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(54) **Wiring holding device in an electrical connector.**

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**DESIGN ENGINEERING, vol. 1980, May, pages 42-43, London, GB; "Trends in cable fastening technique"**

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## Description

### Field of the Invention

The invention relates to a wire holding device for holding electrical wires in predetermined positions in an electrical connector to facilitate the making of electrical connection to the wires.

### Background of the Invention

Connectors used in the telecommunication field, for instance those used to connect multi-core telephone cables, must be as small as possible. They are normally provided with insulation displacement contact elements which are simultaneously connected to multiple wires in a connector by the operation of a tool. In doing so, the wires in the connector must all be arranged in desired positions and held in these positions until the connection is effected.

Prior wire holding devices in electrical connectors are suitable only for connection to wires within a relatively narrow range of diameters, corresponding to the dimensions of a passageway. In order that with a given design, wires of considerably smaller diameter can also be better held, the connector of U.S. Patent No. 4,178,055 provides a second, narrower entrance slot which is arranged in the entrance slot and in the passageway is a diaphragm which will be destroyed upon the introduction of a wire of normal diameter. Thus, the introduction of a connection wire of normal thickness is obstructed, and moreover, there is the danger that upon the destroying of the diaphragm, the insulation of the wire will be damaged in an area where it should remain intact.

U.S. Patent No. 3,713,214 discloses another electrical connector with a wire holding device wherein the wires are clamped between convolutions of a coil spring, with a plurality of coil springs being provided to be made selectively effective in order that wires of different thicknesses can be held. That solution is structurally very expensive and hardly suitable for practical purposes because of the large space required.

WO-A-79/01118 discloses an electrical connector for a wire harness wherein the wires are assembled and held in the connector prior to final termination of the wires in the contacts. A spring retaining arm has upper and lower free end fingers and co-operates with an opposing barrier wall to hold a larger wire between only the upper finger and the wall, and to hold a smaller wire between both free end fingers and the barrier wall.

Although not related to an electrical connector, there is shown in Design Engineering, Volume 1980 May, pages 42-43 "Trends in cable fastening

technique" a fastener for holding electrical wires, the fastener having a passageway into which a wire can be moved essentially normally to its length through an outwardly enlarging entrance slot toward a closed end of the passageway, a first barb which can be resiliently urged aside by the wire upon the introduction thereof into the passageway, said first barb extending from a sidewall of the passageway adjacent the entrance slot. A second barb which may also be resiliently urged aside by a wire extends from a second sidewall of the passageway. Such a fastener is a stand alone device and the barbs are connected to a U-shaped member, the parallel legs of which are joined to a bight portion and upon the insertion of a wire the legs of the U-shaped member tend to resiliently move with respect to the bight portion. Such an arrangement cannot be effected in an electrical connector having a plurality of adjacent passageways.

The present invention seeks to provide an electrical connector for connecting a plurality of electrical wires to electrical contacts in which the foregoing difficulties are overcome.

### Summary of the Invention

According to this invention there is provided an electrical connector for connecting a plurality of electric wires to electrical contacts, said connector including a plurality of wire receiving passageways, said contacts being positioned in said passageways, and a plurality of wire holding devices positioned in the path of an insulated wire in a said passageway into which a wire to be held can be moved essentially normally of its length through an outwardly enlarging entrance slot toward a closed end of the passageway, a pair of nonsymmetrical barbs for holding a said wire in a said passageway and restricting the wire against outward movement characterised in that a first one of the barbs can be resiliently urged aside by the wire upon insertion thereof and extends from a first sidewall of the passageway adjacent the entrance slot, and the second one of the barbs which can be resiliently urged aside by the wire upon the insertion thereof, extends from the sidewall of the passageway that is opposite to the first sidewall, each barb having a root joining it to the respective sidewall, the free end of the second barb together with the closed end of the passageway partitioning off the passageway adjacent said closed end, whereby a large diameter wire will be resiliently held in the passageway by both barbs and a smaller diameter wire can be held in the passageway by the second barb.

