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(54) **A PLUG AND SOCKET ASSEMBLY FOR REMOTE HANDLING**

EINE FERNMANIPULIERBARE STECKER- UND KUPPLUNGSANORDNUNG

ENSEMBLE DE FICHE ET DOUILLE PERMETTANT UNE MANIPULATION A DISTANCE

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Description

[0001] The present invention relates to a plug and socket assembly suitable for remote handling.

[0002] Difficulties arise in hazardous environments for example where connections between plugs and sockets have to be made and/or broken remotely by, for example, manipulator arms or other remote handling devices. Whilst manipulators are good at linear positioning, they are not so good where placement in an axial direction relative to the manipulator and rotation about the axis are required since there is frequently little or no compliance in conventional plug and socket designs and it is also frequently not possible for an operator to determine how much force is being applied by the manipulator, consequently leading to breakages. Many current plug and socket designs for use in hazardous areas are very expensive and overly complex for the use to which they are intended to be put.

[0003] It is an object of the present invention to provide a plug and socket assembly for easily making and breaking plug and socket connections by remote handling means such as manipulator arms for example.

[0004] According to the present invention there is provided a plug and socket assembly for remote handling and making and breaking a connection therebetween, the plug assembly comprising a plug portion and a socket portion having mutual co-operating features to establish a connection therebetween; said plug portion and said socket portion having a substantially common connection making and breaking axis; at least one of said plug portion and said socket portion having a deflectable resilient biasing member which biases said plug portion or said socket portion towards a desired axis; and, handling means associated with the resilient biasing member remote from said plug or socket portion.

[0005] The plug portion and/or the socket portion may have features which assist in the guiding together of the plug and socket. For example, the plug may be housed within a generally cylindrical body member having, for example, a divergent bell-mouth taper and the socket may be housed within a co-operating housing which includes an inwardly directed taper at its leading end to co-operate with the bell-mouth taper of the plug so as to provide guidance towards each other. Provision of the plug and socket portions per se within housings ensures that at the point of making a connection, the plug and socket portions are in the required axial alignment.

[0006] Generally one of either the plug portion or the socket portion may be held in a fixed orientation by being mounted on a piece of plant or on a feature, such as a shelf or wall, of the environment in which it housed. The other of the plug or socket portion will generally be remotely handled by means such as a manipulator, for example, and will generally be provided with the resilient biasing member.

[0007] The resilient biasing member may be, in one embodiment of the present invention, a coil spring able to support the mass of the plug or socket member and hold it in a horizontal position for example without significant drooping away from the common making and breaking axis. Where there is slight misalignment between the plug portion and socket portion when the remote handling means is attempting to make or break a connection therebetween, the biasing member allows either the portion to which it is attached to deflect by the appropriate amount to provide for easy insertion or extraction without placing undue or excessive stress on the components.

[0008] Where the resilient biasing member is a coil spring for example, more extension of the spring than is desirable may occur on breaking of the connection if misalignment between the pulling force direction applied by the remote handling means and the plug/socket common axis is present. In such circumstances the plug and socket may suddenly become disconnected and damage may occur to the component to which it is attached when the spring then suddenly retracts. To obviate such effects, an extension limiting member may be attached between the plug or socket portion and the handling means on the end of the spring remote from the plug or socket. Such an extension limiting member may comprise a length of wire cable joined to the plug or socket portion and the handling means on an end of the resilient biasing member remote from the plug or socket portion. Once a predetermined extension of the spring occurs, the wire cable prevents any further extension and effectively creates a fixed length link to enable the connection to be broken without a large rise in stored energy in the resilient biasing member.

[0009] The handling means may be a tab suitable for gripping by a manipulator.

[0010] In the case of a plug and socket intended for joining coaxial cable, for example, where there is no need for rotational orientation about the common making and breaking axis. However, plugs and sockets which have definite features which need to be mated in a particular rotational orientation may be dealt with by providing the plug and socket portions with alignment means such as, for example, a co-operating axially directed raised spine on the socket portion for example and a groove in the plug portion housing in which the spine is received and in which it is able to slide. Suitable tapers and leadins may be provided to ease initial alignment.

[0011] Plug and socket assemblies of the present invention may provide for electrical, hydraulic, gaseous and mechanical connection purposes.

