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(54) Self terminating connector and cable assembly.

(57) Ends of electrical conductors (5) of an electrical cable are joined to corresponding self terminating, shielded connectors (4), each comprising, a conductive shell (20) connected to at least one corresponding sheath (8), a dielectric support (29) in the shell (20), a conductive switch contact (23) connected to a corresponding signal transmitting conductor (5) and carried by the dielectric support (29) for disconnect connection to an electrical contact inserted into the shielded connector (4), and an electrical circuit element (24) in contact with the shell (20) constructed for disconnect coupling with the switch contact (23) upon withdrawal of the electrical contact from the shielded connector (4), whereby the switch contact (23) is terminated electrically to the shell (20) through the circuit element (24).

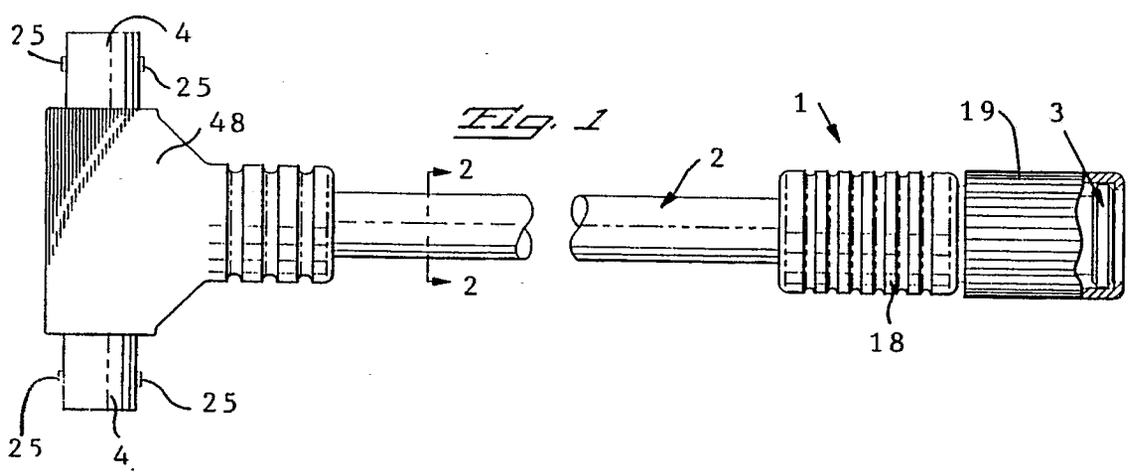

Fig. 1

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An electrical connector is disclosed for connection to an electrical cable having multiple signal carrying conductors to provide a connector, and particularly a connector incorporating an electrical circuit element.

An electrical cable comprised of multiple signal carrying conductors is utilized as a shielded bus of a local area network to interconnect a host computer and work stations that communicate with one another through the network.

The host computer or any one of the workstations provides a packet of electronic data to be sent over the bus. Each work station is associated with an electronic transceiver that functions to transmit the packet to the bus, or to detect a collision of the packet with another packet being transmitted along the bus. Upon detection of a collision, the transceiver sends an electronic collision signal back to the work station, causing the work station to delay transmission of the packet. The process is repeated until the transceiver functions to transmit the packet to the bus. Each transceiver is distinguished from other transceivers by an electronic address. Each packet is encoded with an address to insure that a selected transceiver receives the packet and transmits the packet to the work station associated with that transceiver. Each work station gains access to the network through the transceiver and a cable assembly having a shielded electrical connector that connects to the bus.

A known cable assembly is disclosed in U.S. Patent 4,773,879 comprising, an electrical cable having multiple signal carrying conductors encircled by dielectric material and by at least one conductive sheath, and ends of the cable joined to corresponding electrical connectors. The cable includes two coaxial cables, and conductive sheaths of both cables are connected to a conductive shell of a connector, and two signal transmitting conductors of the two cables are connected to a center contact of the connector that is ordinarily suited for connection to a single coaxial cable. This cable assembly is suitable as a drop wire for disconnect connection of a single work station to a transceiver permanently installed along a bus of a local area network. The transceiver functions to prevent disruption of the bus when the work station and the drop wire are disconnected from the bus. A need exists for a cable assembly that interconnects work stations that incorporate their own transceivers. A further need exists for a cable assembly that will serve as a bus for interconnecting such work stations. A further need exits for a cable assembly that will self terminate to prevent disruption of the bus when such a work station is disconnected from the bus. A further need exists for a cable assembly that links together with similar cable assemblies to form a bus that will self terminate to remain operative in the absence of a work station connected to a connector of the cable assemblies.

Disclosed in U.S. Patent 4,575,694 is a connector adapter having a shell and a circuit element for electrically coupling the shell and an electrical contact of the adapter. The contact remains coupled to the circuit element when one end of the adapter is connected to a first connector, and is uncoupled from the circuit element only by connecting a connector to a second end of the adapter.

An objective of the invention is to provide a shielded electrical connector and a cable assembly, which are useful for connecting a work station to a bus of a local area network. An advantage of the invention resides in a connector that is self terminating when an electrical contact of a work station, especially a work station incorporating a transceiver, is disconnected from the bus, leaving the bus operative in the absence of the work station. A feature of the invention resides in an electrical circuit having a circuit element constructed for disconnect coupling upon withdrawal of an electrical contact from a connector, whereby an electrical contact and the shell are terminated with the circuit element.