By this invention a thick wire may be retained by the first barb, with the second barb pressing the wire to the interior surface of the passageway. A

wire of considerably smaller thickness can be snappingly held between the two barbs. A wire of a still considerably smaller thickness can be held solely by the second barb in the partial passageway.

### The Drawings

In the drawings:

Figure 1 is a diagrammatic plan view of the lower part of an electrical connector for connecting two pairs of electrical wires, with the left-hand half of Figure 1 showing one of the wires of a pair to be interconnected as being inserted but not yet electrically connected, whereas the right-hand half of Figure 1 illustrates a pair of wires which are already electrically connected; Figure 2 is an end elevation view of the direction of the arrow II of Figure 1, but illustrates other wires than Figure 1;

Figure 3 is a partial end elevation view corresponding to the area III of Figure 2, illustrating the holding of wires of different diameters; and Figure 4 is an end elevation view similar to that of Figure 2 of a second embodiment of a wire holding device in accordance with the present invention.

### Description of the Preferred Embodiment

Figure 1 illustrates a lower part 1 of an electrical connector 3 which comprises a wire holding device 5, 7 at each of two opposite ends. Furthermore, the lower part 1 contains two insulation displacement contact elements 9, 11 in each of which a pair of wires extending through the holding device can be interconnected. The interconnection is effected in a known manner, by a non-illustrated upper part being put onto the lower part 1, and a pressing force being exerted on the areas disposed above the contact elements 9, 11; thereby, the wires will be advanced into slots in the contact elements (for example between legs 13 and 15) and have their insulation severed and thereby they will be electrically connected to the contact element and through the contact element to each other. The illustrated contact elements 9, 11 also include a blade 17, which upon electrical connection of a pair of wires will cut off the projecting portions of the connected wires so that the overall condition shown on the right hand of Figure 1 will result in which two wires 19, 21 are electrically interconnected. In the left-hand half of Figure 1, a single wire 23 is illustrated which has been already inserted into the holding devices 5 and 7 but is not yet electrically connected.

Figures 2 and 3 illustrate the structure of the holding device 5 in end views. The wire holding

device 5 illustrated contains four passageways 25, 27, 29, 31 arranged side-by-side. In Figure 2, wires of different diameters are illustrated as being held in the passageways 27, 29, and 31. In the following, only the structure provided in the first passageway 25 will be described in detail since the structure in all of the passageways is the same. The passageway 25 is accessible from the exterior through an entrance slot 33 which enlarges outwardly to facilitate a convenient introduction of a wire in a direction transverse of its length toward a closed end 39 of the passageway. A first barb 35 extends from a sidewall of the passageway adjacent the entrance slot 33, which can be resiliently urged aside by a wire upon the insertion thereof. A second barb 37 extends from the opposite sidewall of the passageway 25, which can be resiliently urged aside by the wire upon the insertion thereof. The second barb 37 has a free end which, together with the closed end 39 of the passageway 25, partitions-off a partial passageway 41 so that a wire 43 of a relatively large diameter (compare passageway 29) will be resiliently contacted in the passageway by the second barb, i.e. pressed against the opposite interior wall of the passageway, while the first barb 35 secures the connection wire against outward movement. A wire 45 of a relatively small diameter (compare in Figure 2 the passageway 29) can be held in the partial passageway 41 by the free end of the second barb 37, and a wire 47 of intermediate diameter (compare in Figure 2 the passageway 27) can be held between the two barbs 35 and 37. These possibilities are diagrammatically illustrated in Figures 2 and 3.

In the illustrated embodiment, the closed end 39 of the passageway 25 is formed by two angularly extending wall portions 49, 51 of the passageway 25. This will make possible a proper fit of wires of different diameters. In the embodiment illustrated, the first barb 35 extends essentially parallel to the adjacent oblique wall portion 49 of the closed end 39 of the passageway 25. This will facilitate the manufacture of the holding device in one piece. In the embodiment illustrated, the second barb 37 extends essentially parallel to the opposite oblique wall portion 51 of the closed end of the passageway 25.