[0012] In order that the present invention may be more fully understood, examples will now be described by way of illustration only with reference to the accompanying drawings, of which:

Figure 1 shows a side elevation of an example of a first embodiment of a plug and socket assembly according to the present invention;

Figure 2 shows an end elevation of the socket of Figure 1;

Figure 3 shows an elevation of a second embodiment of a plug of a plug and socket assembly according to the present invention;

Figure 4 shows the plug of Figure 3, its co-operating socket and other associated equipment in use; and

Figure 5 which shows a schematic side elevation of a junction box utilising plug and socket assemblies according to the present invention.

[0013] Referring now to the drawings and where the same features are denoted by common reference numerals.

[0014] Figures 1 to 3 show a first embodiment 10 of a plug and socket assembly for providing a power supply for example to a piece of plant such as a junction box (see Figure 4 below). The assembly comprises a plug portion 12 and a socket portion 14. The plug portion includes a metal housing sheath 16 for receiving a plug 18 per se of whatever type may be required and indicated only by its pins 20 as dashed lines. The housing 16 has a tapered bell-mouthed lead-in 22 which co-operates with a tapered portion 24 at the nose of a housing 26 which contains a socket 30 per se to receive the pins 20 of the plug 18. The socket portion 14 is fixed to a convenient platform 32 in a predetermined orientation. Since it is necessary for the plug 18 and socket 30 to be in a predetermined rotational orientation to enable mating, the housing 16 is provided with slot 34 which engages with a raised spine 36 on the socket housing 26 to ensure correct rotational orientation. The housing 16 is further provided with a resilient biasing member 40 in the form of a coil spring secured to one end thereof by means of a clamp ring 42. Handling means in the form of a tab 44 on a collar 46 are fixed to the spring 40 at the end remote from the housing 16 by means of a second clamp ring 48, the tab 44 providing convenient gripping means for the fingers 50 of a manipulator (not shown). A wire cable extension limiting member 52 is connected between the two clamp rings 42, 48. A route for a cable 56 from the plug 18 is provided by bores through the housing 16, spring 40 and collar 46 and similarly with a cable 58 from the socket 30.

[0015] In operation, the fingers 50 of the manipulator grip the tab 44 and, in the horizontal position indicated in Figure 1, the coil spring 40 is of sufficient stiffness to support the plug portion 12 without significant. drooping and to all intents the plug portion, spring and handling tab and collar may be moved about as if they were a solid unit. However, when the plug and socket are to be connected the operator of the manipulator merely has to align the plug portion 12 and socket portion 14 relatively closely and move the plug assembly towards the socket portion 14. The tapers 22 and 24 assist in initial entry of the housing 26 into the plug housing 16 whilst the slot 34 and spine 36 ensure correct rotational alignment. If ,however, the axes 60, 62 of the plug 18 and socket 30, respectively are slightly misaligned, the coil spring 40 may deflect at relatively low levels of force to enable the two axes to align and form an essentially common axis to enable making of the connection. Similarly, if the rotational alignment between the slot 34 and spine 36 are slightly out of register, the coil spring 40 will twist about the axis 60 under low force to enable mating of the two components. In order to break the connection, it is merely necessary for the manipulator to pull the plug portion assembly from right to left as viewed in Figure 1. However, if there is some misalignment between the disconnection force application direction and the axes 60, 62 such that the spring 40 starts to stretch, the extension limiting member 52 becomes taught and effectively prevents any further extension and permits the plug to be removed.

[0016] Figures 3 and 4 show elevations of a second embodiment 70 of a plug portion assembly of a plug and socket assembly according to the present invention. In this embodiment the features are essentially similar to those shown with reference to Figures 1 and 2 but in this case the plug and socket (see Figure 5) are for connecting coaxial cable 72 and since coaxial cable plugs and sockets are rotationally symmetrical the slot 34 and spine 36 are omitted. In the particular embodiment shown, the first clamp ring 42 is further provided with a hook 74 so that the plug may be stored on the side of a basket 76 and sensor housing 80 assembly which carries a flying lead 78 of a proximity switch. The basket and sensor housing is carried by a handle 84 to its required position on apparatus to be monitored (not shown) and lowered into position. Once the sensor is located, the plug 70 is then removed by the manipulator 50 from the basket 76 on which it is suspended by the hook 74 and moved to its position on a junction box (see Figure 5). As the plug 70 is being moved from the basket 76 to its socket 86, the flying lead 78 is unravelled from the basket. This embodiment functions in a similar manner to the embodiment of Figures 1 and 2.