Accordingly, the invention includes, an electrical connector for connection to a device incorporating a transceiver of a computer work station, and having two shielded electrical connectors for connection to respective connectors of corresponding cable assemblies, a conductive shell for the two shielded connectors, at least one corresponding switch contact in the shell, at least one circuit element having an impedance connected by an electrical circuit to the shell and to the corresponding switch contact, opposite portions of the switch contact disconnectably engaging an electrical contact extending in each of the shielded connectors for connection to one of the respective connectors of corresponding cable assemblies, and each opposite portion being disconnectable without disconnecting the other opposite portion by connection of a respective one of the shielded connectors to one of the respective connectors of corresponding cable assemblies.

The invention further includes, a separate electrical contact extending in each of the shielded connectors for connection to one of the respective connectors of corresponding cable assemblies, an electrical circuit connecting each electrical contact to the shell through at least one circuit element having an impedance, and each electrical contact being disconnectable from the electrical circuit without disconnecting the other of the electrical contacts by connection of a respective one of the shielded connectors to one of the respective connectors of corresponding cable assemblies.

The invention will now be described by way of example with reference to the following detailed description and accompanying drawings.

Figure 1 is a fragmentary top plan view of a cable assembly.

Figure 2 is a section view taken along the line 2-2 of Figure 1.

Figure 3 is a fragmentary enlarged plan view in section of a portion of the cable assembly shown in Figure 1.

Figure 4 is a fragmentary perspective view with parts exploded of a portion of the cable assembly as shown in Figure 3.

Figure 5 is a fragmentary view in section of a portion of the cable assembly shown in Figure 1.

Figure 6 is a fragmentary view in section of a selected construction of a portion of the cable assembly of Figure 1.

Figure 7 is a network of work stations linked by cable assemblies.

With reference to Figures 1 and 2, a cable assembly 1 includes an electrical cable 2 at one end connected to a single electrical connector 3, and at an opposite end connected to two electrical, shielded connectors 4 that can be joined together. The cable 2 comprises; multiple signal carrying conductors 5, each of which are of multiple strands encircled concentrically by dielectric material 6, in turn, encircled concentrically by a sheath 7 of conductive material over a flexible film of polyethylene terephthalate, in turn encircled concentrically by a conductive sheath 8 of braided wire strands, in turn, collectively encircled by an insulative jacket 9 oblate in transverse section. A conductive drain wire 10 extends along and in contact with the conductive sheaths 8.

With reference to Figure 5, the cable 2 is assembled to the connector 3 in a manner disclosed in U.S. patent 4,773,879. The connector 3 is a plug type and comprises, as shown generally at 11, an encircling conductive shell 12, in turn, encircling a bipartite, insulative body 13, in turn, encircling an insulated electrical contact 14, and, for example, a coupling element 15 in the form of a bayonet type coupling ring rotatably mounted on the shell 12, and adapted for disconnect coupling to a coaxial jack, not shown.

Protruding portions of the signal carrying conductors 5 are twisted together and are connected to the contact 14. Protruding portions of the conductive sheaths 8 are outwardly spread, as in Figure 4. Then the conductive sheaths 8 and a protruding portion of the drain wire 10 are placed to overlap a rear, sleeve section 16 of the shell 12, as in Figure 5. A conductive sleeve 17 encircles the overlapped portions of the conductive sheaths 8 and the drain wire 10 and is radially deformed to clamp and connect the overlapped portions to the sleeve section 16 of the shell 12. Thereby, the cable 2 is connected electrically with the connector 3. With reference to Figure 1, an insulative strain relief 18 is applied, for example, by injection molding a solidifiable insulative material, to encircle and adhere to the sleeve section 16 and corresponding portions of the cable 2 that are either connected with the connector 3 or adjacent to the connector 3. An insulative cylindrical cover 19 encircles the coupling ring 15 and is rotatable with the coupling ring 15.

With reference to Figure 1, two shielded electrical connectors 4 are connected to corresponding signal transmitting conductors 5 that protrude from the cable 2 shown in Figures 3 and 4. The shielded connectors 4 are operative as separate electrical connectors. For convenience they may be connected together in a manner to be described.

With reference to Figures 1, 3 and 4, each shielded connector 4 comprises, a conductive shell 20, a bipartite, dielectric support 21 for assembly in the she11 20, and for being encircled by a cylindrical portion 22 of the shell 20, a conductive switch contact 23 to be carried by the dielectric support 21, and an electrical circuit element 24, for example, a resistor, for mounting in the shell 20 and in contact with the shell 20, and constructed for disconnect coupling with the switch contact 23, whereby the switch contact 23 is terminated electrically to the shell 20 through the circuit element 24.

For example, each cylindrical portion 22 is provided with external bayonet coupling prongs 25. Each shell 20 has an open side 26 connecting along an open side 26 of another shell 20 in a manner as described in U.S. Patent 4,687,446. Desirably, the shells 20 are in intimate contact without gaps to insure gap free shielding and continuous electrical paths along a shortest distance from one shell 20 to another. Semicylindrical portions 27 of corresponding shells 20 connect together to form a composite cylindrical portion 28. Each shielded connector 4 includes a bipartite dielectric support 29 constructed of duplicate sections 30 that separate to enable assembly with the switch contact 23 and the circuit element 24. The sections 30 face each other for assembly together in a corresponding shell 20.

