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(54) Sealed insulation displacement connector.

(57) A sealed insulation displacement (IDC) connector is shown at (2) as a branch connector used,for example, for grounding cables to the chassis of an automobile. The branch connector (2) comprises sealing means (14, 64) in order to provide a sealed IDC connection between IDC contact portions (18) and conducting wires (4). The branch connector (2) comprises a cover member (8) for receiving the conducting wires (4) and a base member (6) having compartments (28) for receiving the cover members (8) therein. The base member (6) comprises a branch conductor (10) having a plurality of juxtaposed IDC contacting portions (18), the branch conductor (10) in-moulded to an insulative housing (12). The compartments (28) also comprise wire retention means that are V-shaped slots (42) having a tapered profile (44) in order to provide sharp edges that press into the wires (4).

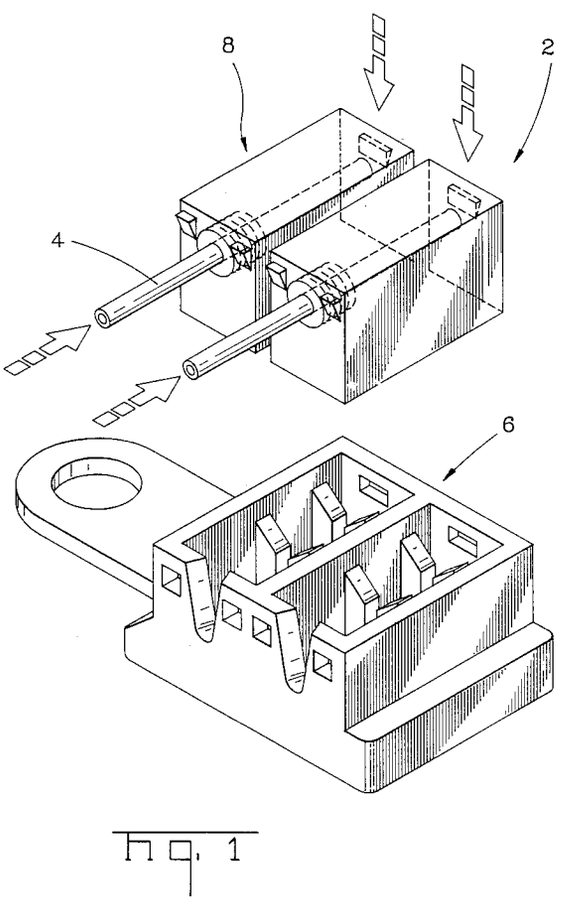

Fig. 1

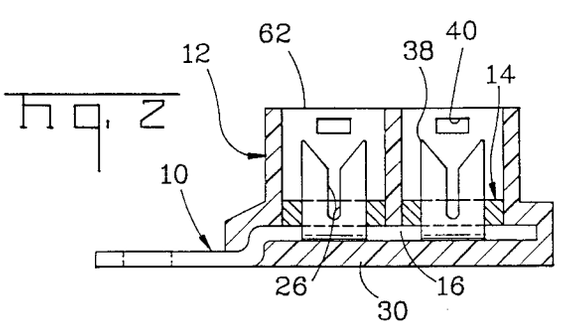

Fig. 2

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This invention relates to a sealed insulation displacement connector.

It is common to find sealed electrical connectors in the electrical industry, and in particular in automobiles whereby connectors in the engine compartment are subject to harsh environmental conditions and corrosive agents. Electrical connectors in an automobile engine compartment must be able to withstand high water pressures due to the high splashing pressure that may occur when the vehicle is at speed. Sealed connectors for automobile use, commonly have crimped connections and are quite costly to produce as there are more parts, manufacturing steps and more complicated assembly procedure compared to unsealed connectors.

In providing electrical connectors for the automobile industry, for example, it is desirable to reduce the number of manual operations during assembly of the automobile as these are costly procedures. There is therefore a need to provide electrical harnesses that can be manufactured in an automated manner, requiring as little manual handling as possible thereof during the assembly process, but nevertheless meeting the rising demands on reliability and electrical current carrying capacity.

It is therefore an object of this invention to provide a reliable electrical connector that is cost effective and that can be easily and rapidly assembled.