[0017] Figure 5 shows a junction box 80 having plug and socket assemblies 10 and 70 according to the present invention.

Claims

1. A plug and socket assembly (10) for use with remote handling apparatus (50) for making and breaking a connection therebetween, the plug and socket assembly comprising a plug portion (12; 70) and a socket portion (14) having mutual co-operating features (18, 30) to establish a connection therebetween; said plug portion and said socket portion having a substantially common connection making and breaking axis (60, 62); at least one of said plug

portion and said socket portion having a deflectable resilient biasing member (40) which permits said plug portion or said socket portion to be deflected towards a desired axis; and **characterised by** having handling means (44) operably connected to the resilient biasing member remote from said plug or socket portion to enable said remote handling apparatus (50) to grip and manoeuvre said plug or socket.

2. A plug and socket assembly according to claim 1 wherein the plug portion and/or the socket portion has features (22, 24) which assist in the guiding together of the plug and socket.

3. A plug and socket assembly according to claim 2 wherein the features include a divergent bell-mouth taper (22) on one of a plug or socket housing (16) and an inwardly directed taper (24) on the other of a plug or socket housing (14).

4. A plug and socket assembly according to any one preceding claim wherein one of either the plug portion or the socket portion (14) is held in a fixed position (32).

5. A plug and socket assembly according to claim 4 wherein the other of the plug (16) or socket portions is provided with the resilient biasing member (40).

6. A plug and socket assembly according to any one preceding claim wherein the resilient biasing member is a coil spring (40).

7. A plug and socket assembly according to claim 6 wherein the coil spring is able to support the mass of the plug or socket member and hold it in a horizontal position without significant drooping away from the common making and breaking axis (60, 62).

8. A plug and socket assembly according to any one preceding claim and further including an extension limiting member (52).

9. A plug and socket assembly according to claim 8 wherein the extension limiting member comprises a length of wire cable (52) joined to the plug or socket portion (42) and the handling means (44) on an end (48) of the resilient biasing member (40) remote from the plug or socket portion.

10. A plug and socket assembly according to any one preceding claim wherein the handling means is a tab (44) suitable for gripping by remote handling means.

11. A plug and socket assembly according to any one preceding claim further including means (34, 36) to ensure rotational alignment.

12. A plug and socket assembly according to claim 11 wherein the means to ensure rotational alignment comprises a raised spine (36) on one of the plug or socket portion and a groove or slot (34) in the other of the plug or socket portion housing in which the spine is received.

Patentansprüche

1. Stecker- und Steckbuchsen-Anordnung (10) zur Verwendung bei Fernhandhabungsgeräten (50) zum Herstellen und Unterbrechen einer Verbindung zwischen diesen, wobei die Stecker- und Steckbuchsen-Anordnung einen Steckerabschnitt (12; 70) und einen Steckbuchsenabschnitt (14) mit gegenseitig zusammenwirkenden Merkmalen (18, 30) zum Herstellen einer Verbindung zwischen diesen umfaßt, der Steckerabschnitt und der Steckbuchsenabschnitt eine im wesentlichen gemeinsame Achse (60, 62) zum Herstellen und Unterbrechen der Verbindung aufweisen, und mindestens eines der Teile Steckerabschnitt und Steckbuchsenabschnitt mit einem auslenkbaren, federnden Vorspannelement (40) versehen ist, das es gestattet, den Steckerabschnitt oder den Steckbuchsenabschnitt zu einer gewünschten Achse hin auszulenken, wobei die Anordnung **dadurch gekennzeichnet ist, daß** sie Handhabungsmittel (44) aufweist, die in einem Abstand vom Stecker- oder Steckbuchsenabschnitt wirksam mit dem federnden Vorspannelement verbunden sind, um es zu ermöglichen, daß das Fernhandhabungsgerät (50) den Stecker oder die Steckbuchse ergreift und manövriert.

2. Stecker- und Steckbuchsen-Anordnung nach Anspruch 1, bei welcher der Steckerabschnitt und/oder der Steckbuchsenabschnitt Merkmale (22, 24) aufweist, die das Zusammenführen von Stecker und Steckbuchse unterstützen.