Each switch contact 23 is of unitary construction, stamped and formed from a strip of metal, and comprises the following portions, a forward, sloped end 31, a curved contact 32, an elongated leaf spring 33, and an electrical terminal 34 that is curved to receive and become connected to a corresponding, protruding signal transmitting conductor 5. For example, the terminal 34 encircles and compressively is joined to the corresponding conductor 5. For example, the circuit element 24 is

a cube of resistive material with opposite sides having corresponding conductive surfaces 35. The circuit element 24 is inserted in a recess 36 extending partially in each section 30 of the dielectric support 29. The recess 36 communicates with a corresponding shell 20. A corresponding conductive surface 35 of the circuit element 24 is against a corresponding shell 20.

A second switch contact 37 of straight, elongated construction is assembled along a corresponding passage 38 extending partially in each section 30. The passage 38 communicates with the recess 36 and with a contact receiving cavity 39 of each section 30. A corresponding end 40 of the second switch contact 37 is received in an undercut pocket 41 of each section 30 of the dielectric support 29 and is restrained from movement. The second switch contact 37 is deflected when mounted in a corresponding dielectric support 29, to bias the second switch contact 37 in pressure engagement against a corresponding conductive surface 35 of the circuit element 24. In turn, the circuit element 24 is biased to apply pressure engagement of the other conductive surface 35 against a corresponding shell 20.

For example, the circuit element 24 and the second switch contact 37 is assembled, first with one of the sections 30, followed by assembly of each switch contact 23 along a corresponding passage 42 extending in one of the sections 30. Each switch contact 23 has an elbow 43 along a corresponding shaped turn 44 of the passage 42 to restrain the switch contact 23 from movement. The leaf spring 33 of each switch contact 23 extends along a corresponding cavity 39 that communicates with a corresponding passage 42, and that is spacious to permit deflection of the leaf spring 33. Each cavity 39 communicates with a corresponding front end 45 of the dielectric support 29. The sloped front end 31 of each switch contact 23 projects across the corresponding cavity 39.

Each leaf spring 33 must be deflected to be mounted along a corresponding cavity 39 of a corresponding dielectric support 29. Each deflected leaf spring 33 biases the curved contact 32 in pressure engagement against a corresponding second switch contact 37. The pressure engagement establishes an electrical circuit that couples a corresponding signal transmitting conductor 5, the switch contact 23, the circuit element 24 and a corresponding shell 20. The circuit also extends along the second switch contact 37.

With reference to Figure 6, each dielectric support 29 is alternatively provided with a recess 46 extending partially in each of the sections 30 and receiving a corresponding circuit element 24 in alignment with a corresponding curved contact 32. Each leaf spring 33 must be deflected to be mounted along a corresponding cavity 39 of a corresponding dielectric support 29. Each deflected leaf spring 33 biases the curved contact 32 in pressure engagement against a conductive surface 35 of a corresponding circuit element 24. The pressure engagement establishes an electrical circuit that couples a corresponding signal transmitting conductor 5, the switch contact 23, the circuit element 24 and a corresponding shell 20.

With reference to Figures 3 and 4, the shells 20 are brought together along their open sides 26. Protruding portions of the conductive sheaths 8 are outwardly spread, as in Figure 4. Then the conductive sheaths 8 and a protruding portion of the drain wire 10 are placed to overlap the composite cylindrical portion 28, as in Figure 3. A conductive sleeve 47 encircles the overlapped portions of the conductive sheaths 8 and the drain wire 10 and is radially deformed to clamp and connect the overlapped portions to the corresponding shells 20. Thereby, the cable 2 is connected electrically with each shielded connector 4. The corresponding shells 20 provide shields encircling corresponding insulated switch contacts 23. The shells 20 of the shielded connectors 4 are connected together as a composite shell and are connected to each sheath 8 of the cable 2. With reference to Figure 3, an insulative strain relief 48 is applied, for example, by injection molding a solidifiable insulative material, to encircle and adhere to the corresponding connectors 4, the composite cylindrical portion 28, the conductive sleeve 47 and the corresponding portions of the cable 2, either connected with the corresponding connectors 4 or adjacent to the corresponding connectors 4.

With reference to Figure 7, the cable assembly 1 is useful to build a local area network 49 that interconnects computer work stations, each shown at 50, and that self terminates to prevent disruption of the network 49 when a work station 50 is disconnected from the network 49. Each work station 50 incorporates its own transceiver, not shown, that functions as described above. Each work station 50 has a coaxial jack type connector 51. Each work station 50 to be connected along the network 49 is provided with a corresponding cable assembly 1, by coupling the coaxial connector 3 of the cable assembly 1 to the connector 51 of the work station 50.

A network 49 of two work stations 50 is built by linking two cable assemblies 1 of the work stations 50 with a standard cable assembly 52. The standard cable assembly 52 is constructed of a known coaxial cable 53 having a single, signal transmitting conductor, like one of the conductors 5, connected at opposite ends with plug type coaxial connectors 54 of known construction. Figure 7 shows a standard cable assembly 52 connected to two cable

assemblies 1 associated with corresponding work stations 50. Communications signals can be transmitted between the two work stations 50 along a network 49 built by the two cable assemblies 1 and the standard cable assembly 52.

Figure 3 shows disconnect coupling of the standard cable assembly 52 with the shielded connector 4 of the cable assembly 1. A bayonet coupling ring 55 of the connector 54 is connected to the bayonet prongs 25 of the shielded connector 4. A signal transmitting center contact 56 of the connector engages the switch contact 23 of the shielded connector 4, thereby establishing a signal transmitting circuit that couples the work station 50, a corresponding signal transmitting conductor 5, the switch contact 23, the standard cable assembly 52, and the corresponding cable assembly 1 associated with the second work station 50.