It is another object of this invention to provide a sealed connector for insulation displacement technology.

It is yet another object of this invention to provide a cheap and reliable sealed branch connector that can be used for distributing electrical power or grounding a plurality of conductors, for example for use in an automobile. The objects of this invention have been achieved by providing a connector having insulation displacement contacts therein, a base member and a cover member having wire mounting means for mounting electrical wires thereto, the cover member fixable to the base member such that electrical connection is made between the wires and the IDC contacts, characterized in that wire sealing means are provided between the cover and the wire, and elastomeric cover sealing means are provided between the base and cover members such that the electrical connection is completely sealed off from the exterior.

One of the embodiments of this invention will now be described in more detail with reference to the drawing figures whereby;

Figure 1 is an isometric view of a sealed electrical branch connector about to be connected to conducting wires;

Figure 2 is a cross sectional view through a base member of the connector of Figure 1;

Figure 3 is a top view of the base member of the electrical connector of Figure 1;

Figures 4 and 5 are top and side cross sectional views of a cover member as shown in Figure 1;

Figure 6 is a side cross sectional view through the connector of Figure 1 showing an electrical conducting wire electrically connected thereto;

Figure 7 is a detailed partial cross sectional view of strain relief means provided on the connector.

With reference to Figure 1, one embodiment along the lines of this invention is generally shown at 2 as a two position branch connector for electrical connection to conducting wires 4. The branch connector 2 comprises a base member 6 and cover members 8.

Referring to Figures 1, 2 and 3, the base member 6 is shown comprising a stamped and formed sheet metal conductor 10, an insulative housing 12, and sealing means 14. The conductor 10 comprises a substantially flat interconnecting base portion 16, insulation displacement contact portions 18 in parallel and juxtaposed manner upstanding from the interconnecting portion 16, and an exterior contact portion 20 having a bolt or rivet hole 22. The insulation displacement contact (IDC) portions 18 comprise a pair of opposing upstanding IDC walls 24 comprising slots 26 for receiving the electrical conducting wire 4 and making electrical contact therewith. The housing 12 comprises compartments 28 having a base wall 30, and upstanding side walls 32, a back wall 34 and an opposing wire receiving front wall 36, whereby the walls 32, 34, 36 surround a pair of IDC contact portions 18 and extend past upper ends 38 thereof. The compartments 28 also comprise cover retention means in the form of window cutouts 40, and a V-shaped wire receiving slot 42 having a tapered profile 44.

Referring now to Figures 1, 4 and 5, the cover member 8 is shown comprising an insulative housing 46, having a wire receiving cavity 48, transversely intersected by IDC contact portion slots 50 extending from a mating face 52, and a single wire seal cylindrical receiving cavity 54 aligned and adjoined to the wire receiving cavity 48 and extending from a wire receiving face 56 of the cover member 8. The cover member 8 also has retention means 58 consisting of tapered projections cooperable with the windows 40 of the base member housing 12. The mating face 52 comprises an outer sealing surface 60 surrounding the IDC receiving slots 50, the contour of the sealing surface 60 being continuous and planar.

The branch connector 2 is manufactured by first stamping and forming the branch conductor 10 from sheet metal and then placing it in a mould whereby the insulative housing 12 is overmoulded

to the branch conductor 10. The sealing means 14 can then also be overmoulded over the conductor 10 and base 30 of the compartments 28 so as to provide a planar sealing surface on the floor of the compartments 28 that surrounds the IDC contact portions 18 and is biasable against the cover sealing surface 60. The in-moulding of the branch conductor 10 to the housing 12 and sealing floor 14, enables electrical connection between the exterior conducting portion 20 and the IDC portions 18 yet ensuring that the IDC contact portions 18 are completely sealed off from the exterior except for a cover receiving face 62 (Figure 2) that is then sealed off by the cover member 8 as described hereinafter. The compartment walls 32, 34, 36 extent past ends 38 of the IDC contact portions 18 which provides, among other things, protection thereof against damage during handling and assembly.