In the embodiment illustrated in Figures 2 and 3, the root 53 of the second barb 37 is closer to the closed end 39 of the passageway 25 than the root 55 of the first barb 35. Thereby, the insertion of a wire is facilitated, and the inserted wire is guided beneath the first barb 35 in the manner desired to obtain interlocking.

In the embodiment illustrated, the second barb 37 is longer than the first barb 35. Thereby, the second barb can effect a pressing function as well as a retaining function with respect to the partial

passageway 41. The first barb 35 need be only as long as to be capable of retaining a wire of the largest diameter to be applied.

Figure 4 illustrates an embodiment that is essentially the same as the embodiment of Figures 1, 2 and 3, but is illustrated in a pre-use condition in which the free ends of the two barbs 435, 437 are interconnected via a connection 457 which can be broken by the introduction of a wire. Due to that destroyable connection 457, the wire holding device can be manufactured more easily. Moreover, the force that is necessary to disrupt the connection 457 ensures that the respective wire is driven completely into its final position in the passageway 25. The disrupting of the connection 457 can be sensed audibly and tactilely; thereby, the operator receives an indication that the respective wire has been fully inserted into the wire holding device. Furthermore, the connection 457 provides that the two barbs 435 and 437 are not inadvertently prematurely pressed-in during the storage and upon handling of the wire holding devices. This is particularly important if the barbs, as illustrated, are unitary constituents of a structural part of plastic material and do not have an ideal resiliency.

In the embodiment illustrated in Figure 4, and in the pre-use condition illustrated, the second barb 437 extends at an acute angle to the adjacent wall portion 451 of the closed end of the passageway 425. This is appropriate in order that after the disrupting of the connection 457, the second barb 437 can be urged into a use position similar to that shown in Figure 2, so that it will extend approximately parallel to the wall portion 451.

As can be recognized, wires of different diameters can be smoothly inserted and securely held in the described wire holding device. With usual wires which consist of a solid conductor core and an outer insulation (compare in Figure 2 the conductor core 59 and the insulation 61 of the connection wire 43), the insulation will not be damaged in the wire holding device. Even with the embodiment in the pre-use condition according to Figure 4, the insulation of the inserted wires will not be damaged because the connection 457 to be disrupted extends in the longitudinal direction of the connection wire, and there is no sharp rigid edge along which the wire must be moved.

## Claims

1. An electrical connector for connecting a plurality of electric wires to electrical contacts, said connector including a plurality of wire receiving passageways, said contacts being positioned in said passageways, and a plurality of wire holding devices positioned in the path of an insulated wire in a said passageway (25, 425) into which a wire to be held can be moved essentially normally of its length through an outwardly enlarging entrance slot toward a closed end (39, 451) of the passageway, a pair of nonsymmetrical barbs (35, 37; 435, 437) for holding a said wire in a said passageway and restricting the wire against outward movement characterised in that a first one of the barbs (35, 435) can be resiliently urged aside by the wire upon introduction thereof and extends from a first sidewall of the passageway adjacent the entrance slot, and the second one of the barbs (37, 437) which can be resiliently urged aside by the wire upon the insertion thereof extends from the sidewall of the passageway that is opposite to the first sidewall, each barb having a root joining it to the respective sidewall, the free end of the second barb (37, 437) together with the closed end of the passageway partitioning off the passageway adjacent said closed end, whereby a large diameter wire (43) will be resiliently held in the passageway by both barbs (35, 37; 435, 437) and a smaller diameter wire (45) can be held in the passageway by the second barb (37, 437).
2. The connector according to claim 1 wherein said first barb (35, 435) and said second barb (37, 437) have their roots positioned in opposed relationship on opposite sidewalls of the passageway.
3. The connector according to claim 1 including a preuse condition in which the free ends of the two barbs are interconnected via a connection which is adapted to be disrupted by the introduction of a wire (43, 45, 47).
4. A connector according to claim 1 wherein the barbs are positioned such that a large diameter wire (43) will be resiliently contacted in the passageway (25) by the second barb (37) and held by the first barb (35) against outward movement, a small diameter wire (45) can be held in the partial passageway (41) by the free end of the second barb (37), and an intermediate diameter wire (47) can be held between the two barbs (35,37).
5. The connector according to claim 1, characterized in that the closed end (39) of the passageway (25) is formed by two wall portions (45,51) of the passageway (25) which extend at an angle to each other.
6. The connector according to claim 5, characterized in that the first barb (35) extends approxi-