With reference to Figure 3, the center contact 56 deflects the switch contact 23 away from the second switch contact 37 to disengage the switch contact 23, and to disconnect and interrupt the electrical circuit coupling the circuit element 24 with the switch contact 23. When the connector 54 of the standard cable assembly 52 is disconnected from the shielded connector 4, the second switch contact 37 will return by spring action to engage the second switch contact 37, thereby again establishing the circuit that couples a corresponding signal transmitting conductor 5, the switch contact 23, the circuit element 24 and a corresponding shell 20. The circuit also extends along the second switch contact 37.

With reference to Figure 6, deflection of the switch contact 23 away from the circuit element 24, for example, by a center contact 56, not shown, will interrupt the circuit that couples the circuit element 24 and the switch contact 23. In the absence of a center contact 56, the second switch contact 37 will return by spring action to engage the circuit element 24.

With reference to Figure 3, the shielded connector 4 of the cable assembly 1 that is not connected with a standard cable assembly 52 is self terminating, in that the switch contact 23 is coupled to the shell 20 through a fixed impedance provided by the impedance of the circuit element 24. The above described network 49 of the two work stations 50 is not disrupted, since the self terminating, shielded connector 4 will not appear as an open circuit to transmission of a communications signal from either of the two work stations 50.

With reference to Figure 7, an advantage of the cable assembly 1 is that a network 49 built with the cable assembly 1 can be extended by adding a combination comprising, another work station 50 and another cable assembly 1 and another standard cable assembly 52. According to another advantage, the network 49 can be reduced by disconnecting the combination, without disrupting the network 49, since each shielded connector 4 of the cable assembly 1 is self terminating in the absence of being connected to a standard cable assembly 52. Another advantage is that a work station 50 may be removed from the network 49 to be available as a portable work station 50 away from the network 49, and can return to the network 49, without disrupting the network 49.

Each of the discussed advantages, features and objectives of the disclosed invention exists independently and contributes to the use and importance of the invention.

Claims

1. An electrical connector for connection to a device incorporating a transceiver of a computer work station, and having two shielded electrical connectors (4) for connection to respective connectors (54) of corresponding cable assemblies (52), characterised by;
a conductive shell (20) for the two shielded connectors (4),
at least one corresponding switch contact (37) in the shell (20),
at least one circuit element (24) having an impedance connected by an electrical circuit to the shell (20) and to the corresponding switch contact (37),
opposite portions of the switch contact (37) disconnectably engaging an electrical contact (23) extending in each of the shielded connectors (4) for connection to one of the respective connectors (54) of corresponding cable assemblies (52), and each opposite portion being disconnectable without disconnecting the other opposite portion by connection of a respective one of the shielded connectors (4) to one of the respective connectors (54) of corresponding cable assemblies (52).

2. An electrical connector as recited in claim 1, characterised by;
the circuit element (24) engaging the corresponding switch contact (37) and the shell (20).

3. An electrical connector as recited in claim 1 or 2, characterised by;
a signal conductor (5) of an electrical cable (2) connected to a corresponding electrical contact (23), and a third electrical connector (3) connected to an end of the cable (2).

4. An electrical connector as recited in claim 3, characterised by;
an insulative strain relief (48) adhered to the shell (20) and the cable (2).

5. An electrical connector for connection to a device incorporating a transceiver of a computer work station, and having two shielded electrical

connectors (4) for connection to respective connectors (54) of corresponding cable assemblies (52), characterised by;
a conductive shell (20) for the two shielded connectors (4),
a separate electrical contact (23) extending in each of the shielded connectors (4) for connection to one of the respective connectors (54) of corresponding cable assemblies (52), an electrical circuit connecting each electrical contact (23) to the shell (20) through at least one circuit element (24) having an impedance, and each electrical contact (23) being disconnectable from the electrical circuit without disconnecting the other electrical contact (23) by connection of a respective one of the shielded connectors (4) to one of the respective connectors (54) of corresponding cable assemblies (52).

6. An electrical connector as recited in claim 5, characterised by;
a corresponding circuit element (24) in each shielded connector (4), and each electrical contact (23) disengageably engages a corresponding circuit element (24).

7. An electrical connector as recited in claim 5, characterised by;
at least one corresponding switch contact (37) in the shell (20) connected in the electrical circuit with each electrical contact (23).

8. An electrical connector as recited in claim 5, 6 or 7, characterised by;
each of the electrical contacts (23) being constructed for deflection to disconnect from the electrical circuit.

9. An electrical connector as recited in claim 5, 6, 7 or 8, characterised by;
signal conductors (5) of an electrical cable (2) connected to the electrical contacts (23), and a third connector (3) connected to the end of the cable (2).

10. An electrical connector as recited in claim 9, characterised by;
a strain relief (48) adhered to the shell (20) and the cable (2).