In order to make electrical connection between the branch conductor 10 and the electrical wires 4, a single wire seal 64 (Figure 5) is first inserted into the seal receiving cavity 54 of the cover member 8, the conducting wire 4 is then inserted through a wire receiving cavity 66 of the seal 64 and into the wire receiving cavity 48 until it abuts an end wall 68 of the cover 8. The single wire seal 64 has sealing ribs on its outer and inner surfaces that are resiliently biased against the seal receiving cavity 54 and the wire 4 such that the wire is sealed with respect to the cover member 8 except for the mating face 52. The cover member 8 can than be pressed into the compartments 28 whereby the IDC contacts 24 are inserted into the receiving slots 50 such that the wire 4 is forced into the IDC slots 26 that cut through the insulation and make electrical contact with conducting strands of the wires 4. Simultaneously to the latter, the exterior portion of the wire 4 adjacent the seal 64 is inserted into the V-shaped slot 42 whereby the wire 4 is squeezed between opposing edges 70, 72 thereof, the tapered profile 44 creating acute angled edges 70, 72 for effectively digging into the wire 4 in order to act as a retention means. The tapered profile 44 is such that the smallest width between edges 70, 72 is adjacent the inner side of the compartment 28 so as to effectively retain the wire from an external pulling force therealong. When the cover member 8 is almost fully inserted into the compartment 28, the sealing surface 60 thereof abuts the sealing floor 14 whereby the cover member 8 can then be further inserted by resiliently biasing the sealing surface 60 thereagainst until the projections 58 of the cover engage in the windows 40 of the compartments 28. The cover member 8 is thus securely latched to the compartments 28 and resiliently biased against the sealing floor 14, the IDC connection between wire 4 and contact portion 18 thus being completely sealed off from the exterior.

It must be appreciated that the embodiment disclosed hereinabove, is only an example of the invention whereby many other embodiments can be imagined without departing from the spirit thereof. More particularly, the sealing means 14 may not be moulded over the whole floor of the compartment but only at a position adjacent the sealing surface 60 of the cover, or the sealing means 14 could be provided as a loose piece or even moulded to the sealing surface 60 of the cover member 8. The connector 2 may also not be a branch connector having a common interconnecting portion 16, but may have separate terminals each having exterior contact portions (20), the exterior contact portions 20 could be of any form known in the prior art. The branch connection is a two position branch connector but of course if need be, a large plurality of IDC contacting portions 18 can be provided by simply extending the interconnecting portion 16 and moulding more compartments thereto. It could even be imagined to provide sealing means along the inner surfaces of the compartment walls 32, 34, 36 surrounding the IDC contact portions 18.

Advantageously therefore the base member 6 of the connector can be assembled to a structure, for example the body work of an automobile, and the conducting wires 4 can be very rapidly and simply electrically connected thereto at a later assembly stage. Yet advantageously is the provision of a reliable sealed connector without requiring the use of sealing gels or greases whereby insulation displacement technology is used. As the seal 64 is compressed between the wire 4 and the seal receiving cavity 54 of the cover member 8, the wire 4 can be assembled to the cover member 8 and provisionally held thereto during preparation of the harness in an automated process at the harness making location, the seal 64 provisionally holding the wire to the cover member 8. The wire 4 can then be electrically connected to a branch connector, for example, in a very simple manner by merely pushing the cover member 8 into the compartments 28. Yet advantageously, is the cost effective and simple sealed IDC branch connector with stamped and formed terminals 18, 16 that can comprise a large plurality of terminals as desired.

Claims

1. An electrical insulation displacement connector (2) comprising a base member (6) having insulation displacement contacts (IDC) (18) therein, and a cover member (8) having wire mounting means (48) for mounting an electrical wire (4) thereto, the cover member (8) fixable

to the base member (6) such that electrical connection is made between the wires (4) and the IDC contacts, characterized in that wire sealing means (64) are provided between the cover (8) and the wire (4), and elastomeric cover sealing means (14) are provided between the base and cover members such that the electrical connection is completely sealed off from the exterior.

2. The electrical connector of claim 1 characterized in that the cover sealing means (14) is inmoulded to the base member (6).

3. The electrical connector of claims 1 or 2 characterized in that the IDC contacts (18) are inmoulded with the base member (6).

