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(54) Electrical connector

(57) A housing 4 includes a carriage 6 and block 8, which are slidably cooperable to retain a first cable 18 therebetween. A further cable 40 to be electrically coupled to the first cable 18 fits within the block 8. Screw members 36, 38 electrically couple the cables 18, 40 together within the confines of the housing 4. A blade 26, also within the confines of the housing 4, is able to sever the cable 18 prior to electrically coupling this with the further cable 40. Because all of the operations are carried out within the confines of the housing 4, the risk to an operative of an electric shock is reduced.

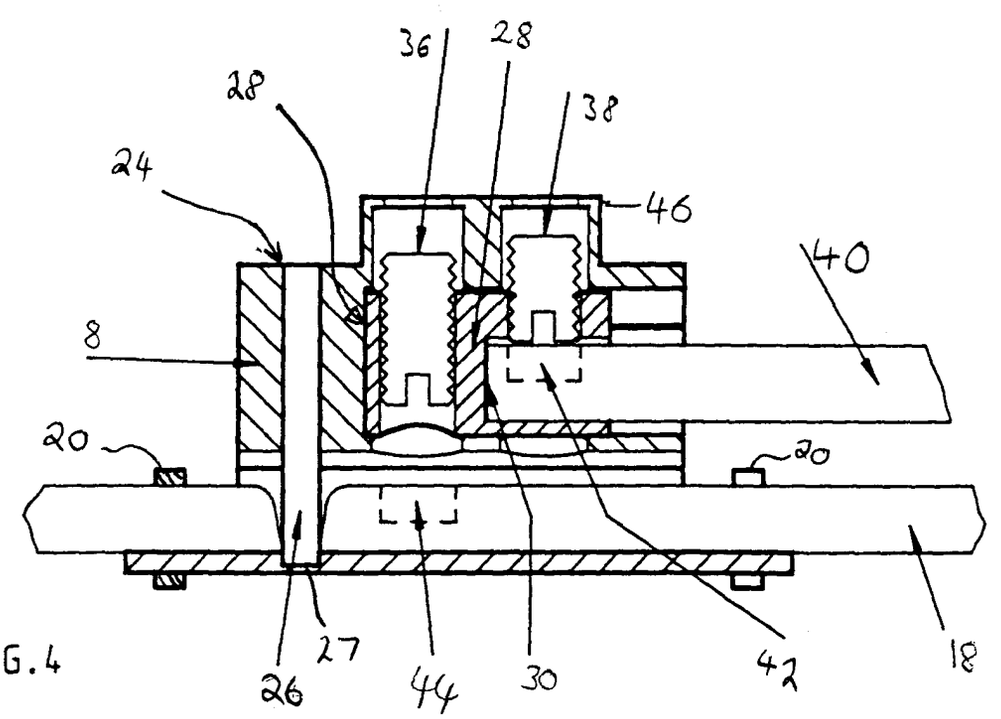

FIG.4

EP 0 969 555 A2

Description

[0001] The present invention relates to electrical connectors for coupling cables and has particular, although not exclusive, relevance to the use of such connectors for safely coupling cables which are required to carry electric current from one point to another.

[0002] There is often a need to extend an electrical cable. For instance, if there is a desire to move a lamp-post from one position to another, it can be necessary to extend the length of cable supplying power to the lamp-post. In such a case, it is preferable that the cable is not carrying electrical power whilst being extended. This is because it is necessary to cut the cable and provide a coupling piece between the original cable and the extension cable. If this work is conducted whilst the cable is conducting electricity, or 'live', then there exists the potential for an operative to receive an electric shock. Even if an electric shock is not received, there is still the possibility of arcing between the coupling and the live cable. Such arcing, even if not dangerous to an operative, can cause damage to the cable or the electrical coupling, or both.

[0003] Whilst it is possible to disconnect the cable to be cut from the power supply, this can cause problems. This is because power is very often supplied in parallel to many cables via an electricity sub-station or the like. If power to one cable is disconnected, then power to all cables must be disconnected. This is inconvenient when the requirement is that only one cable not be live in order to be safely extended.