3. Stecker- und Steckbuchsen-Anordnung nach Anspruch 2, bei der die Merkmale einen divergierenden, glockenförmigen Kegel (22) auf einem Stekker- oder Steckbuchsengehäuse (16) und einen nach innen gerichteten Kegel (24) auf dem anderen Teil von Stecker- oder Steckbuchsengehäuse (14) aufweisen.

4. Stecker- und Steckbuchsen-Anordnung nach einem vorhergehenden Anspruch, bei der entweder der Steckerabschnitt oder der Steckbuchsenabschnitt (14) in einer festen Stellung (32) gehalten wird.

5. Stecker- und Steckbuchsen-Anordnung nach Anspruch 4, bei der das andere Teil von Steckeroder Steckbuchsenabschnitt (16) mit dem federnden Vorspannelement (40) versehen ist.

6. Stecker- und Steckbuchsen-Anordnung nach einem vorhergehenden Anspruch, bei der das federnde Vorspannelement eine Schraubenfeder (40) ist.

7. Stecker- und Steckbuchsen-Anordnung nach Anspruch 6, bei der die Schraubenfeder die Masse des Stecker- oder Steckbuchsenelementes tragen und es in einer horizontalen Stellung ohne merkliches Weghängen von der gemeinsamen Achse (60, 62) zum Herstellen und Unterbrechen der Verbindung halten kann.

8. Stecker- und Steckbuchsen-Anordnung nach einem vorhergehenden Anspruch, ferner mit einem Dehnungsbegrenzungselement (52).

9. Stecker- und Steckbuchsen-Anordnung nach Anspruch 8, bei der das Dehnungsbegrenzungselement ein Stück Drahtseil (52) aufweist, das mit dem Stecker- oder Steckbuchsenabschnitt (42) und der Handhabungseinrichtung (44) an einem Ende (48) des federnden Vorspannelementes (40) in einem Abstand vom Stecker- oder Steckbuchsenabschnitt verbunden ist.

10. Stecker- und Steckbuchsen-Anordnung nach einem vorhergehenden Anspruch, bei der die Handhabungseinrichtung eine Nase (44) ist, die von Fernhandhabungsmitteln ergriffen werden kann.

11. Stecker- und Steckbuchsen-Anordnung nach einem vorhergehenden Anspruch, ferner mit Mitteln (34, 36) zum Sicherstellen einer Rotationsausrichtung.

12. Stecker- und Steckbuchsen-Anordnung nach Anspruch 11, bei der die Mittel zum Sicherstellen einer Rotationsausrichtung ein erhöhter Grat (36) auf dem Stecker- oder dem Steckbuchsenabschnitt und eine Nut oder einen Schlitz (34) in dem anderen Teil von Steckeroder Steckbuchsengehäuse aufweisen, in der (dem) der Grat aufgenommen ist.

Revendications

1. Ensemble de fiche et douille (10) pour utilisation avec un appareil (50) de manipulation à distance, pour réaliser et supprimer une connexion entre ces derniers, l'ensemble fiche et douille comprenant une partie de fiche (12 ; 70) et une partie de douille (14) présentant des caractéristiques à coopération mutuelle (18, 30) pour établir une connexion entre ces dernières, ladite partie de fiche et ladite partie de douille présentant un axe d'établissement et de rupture de la connexion, sensiblement commun (60, 62) ; au moins l'une des parties de fiche ou partie de douille présentant un élément (40) de rappel élastique et à déviation, qui permet à ladite partie de fiche ou ladite partie de douille d'être déviée vers un axe voulu, **caractérisé en ce qu'**il comporte des moyens de manipulation (44) reliés de manière opérationnelle à l'élément de rappel élastique à distance de ladite partie de fiche ou ladite partie de douille, afin de permettre audit appareil de manipulation à distance (50) de saisir et de manoeuvrer ladite fiche ou ladite douille.

2. Ensemble de fiche et douille selon la revendication 1, **caractérisé en ce que** la partie de fiche et/ou la partie de douille présente des caractéristiques (22, 24) qui aident au guidage ensemble de la fiche et de la douille.

3. Ensemble de fiche et douille selon la revendication 2, **caractérisé en ce que** les caractéristiques incluent un divergent (22) en forme d'embouchure de cloche, sur une des enveloppes (16) de douille ou de fiche et un rétrécissement dirigé vers l'intérieur (24) sur l'autre des enveloppes (14) de douille ou de fiche.