4. The connector of any preceding claim characterized in that the base member (6) has a plurality of the insulation displacement contacts (18) for receiving a plurality of wires (4).

5. The connector of claim 4 characterized in that the plurality of IDC contacts (18) are electrically interconnected by an interconnecting base portion (16).

6. The connector of claim 4 or 5 characterized in that the IDC contacts (18) are disposed in a parallel juxtaposed manner.

7. The connector of any preceding claim characterized in that there is one cover member (8) for each wire (4).

8. The connector of any preceding claim characterized in that the IDC contacts (18) are integrally formed with an exterior contact portion (20) for electrically connecting the IDC contacts (18) to an external conductor other than the wires (4).

9. The connector of claim 8 characterized in that the exterior contact portion (20) also serves to securely mount the base member (6) to a structure via mounting means (22) of the contact portion (20).

10. The connector of claims 8 or 9 characterized in that the IDC contacts (18), interconnecting base portion (16) and exterior contact portion (20) are of one integral stamped and formed sheet metal part.

11. The connector of any preceding claim characterized in that the base member (6) comprises an insulative housing (12) having compartments (28) surrounding the IDC contacts (18), whereby the cover member (8) is receivable within the compartment (28) and securely fixable thereto.

12. The connector of claim 11 characterized in that there is one separate compartment (28) for each wire (4) and corresponding IDC contact portion (18).

13. The connector of claim 11 or 12 characterized in that the compartment (28) comprises walls (32, 34, 36) extending from a base wall (30) below the upstanding IDC contacts (18) in a direction parallel to the contacts and past a wire receiving end (38) thereof.

14. The connector of any of claims 11-13 characterized in that the compartment (28) comprises a wall (36) substantially transverse to the direction of the wire (4) and parallel to the IDC contacts (18), the wall (36) comprising a V-shaped slot (42) for receiving the wire (4) therein during mounting of the cover member (8) to the base member (6), the spacing between edges (70, 72) of the V-shaped slot (42) such that when the cover member (8) is securely fixed to the base member (6), the wire (4) is tightly squeezed therebetween.

15. The connector of claim 14 characterized in that the edges (70, 72) of the V-shaped slot (42) have transversely thereof a tapered profile (44), whereby the smallest distance between opposing edges (70, 72) is adjacent the cover member (8).

16. The connector of any preceding claim characterized in that the cover member (8) comprises an insulative housing (46) having a wire receiving cavity (46) aligned and adjoined thereto, and IDC receiving slots (50) transversely intersecting the wire receiving cavity (46).

17. The connector of any preceding claim characterized in that the wire sealing means (64) comprises a cylindrical shaped single sire seal (64) of elastomeric material.

18. The connector of any preceding claim characterized in that the cover member (8) has a continuous outer sealing surface (60) on an IDC contact receiving side (52) thereof, the whole sealing surface pressable against the cover sealing means (14) on the base member (6) such that when the cover is retained to the base member by retention means (40, 58), the

elastomeric sealing means (14) is resiliently compressed against the cover sealing surface (60).