mately parallel with the adjacent wall portion (49) of the closed end (39) of the passageway (25).

7. The connector according to claim 6, characterized in that the second barb (37) extends approximately parallel to the adjacent wall portion (51) of the closed end (39) of the passageway (25).
8. The connector according to claim 1, characterized in that the root (53) of the second barb (37) is closer to the closed end (39) of the passageway (25) than the root (55) of the first barb (35).
9. The connector according to claim 1 or 4 characterized in that the second barb (37) is longer than the first barb (35).
10. The connector according to any preceding claim 1 characterized in that the barbs (35,37) are unitary constituents of a structural part of plastic material.

#### Patentansprüche

1. Elektrischer Steckverbinder zur Verbindung einer Mehrzahl von elektrischen Drähten mit elektrischen Kontakten, dadurch gekennzeichnet, daß der genannte Steckverbinder eine Mehrzahl von Durchgängen zur Aufnahme der Drähte aufweist, wobei die genannten Kontakte in den genannten Durchgängen positioniert sind, und dadurch gekennzeichnet, daß eine Mehrzahl von Drahthaltevorrichtungen in dem Pfad eines Isolierdraht in dem genannten Durchgang (25, 425) positioniert ist, wobei der zu haltende Draht im wesentlichen normalerweise der Länge nach in diesen Durchgang gebracht werden kann, durch einen nach außen großer werdenden Eingangsschlitz zu einem geschlossenen Ende (39, 451) des Durchgangs, ferner umfaßt der Steckverbinder ein Paar unsymmetrischer Widerhaken (35, 37; 435, 437) zum Halten des genannten Drahts in dem genannten Durchgang und um den Draht gegen eine Bewegung nach außen einzuschränken, dadurch gekennzeichnet, daß ein erster Widerhaken (35, 435) nach der Einführung des Drahts elastisch zur Seite gedrängt werden kann und er sich von einer ersten Seitenwand des Durchgangs neben dem Eingangsschlitz erstreckt, und daß der zweite Widerhaken (37, 437), der nach der Einführung des Drahts elastisch zur Seite gedrängt werden kann, sich von der Seitenwand des Durchgangs erstreckt, die sich gegenüber der ersten

Seitenwand befindet, wobei jeder Widerhaken einen Grundteil aufweist, durch den sie mit der entsprechenden Seitenwand verbunden werden, wobei das freie Ende des zweiten Widerhakens (37, 437) zusammen mit dem geschlossenen Ende des Durchgangs, den Durchgang neben dem genannten geschlossenen Ende abteilt, wodurch ein Draht (43) mit großem Durchmesser elastisch durch die beiden Widerhaken (35, 37; 435, 437) in dem Durchgang gehalten wird, und wobei ein Draht (45) mit geringerem Durchmesser durch den zweiten Widerhaken (37, 437) in dem Durchgang gehalten werden kann.

2. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß die Grundteile des genannten ersten Widerhakens (35, 435) und des genannten zweiten Widerhakens (37, 437) in entgegengesetzter Beziehung und an gegenüberliegenden Seitenwänden des Durchgangs positioniert sind.

3. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß der Steckverbinder einen Zustand vor der Verwendung aufweist, in welchem die freien Enden der beiden Widerhaken über eine Verbindung miteinander verbunden sind, wobei die Verbindung so adaptiert ist, daß sie durch die Einführung eines Drahts (43, 45, 47) zerbrochen wird.

4. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß die Widerhaken so positioniert sind, daß der Draht (43) mit großem Durchmesser in dem Durchgang (25) in elastischem Kontakt mit dem zweiten Widerhaken (37) steht und von dem ersten Widerhaken (35) gegen eine Bewegung nach außen gehalten wird, wobei der Draht (45) mit geringem Durchmesser in dem Teildurchgang (41) durch das freie Ende des zweiten Widerhakens (37) gehalten werden kann, und wobei ein Draht (47) mit mittlerem Durchmesser zwischen den beiden Widerhaken (35, 37) gehalten werden kann.

5. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß das geschlossene Ende (39) des Durchgangs (25) durch zwei Wandteile (45, 51) des Durchgangs (25) gebildet wird, die sich zueinander in einem Winkel erstrecken.

6. Steckverbinder nach Anspruch 5, dadurch gekennzeichnet, daß sich der erste Widerhaken (35) nahezu parallel zu dem benachbarten Wandteil (49) des geschlossenen Endes (39) des Durchgangs (25) erstreckt.

7. Steckverbinder nach Anspruch 6, dadurch gekennzeichnet, daß sich der zweite Widerhaken (37) nahezu parallel zu dem benachbarten wandteil (51) des geschlossenen Endes (39) des Durchgangs (25) erstreckt.

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8. Steckverbinder nach Anspruch 1, dadurch gekennzeichnet, daß der genannte Grundteil (53) des zweiten Widerhakens (37) näher an dem geschlossenen Ende (39) des Durchgangs (25) liegt als der Grundteil (55) des ersten Widerhakens (35).

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9. Steckverbinder nach Anspruch 1 oder 4, dadurch gekennzeichnet, daß der zweite Widerhaken (37) länger ist als der erste Widerhaken (35).

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10. Steckverbinder gemäß einem der vorstehenden Ansprüche, dadurch gekennzeichnet, daß die Widerhaken (35, 37) Einheitsbestandteile eines Konstruktionsteils aus einem Kunststoff darstellen.

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#### Revendications

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1. Connecteur électrique pour connecter une pluralité de fils électriques à des contacts électriques, ledit connecteur incluant une pluralité de passages de réception de fil, lesdits contacts étant situés dans lesdits passages, et une pluralité de dispositifs de maintien de fil situés dans la voie d'un fil isolé contenu dans un dit passage (25, 425) dans lequel un fil qui doit être maintenu peut être déplacé essentiellement normalement à sa longueur, au travers d'une fente d'entrée s'élargissant vers l'extérieur, en direction d'une extrémité fermée (39, 451) du passage, une paire de barbes non symétriques (35, 37 ; 435, 437) pour maintenir un dit fil dans ledit passage et pour limiter le déplacement du fil vers l'extérieur, caractérisé en ce qu'une première des barbes (35, 435) peut être poussée de manière élastique de côté par le fil du fait de son insertion et s'étend depuis une première paroi latérale du passage adjacente à la fente d'entrée et la seconde des barbes (37, 437) peut être poussée de façon élastique de côté par le fil du fait de son insertion et s'étend depuis la paroi latérale du passage qui est opposée à la première paroi latérale, chaque barbe comportant un pied qui la joint à la paroi latérale respective, l'extrémité libre de la seconde barbe (37, 437) ensemble avec l'extrémité fermée du passage cloisonnant le passage adjacent à ladite extrémité fermée, de telle sorte qu'un fil de grand diamètre (43) soit maintenu de façon

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élastique dans ledit passage au moyen des deux barbes (35, 37 ; 435, 437) et qu'un fil de diamètre plus petit (45) puisse être maintenu dans le passage au moyen de la seconde barbe (37, 437).