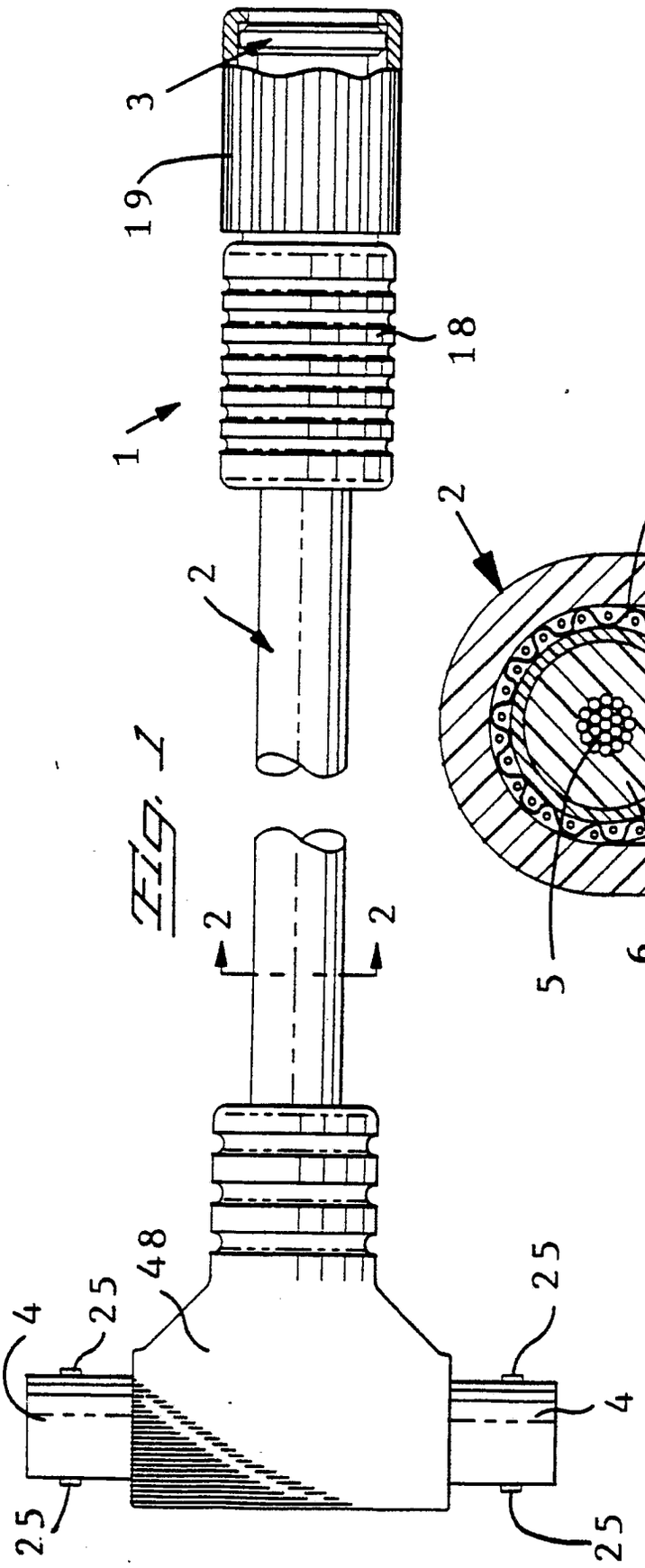

Fig. 1

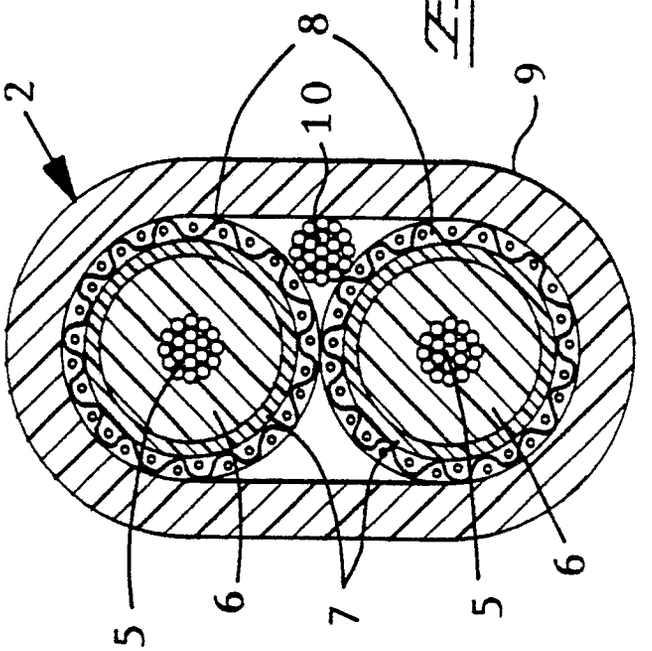

Fig. 2

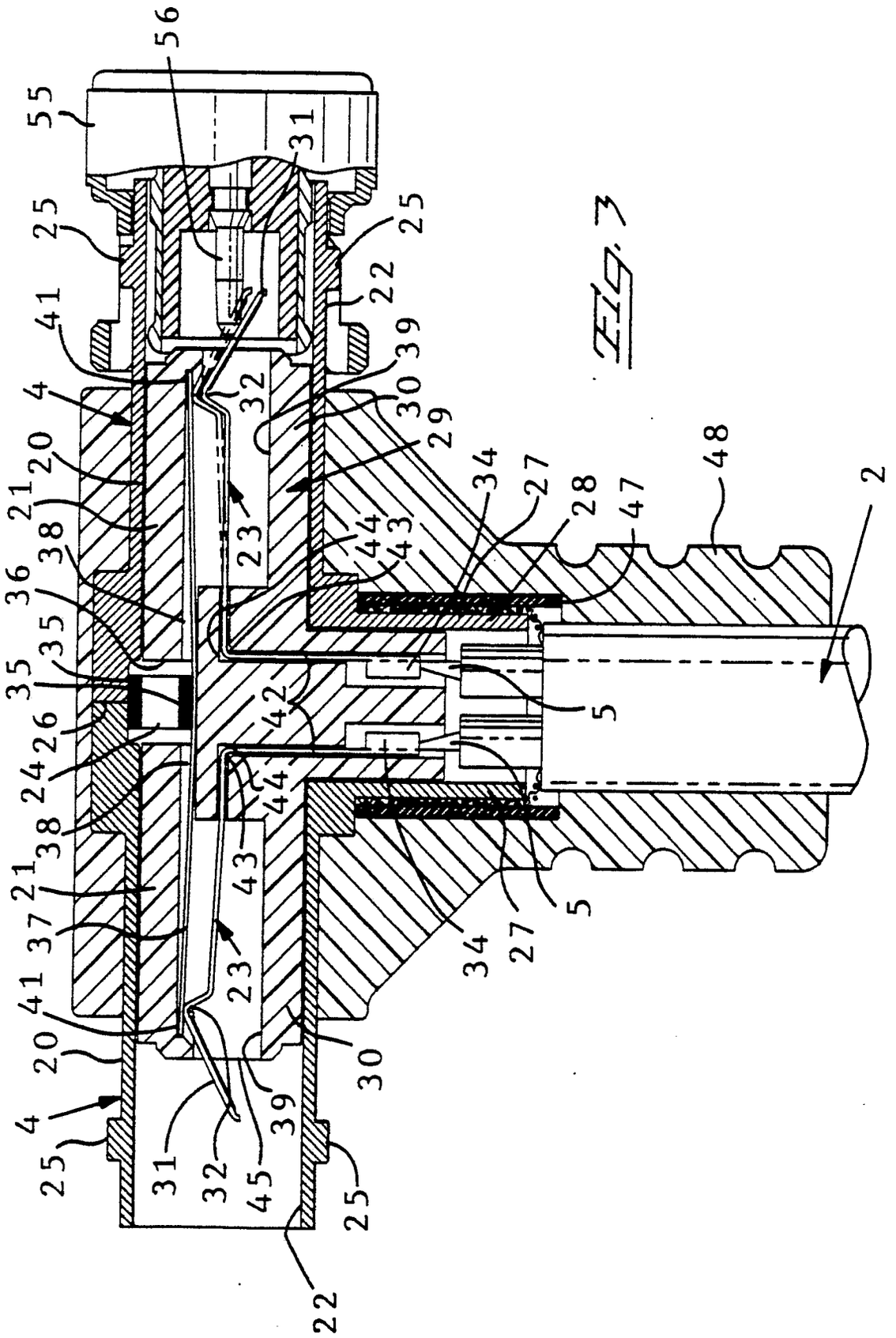