19. The connector of claim 18 characterized in that the sealing surface (60) is planar.

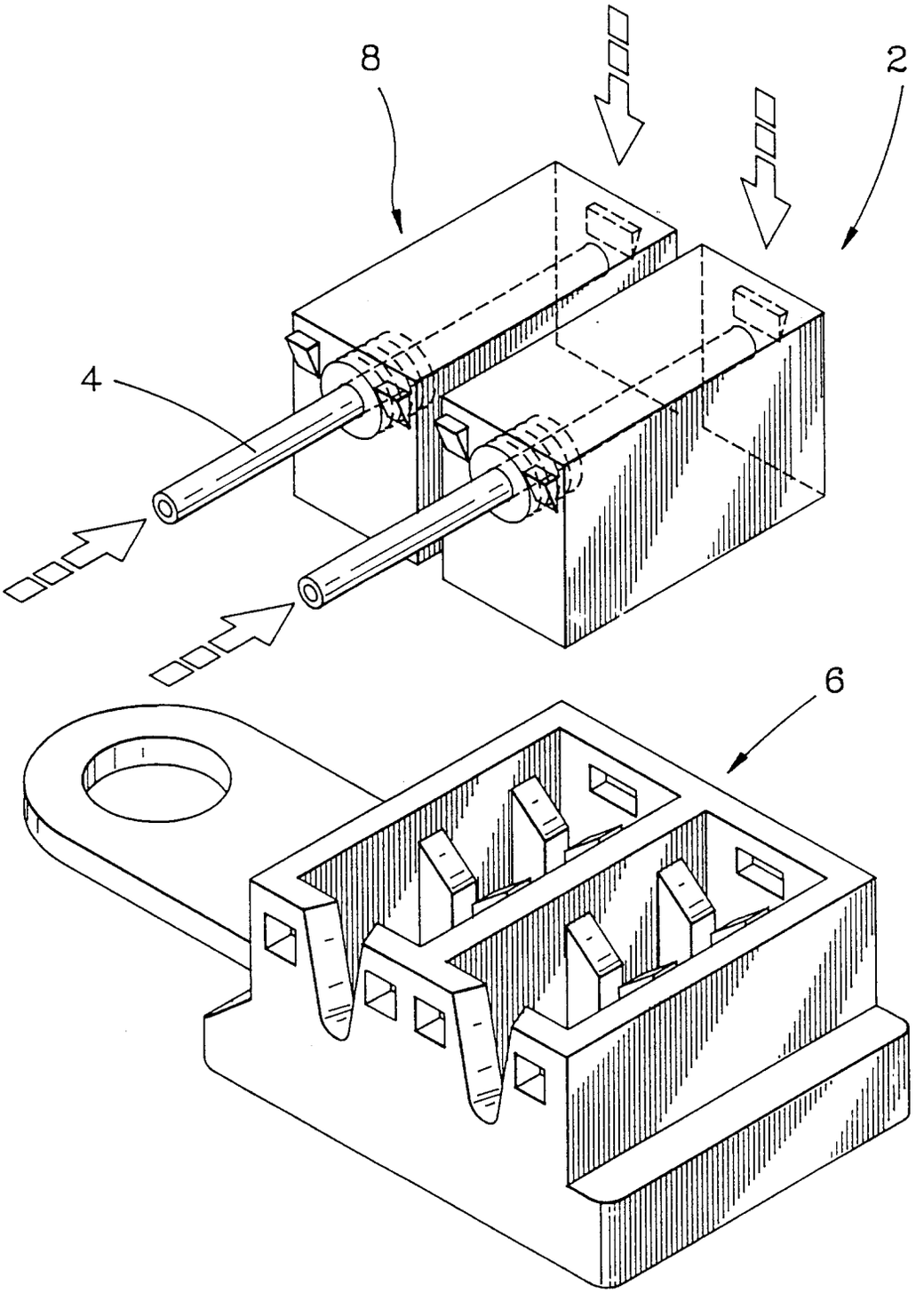