2. Connecteur selon la revendication 1, dans lequel ladite première barbe (35, 435) et ladite seconde barbe (37, 437) ont leurs pieds situés à l'opposé l'un de l'autre sur des parois latérales opposées du passage.

3. Connecteur selon la revendication 1, incluant une condition de pré-utilisation dans laquelle les extrémités libres des barbes sont interconnectées à une connexion qui est conçue pour être interrompue par l'introduction d'un fil (43, 45, 47).

4. Connecteur selon la revendication 1, dans lequel les barbes sont situées de telle sorte qu'un fil de grand diamètre (43) soit mis en contact élastique dans le passage (25) avec la seconde barbe (37) et soit retenu par la première barbe (35) contre tout déplacement vers l'extérieur, de telle sorte qu'un fil de petit diamètre (45) puisse être maintenu dans le passage partiel (41) au moyen de l'extrémité libre de la seconde barbe (37) et de telle sorte qu'un fil de diamètre intermédiaire (47) puisse être maintenu entre les deux barbes (35, 37).

5. Connecteur selon la revendication 1, caractérisé en ce que l'extrémité fermée (39) du passage (25) est formée par deux parties de paroi (45, 51) du passage (25) qui s'étendent selon un certain angle l'une par rapport à l'autre.

6. Connecteur selon la revendication 5, caractérisé en ce que la première barbe (35) s'étend approximativement parallèlement à la partie de paroi adjacente (49) de l'extrémité fermée (39) du passage (25).

7. Connecteur selon la revendication 6, caractérisé en ce que la seconde barbe (37) s'étend approximativement parallèlement à la partie de paroi adjacente (51) de l'extrémité fermée (39) du passage (25).

8. Connecteur selon la revendication 1, caractérisé en ce que le pied (53) de la seconde barbe (37) est plus proche de l'extrémité fermée (39) du passage (25) que le pied (55) de la première barbe (35).

9. Connecteur selon la revendication 1 ou 4, caractérisé en ce que la seconde barbe (37) est

plus longue que la première barbe (35).

10. Connecteur selon la revendication précédente  
1, caractérisé en ce que les barbes (35, 37)  
sont des constituants unitaires d'une partie 5  
structurelle en une matière plastique.

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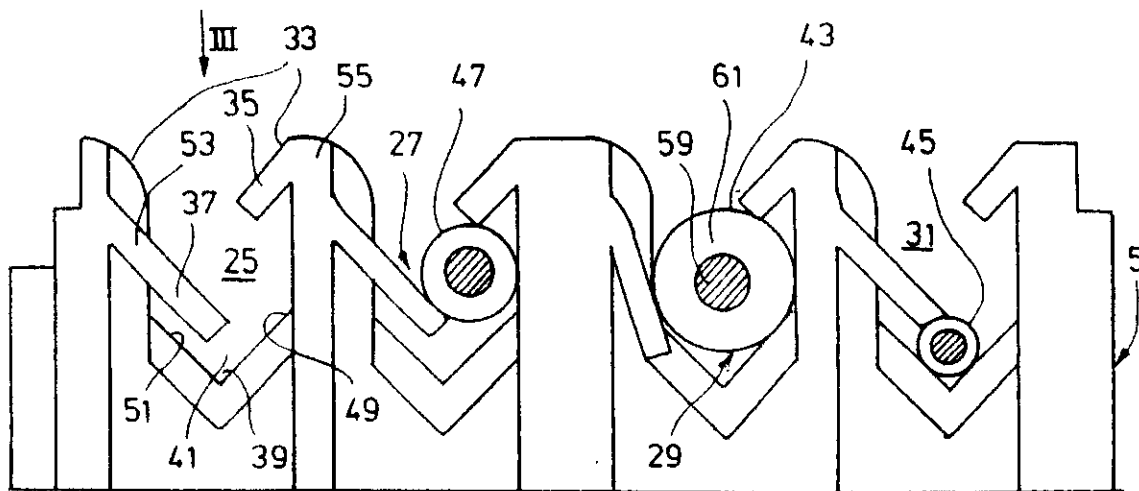