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Fig. 3

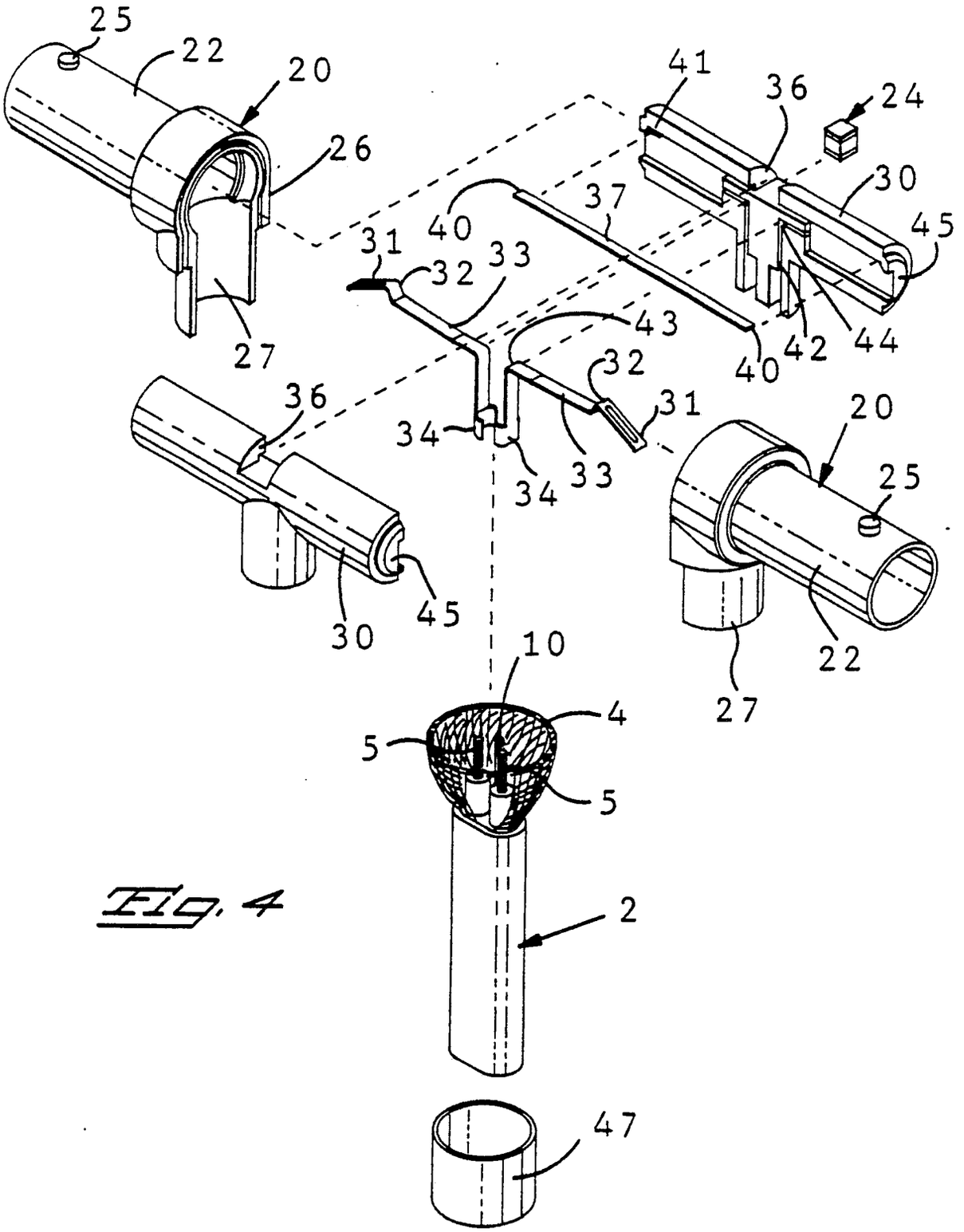
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Fig. 4

