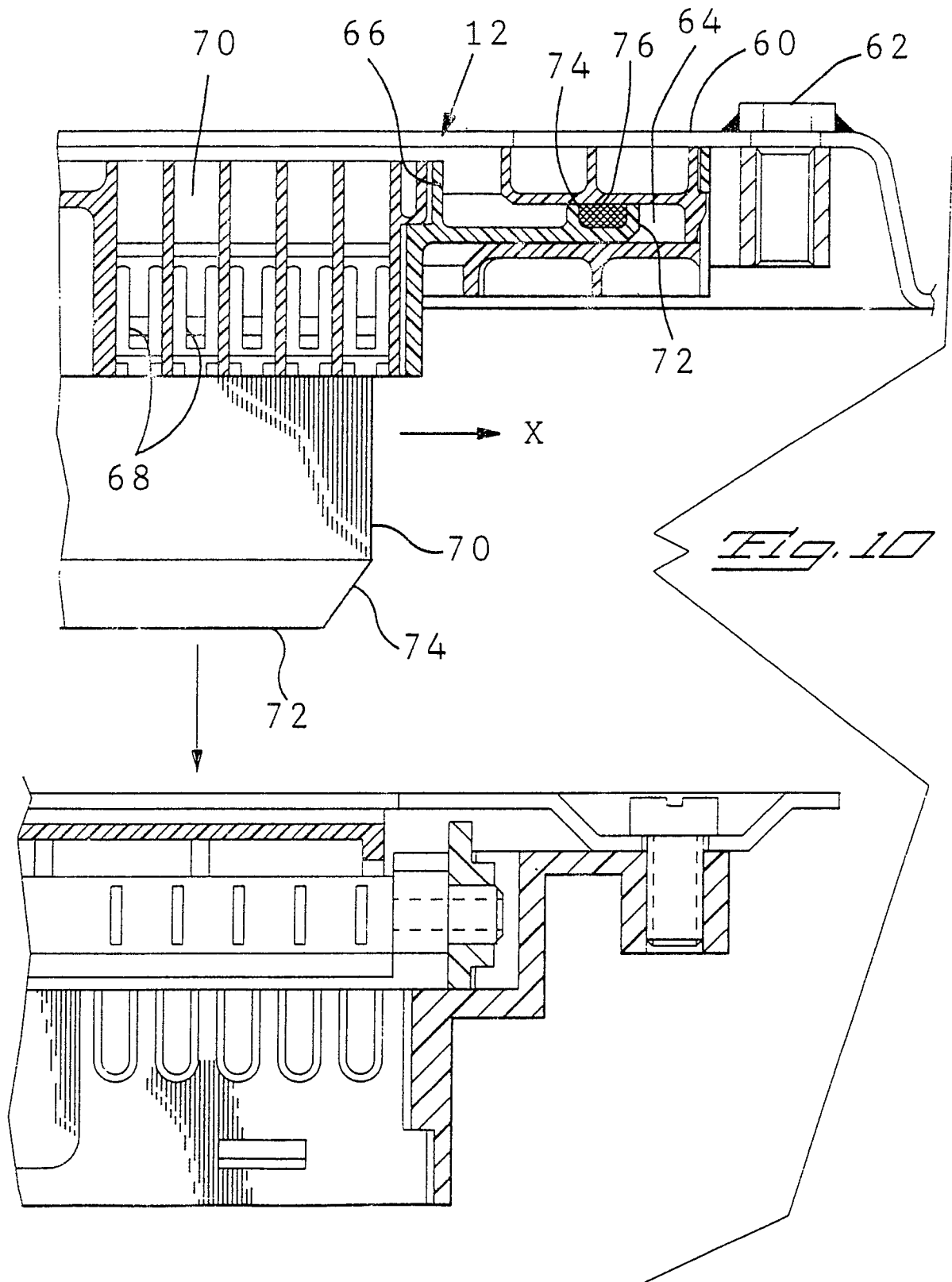


*Fig. 7*



*Fig. 8*







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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-1731973 (C.FISCHER) * page 1, line 67 - page 2, line 14; figure 1 *	1, 3, 5, 6	H01R13/703 H01R13/453
A	---	4	
X	GB-A-368016 (A.C.WYNNE) * page 2, lines 51 - 82; figure 2 *	1-3, 5, 6	
A	---		
A	GB-A-177713 (J.HALL & CO.) * page 1, lines 53 - 74; figure 1 *	1, 3, 5, 6	
A	---		
A	US-A-1689495 (F.MCELROY) * page 1, lines 8 - 72; figure 2 *	1, 3, 5, 6	
A	---		
A	DE-C-465580 (F.DRIESCHER) * claim 1; figure 2 *	1-6	
A	---		
A	US-A-4758696 (D.GRAZER) * abstract; figure 1 *	1, 3-6	
A	---		
A	FR-A-1543773 (ELECTRONICS CORPORATION OF AMERICA) * page 1, lines 1 - 4 * * page 1, lines 36 - 41; figure 1 *	1, 2	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	---		
A	US-A-3857625 (CRANE ET AL.) * abstract; figures 1-4 *	1	H01R H02G
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The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	01 FEBRUARY 1990	HORAK A. L.	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			