FIG.2

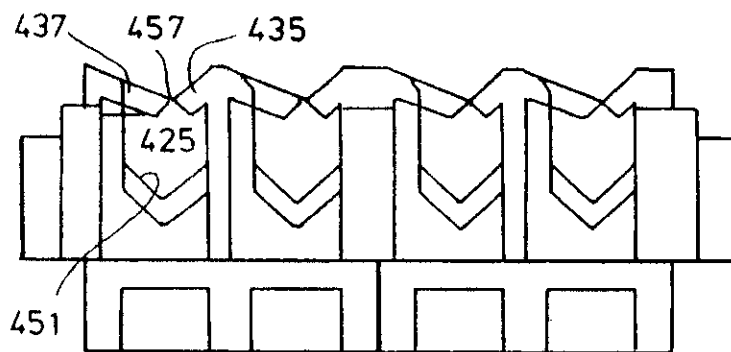


FIG. 4

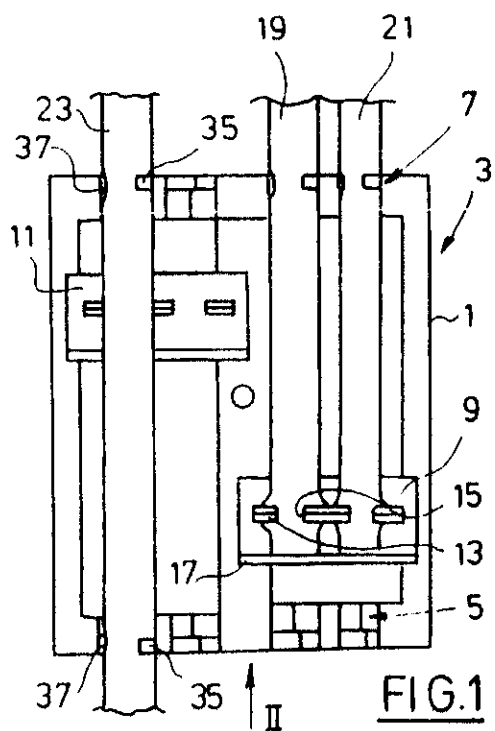
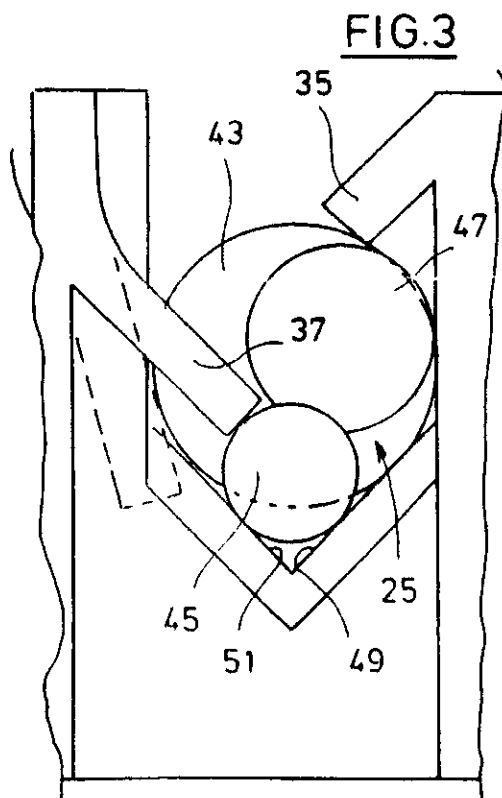


FIG. 1



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STATUS PATENT IN FORCE