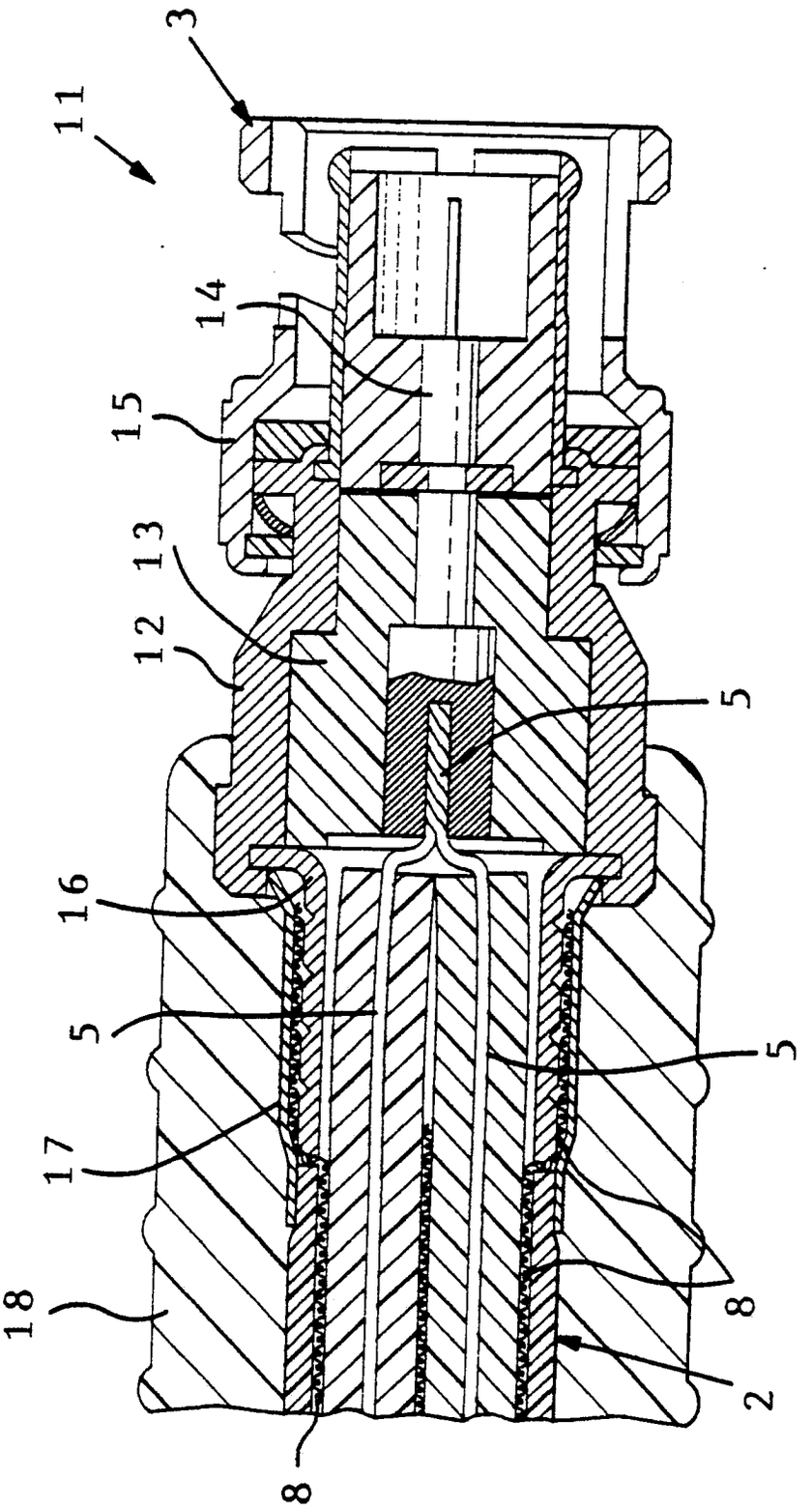

Fig. 5.