4. Ensemble de fiche et douille selon l'une des revendications précédentes, **caractérisé en ce que** l'une des parties de fiche ou de douille (14) est maintenue en position fixe (32).

5. Ensemble de fiche et douille selon la revendication 4, **caractérisé en ce que** l'autre partie de fiche (16) ou de douille est pourvue dudit élément (40) de rappel élastique.

6. Ensemble de fiche et douille selon l'une des revendications précédentes, **caractérisé en ce que** l'élément de rappel élastique est un ressort en spirale (40).

7. Ensemble de fiche et douille selon la revendication 6, **caractérisé en ce que** le ressort en spirale est apte à supporter la masse de l'élément de fiche ou de douille et le maintenir sans qu'il se penche en s'éloignant de l'axe de connexion et déconnexion (60, 62).

8. Ensemble de fiche et douille selon l'une des revendications précédentes, **caractérisé en ce qu'**il inclut en outre un élément de limitation d'extension (52).

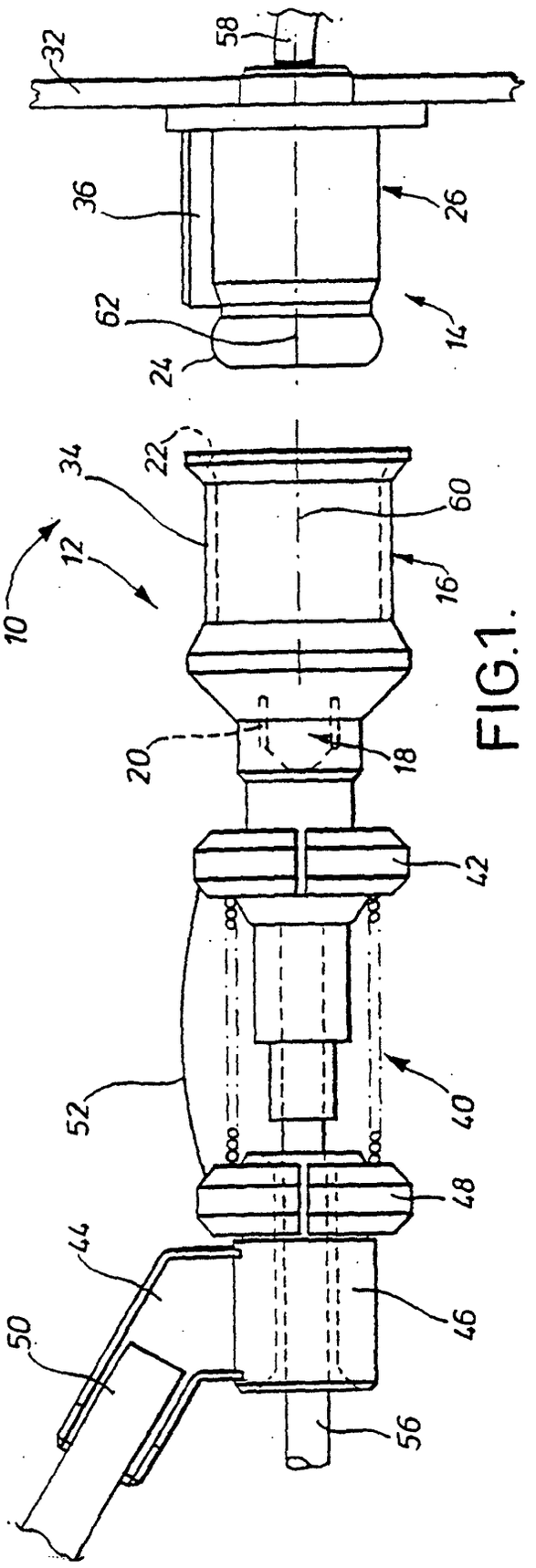
9. Ensemble de fiche et douille selon la revendication 8, **caractérisé en ce que** l'élément de limitation de

l'extension comporte une longueur de câble (52) joint à la partie de fiche ou de douille (42) et les moyens de manipulation (40) à une extrémité (48) de l'élément de rappel élastique à distance de la partie de fiche ou de douille.

10. Ensemble de fiche et douille selon l'une des revendications précédentes, **caractérisé en ce que** le moyen de manipulation est une languette (44) apte à être saisie par les moyens de manipulation à distance.