Fig. 1

Fig. 2

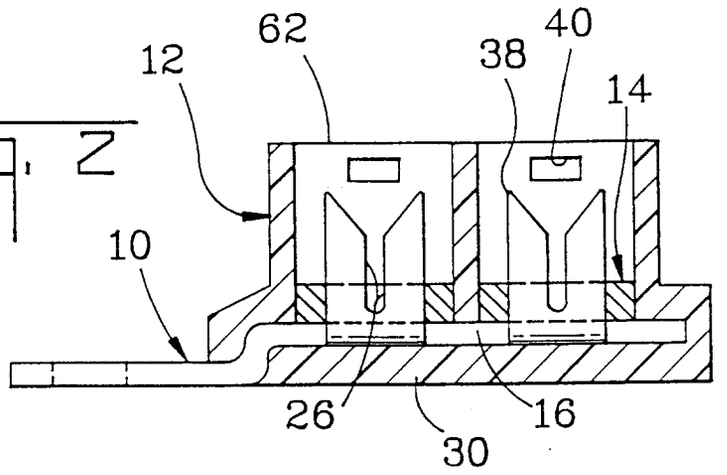
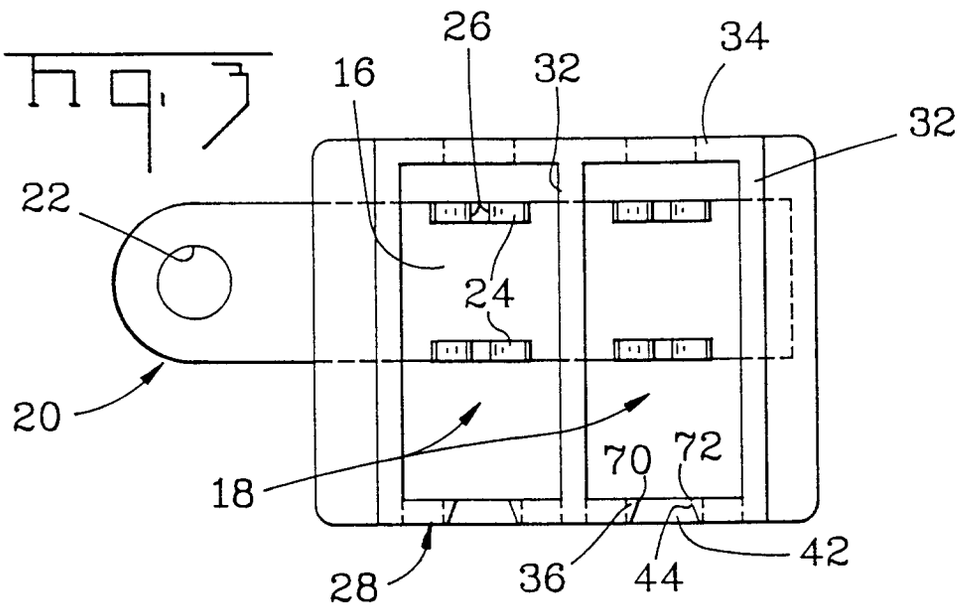