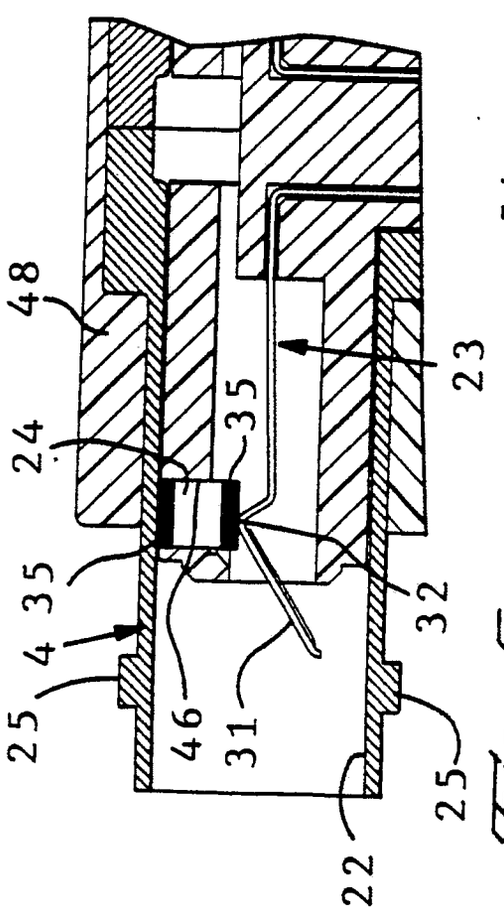
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Fig. 6

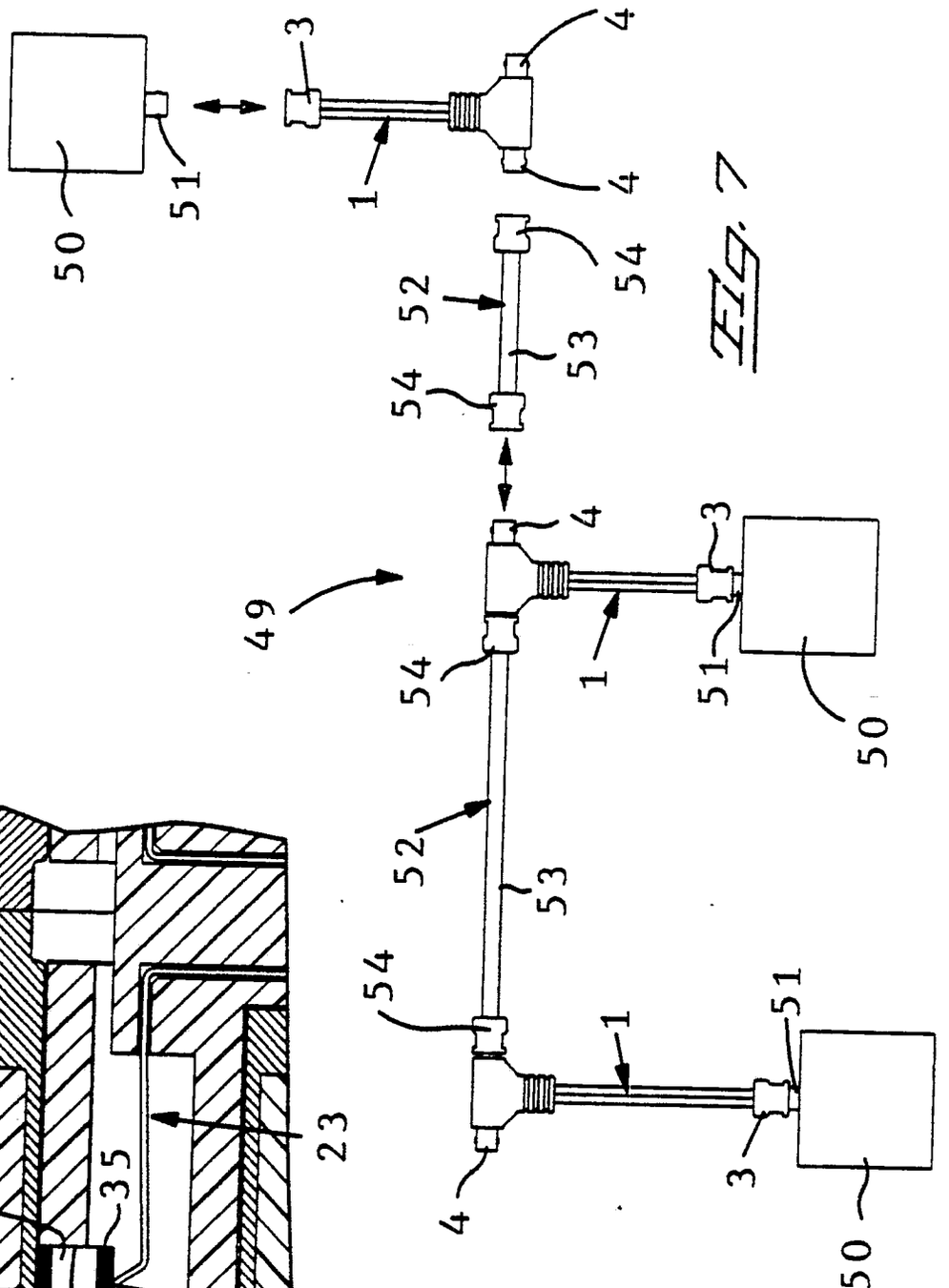
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Fig. 7