11. Ensemble de fiche et douille selon l'une des revendications précédentes, **caractérisé en ce qu'**il comporte en outre des moyens (34, 36) pour assurer un alignement en rotation.

12. Ensemble de fiche et douille selon la revendication 11, **caractérisé en ce que** les moyens pour assurer un alignement comporte une arête (36) élevée sur l'une des parties de fiche ou de douille et une gorge ou rainure (34) dans l'autre des enveloppes de partie de fiche ou de douille dans laquelle l'arête est reçue.


58
32
36
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62
14
24
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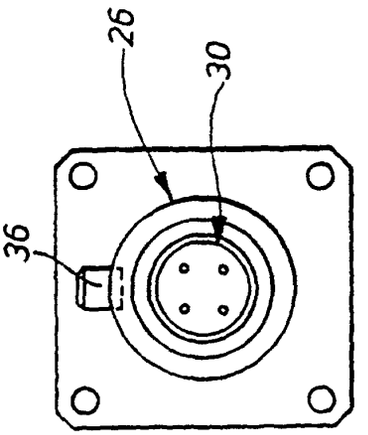
FIG.1.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36

FIG.2.

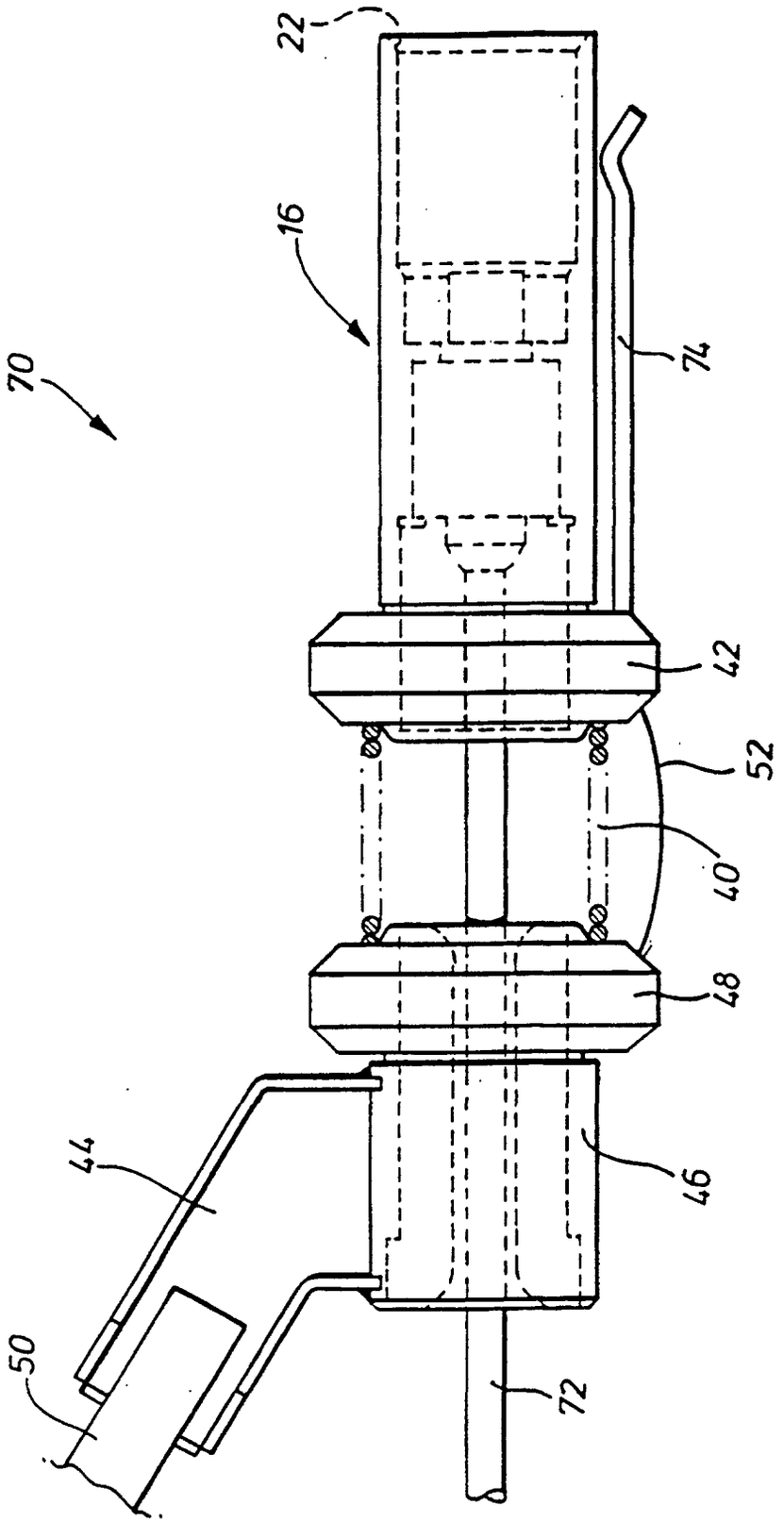

FIG.3.

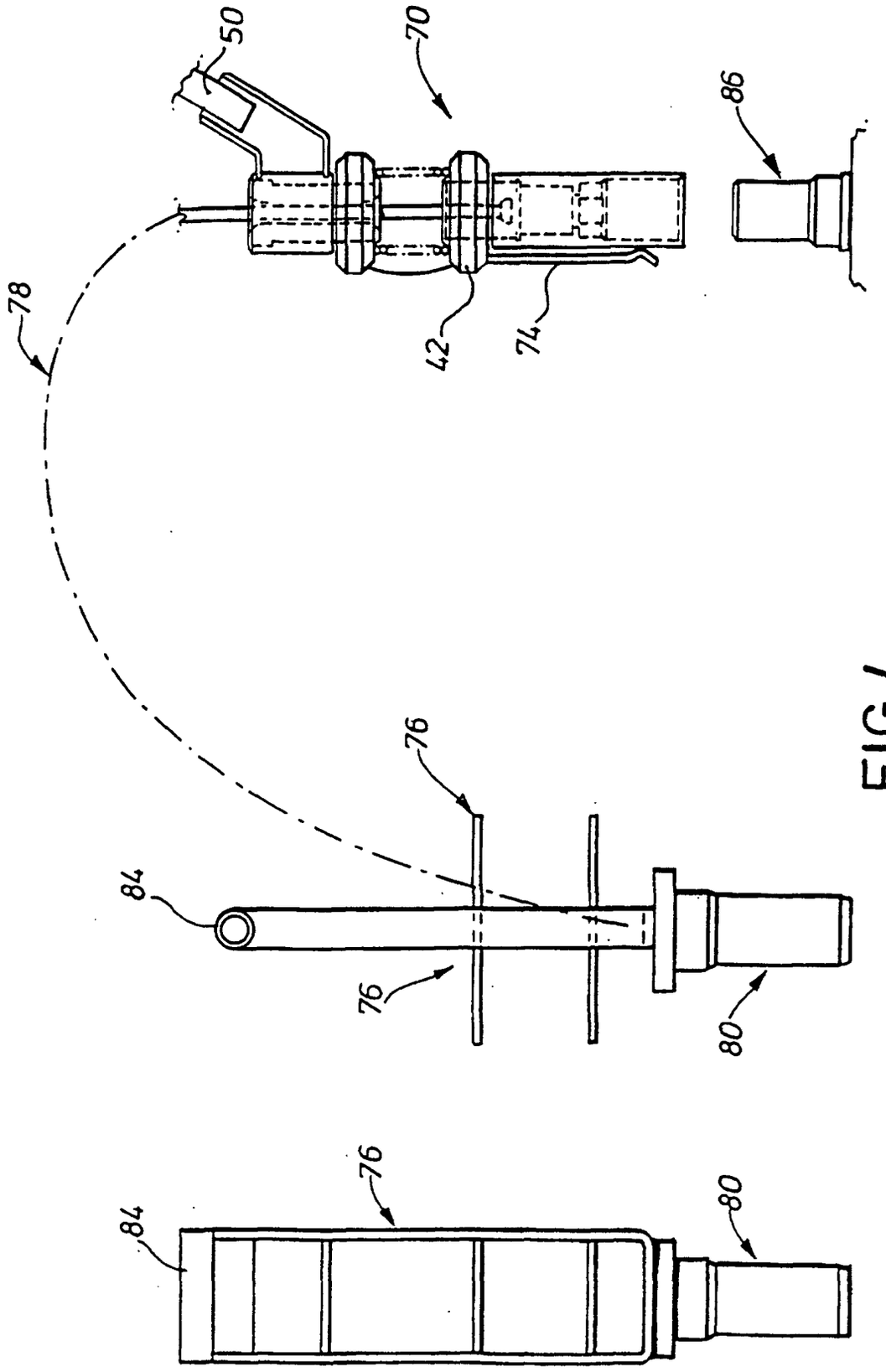

FIG.4.