[0004] European Patent Application No 0,803,934 discloses an electrical conductor which permits the coupling of one cable to another. The connector includes a first channel within which a first cable for connecting is received. A metallic screw is driven into engagement with the conducting inner core of the first cable. The screw is electrically coupled with a further screw which itself is driven into engagement with a second cable housed in a further channel. In this way, the two cables may be electrically coupled together.

[0005] The same problem exists in the disclosure of EP 0,803,934 as with the above-mentioned prior art; namely, because the first cable to be coupled is live when being operated upon, the possibility of arcing or electric shock for an operative still exists, when the first cable needs to be cut.

[0006] It is thus an object of the present invention to at least alleviate the aforementioned shortcomings and provide an electrical connector for cutting and coupling electrical cables together, wherein the connection may safely be made whilst at least one of the cables is live or at least has a potential difference across it. It is a further object of the present invention to provide an electrical connector which may be safely used by only one operative, and therefore provide a labour-saving device. With conventional live working, usually two operatives are needed.

[0007] According to a first aspect of the present invention, therefore, there is provided an electrical connector comprising:

an electrically-insulative housing for clamping about a first electrical cable which is coupled to a voltage source;
means for severing the cable within the confines of the housing, a first portion of the cable coupled to the voltage source being retained in the housing;
means for clamping a second cable within the housing; and
means for electrically coupling the first portion of the first cable to the second cable.

[0008] By permitting the cable to be severed within the confines of the housing, and because the housing is electrically insulative, the potential for an operative to receive a shock or for arcing to occur is minimised.

[0009] Preferably, the housing comprises a carriage and a block received by the carriage. This arrangement permits easy confinement of the first cable. Advantageously, the first cable is clamped between the carriage and the block.

[0010] Preferably the means for cutting comprises a channel formed within the housing through which a blade for severing the cable may pass. Advantageously, the means for cutting include a blade.

[0011] Preferably, the means for electrically coupling the first portion of the first cable to the second cable includes an electrically conductive union member within the housing. In a preferred embodiment, the means for electrically coupling the first portion of the first cable to the second cable further includes electrically conductive screw members, each of which may be driven into electrical and physical engagement with a respective cable, and each of which screw members is electrically coupled to the union member when in engagement with its respective cable. Advantageously, the screw members each carry an electrically insulative head. Advantageously, a holding tool is provided for use with the electrical connector of the present invention, which holding tool comprises a bracket having a first portion shaped to hold the housing and a further portion shaped to allow access to the means for severing the cable.

[0012] According to a further aspect of the present invention, there is provided a holding tool for holding an electrical connector wherein the holding tool comprises a bracket having a first portion shaped to hold the housing and a further portion shaped to allow access to the means for severing the cable.

[0013] According to a yet further aspect of the present invention, there is provided a method of electrically coupling cables using an electrical connector , the method comprising:

placing within a housing of the connector a first cable which is coupled to a voltage source;

severing the first cable so that a severed end of a cable portion which is still coupled to the voltage source is retained in the housing;
placing a second cable within the housing; and
electrically coupling the first portion of the first cable to the second cable.

[0014] The present invention will now be described, by way of example only, and with reference to the following drawings:

Figure 1 shows a perspective view of an electrical connector, including a first and second cable;
Figure 2 shows a partial cut-away view of the illustration of Figure 1;
Figure 3 shows a sectional view along the line X-X of Figure 1;
Figure 4 shows a section view taken along line Y-Y of Figure 1; and
Figure 5 shows a perspective view of an electrical connector,

including first and second cables in accordance with the present invention and further including a tool holder.

[0015] Referring firstly to Figures 1 to 4, it can be seen that an electrical connector shown generally as 2 comprises a housing 4 for retaining cables to be connected. The housing 4, in this example, comprises a carriage 6 and a block 8 slidably received within the carriage. Both the carriage 6 and block 8 are formed from electrically non-conductive plastics material, such as PVC, polypropylene, nylon, polyethylene or glass reinforced versions of these. In this example, PVC is used. Furthermore, it can be seen that the carriage 6 comprises two arms and a lower cross member 10, thus comprising a generally U-shaped member. The extreme ends of the arms of the carriage 6 are each formed with a depending lip 12. Similarly, the block 8 is formed with co-operable recesses 14. Also, at the end of the arms of the carriage 6 adjacent the cross member 10, the arms each have a depending lip 16 on which the lower portion of the block 8 rests.