Fig. 3



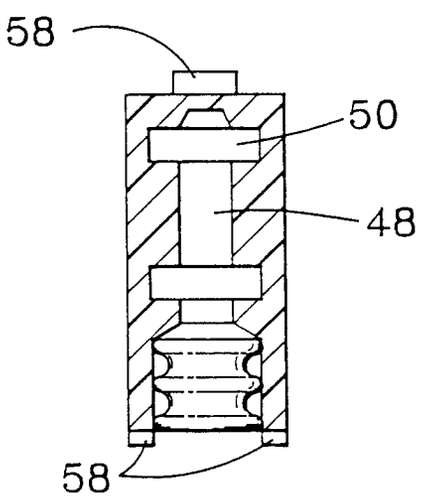


Fig. 4

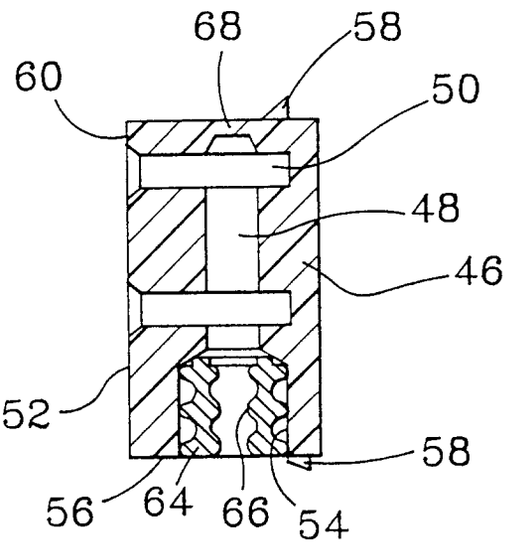


Fig. 5

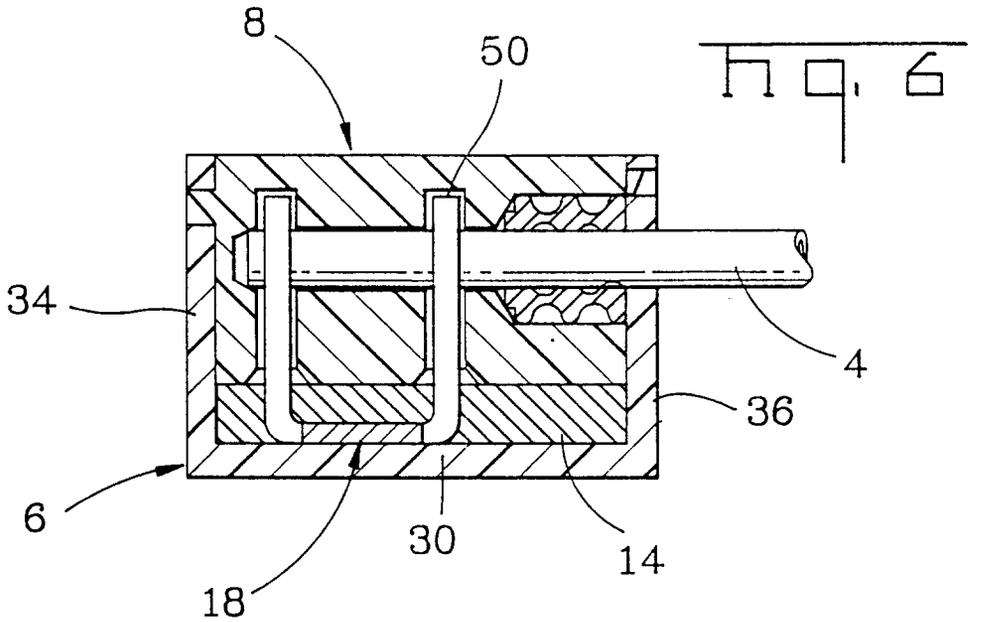


Fig. 6

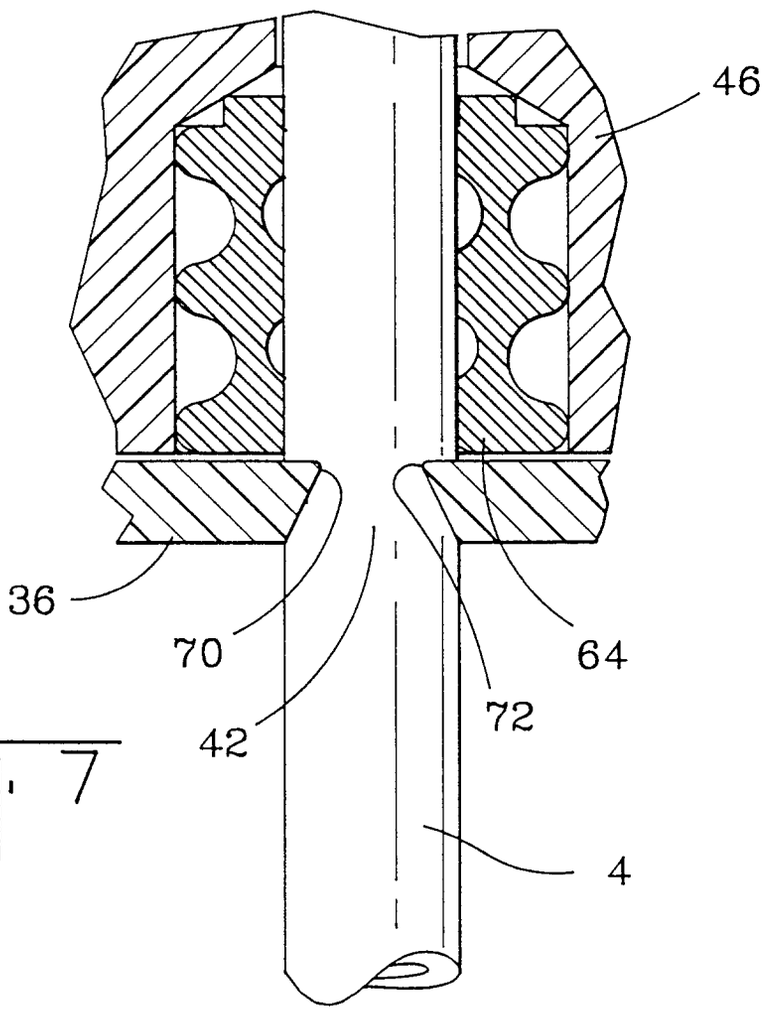


Fig. 7