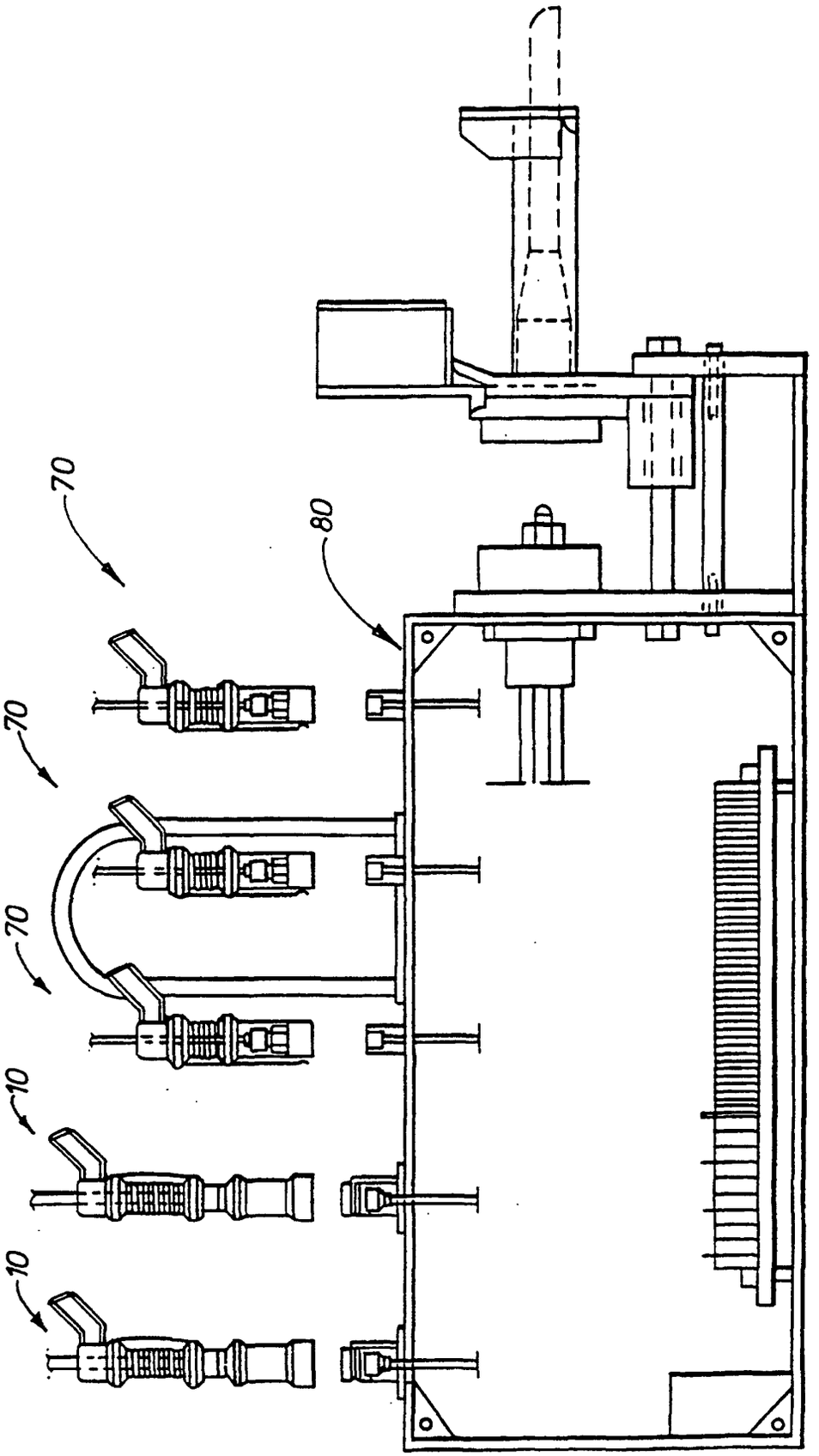

FIG.5.