[0016] The purpose of the depending lips 12, 16 of the carriage 6 and corresponding recess 14 of the block 8 is to permit the block 8 to only slide laterally within the carriage 6 and to prevent movement in the direction shown by the arrow A-A of Figure 3. This arrangement enables the cooperation between the carriage 6 and block 8 to clamp a first cable 18 within the housing 4. In the event that the diameter of the cable 18 is too small to be clamped between the carriage 6 and block 8, a conventional cable-tie 20, such as that shown in Figure 5, may also be used. In this way, therefore, relative movement between the first cable 18 and the housing 4 is prevented. If a cable-tie 20 is to be used, then it is advantageous for the lower cross member 10 to have a recess 22 formed therein in order to locate the cable-tie 20 in the axial direction.

[0017] The housing 4 includes a means for severing the cable 18 so as to retain one of the severed ends within the confines of the housing. In this example, a channel 24 is formed within the block 8 to permit a blade 26 to be driven therethrough and sever the cable 18. Alternatively, the housing 4 may be formed with an integral blade able to sever the cable 18 as it is brought within the confines of the housing 4.

[0018] A blade 26, having been driven down through the channel 24, severs the cable 18. The blade 26 is chosen to be formed from an electrically-insulative material or a structure such as a metal coated with an electrically-insulative material such as PVC or polypropylene. In this way, when the cable 18 is severed by the blade 26 no arcing occurs. The blade 26 extends down into a channel 27 in the cross-member 10 to ensure that the blade cuts fully through the cable, and is flush with the upper surface of the carriage 8 when driven fully home through the cable.

[0019] Once the cable 18 has been severed, then only the live portion needs to be held within the confines of the housing. However, in this example the cable 18 is retained by cable-ties 20, and therefore both portions of the cable 18 at either side of the blade 26 will be held in position. Referring particularly to Figure 4, it is only the right-hand portion of the cable 18 with respect to the blade 26 which is live and which is to be electrically coupled to a second cable.

[0020] Within the block 8, there is an electrically-conductive union member, here a metallic connecting piece 28. In this example, this connecting piece 28 comprises a cylinder having a blind bore 30 formed therein. The connecting piece 28 has two axially-aligned radial bores 32, 34. Each radial bore 32, 34 is formed with a screw thread. The radial bore 32 passes diametrically through the connecting piece 28 from one surface to the opposite side. The radial bore 32 does not communicate with the blind bore 30. The other radial bore 34 communicates with the blind bore 30 and does not pass diametrically through the connecting piece 28. Each radial bore 32, 34 accepts a co-operable electrically conductive screw member 36, 38. The head of each screw member 36, 38 is preferably formed from an electrically non-conductive material.

[0021] A second cable 40 to be electrically coupled to the first portion of the first cable 18 is inserted into the blind bore 30 of the connecting piece 28.

[0022] In order to retain the second cable 40 within the blind bore 30, the screw member 38 is driven down the thread formed within the radial bore 34, such that the lower end of the screw member 38 pierces the cable 40 and electrically couples with the internal metallic core thereof. This piercing action in order to clamp the second cable 40 into position and provide an electrical connection thereto is shown as 42.

[0023] It is now necessary to electrically couple the first portion of the first cable 18 to the second cable 40. This is achieved by driving the screw member 36 down through the radial bore 32 and into engagement with the

first cable 18. The lower portion of the screw member 36 pierces the cable 18 (shown in dotted outline at 44) and is driven into engagement with its central, electrically conductive, core to form an electrical connection and also clamp the cable end in position.

[0024] Because each of the bodies of the screw members 36, 38 and the connecting piece 28 are electrically conductive, then by virtue of each screw member 36, 38 being driven into engagement with the central conductive core of each respective cable 18, 40, an electrically conductive path is formed between each cable 18, 40. In this way, therefore, electrical coupling of the first cable 18 to the second cable 40 has been effected. The entire operation of severing the first cable 18, clamping the second cable 40 and electrically coupling the first and second cables 18, 40 is achieved within the confines of the housing. Furthermore, because the housing 4, the severing blade 26 and each of the driven heads of the screw members 36, 38 are all electrically insulative, or operated with fully insulated tools, there is no possibility of electrical arcing or of shock occurring to an operative.

[0025] In order to further ensure the safety of an operative when working upon the screw members 36, 38, the block 8 is formed with a protective turret 46. The turret 46 is formed from the same electrically insulative material as the rest of the housing 4 and has formed therein two access holes 48, 50. The access hole 48 provides access to the screw 36 in the radial bore 32. The access hole 50 provides access to the screw member 38 in the radial bore 34.

[0026] Referring now particularly to Figure 5, it can be seen that a holding tool 52 may be used for holding the entire housing 4 in place while the above operations are carried out. The holding tool 52 includes a bracket member 54 having a first portion shaped to hold the housing 4. The first portion, in this example, the lower U-shaped lip 56, is shaped to co-operate with the lower portion of the carriage 6.

[0027] The bracket 54 has a further portion, here the upper lip 58, configured to provide three access holes 60, 62, 64. The access hole 60 provides access to the channel 24 for the blade 26. Each access hole 62, 64 provides access to the respective access holes 48, 50 in the turret 46.

[0028] Provision of the holding tool 52 allows an operative to keep his hands away from the housing 4 when coupling the cables 18, 40 as described above.

[0029] Preferably, the entire holding tool 52 may be formed of electrically insulative material such as PVC, or be a fully insulated metal tool.

[0030] The embodiment described above includes a blade 26 which is separate from the housing 4. It may be advantageous for the blade 26 to be integral with the housing 4 such that, as the housing 4 is clamped around the first cable 18, the blade automatically severs the cable 18.

[0031] Although no particular form of driving the screw members 36, 38 has been described above, it would be readily apparent to those skilled in the art that, for example, each screw head may be formed with an Allen RTM head. Alternatively, it may be formed with a conventional cross head recess for accepting an appropriate screwdriver.

Claims

1. An electrical connector comprising:

   an electrically-insulative housing for clamping about a first electrical cable which is coupled to a voltage source;
   means for severing the cable within the confines of the housing, a first portion of the cable coupled to the voltage source being retained in the housing;
   means for clamping a second cable within the housing; and
   means for electrically coupling the first portion of the first cable to the second cable.

2. An electrical connector according to claim 1 wherein the housing comprises a carriage and a block received by the carriage.

3. An electrical connector according to claim 2 wherein the first electrical cable is clamped between the carriage and the block.

4. An electrical connector according to any one of the preceding claims wherein the means for cutting comprises a channel formed within the housing through which a blade for severing the cable may pass.

5. An electrical connector according to any one of the preceding claims wherein the means for cutting includes a blade.

6. An electrical connector according to any one of the preceding claims wherein the means for electrically coupling the first portion of the first cable to the second cable includes an electrically conductive union member within the housing.

7. An electrical connector according to claim 6 wherein the means for electrically coupling the first portion of the first cable to the second cable further includes electrically conductive screw members, each of which may be driven into electrical and physical engagement with a respective cable, and each of which screw members is electrically coupled to the union member when in engagement with said respective cable.

8. An electrical connector according to claim 7 where-

in the screw members each carry an electrically insulative head.

9. A holding tool for holding an electrical connector according to any one of the preceding claims, wherein the holding tool comprises a bracket having a first portion shaped to hold the housing and a further portion shaped to allow access to the means for severing the cable.

10. A method of electrically coupling cables using an electrical connector , the method comprising:

placing within a housing of the connector a first cable which is coupled to a voltage source;
severing the first cable so that a severed end of a cable portion which is still coupled to the voltage source is retained in the housing;
placing a second cable within the housing; and
electrically coupling the first portion of the first cable to the second cable.

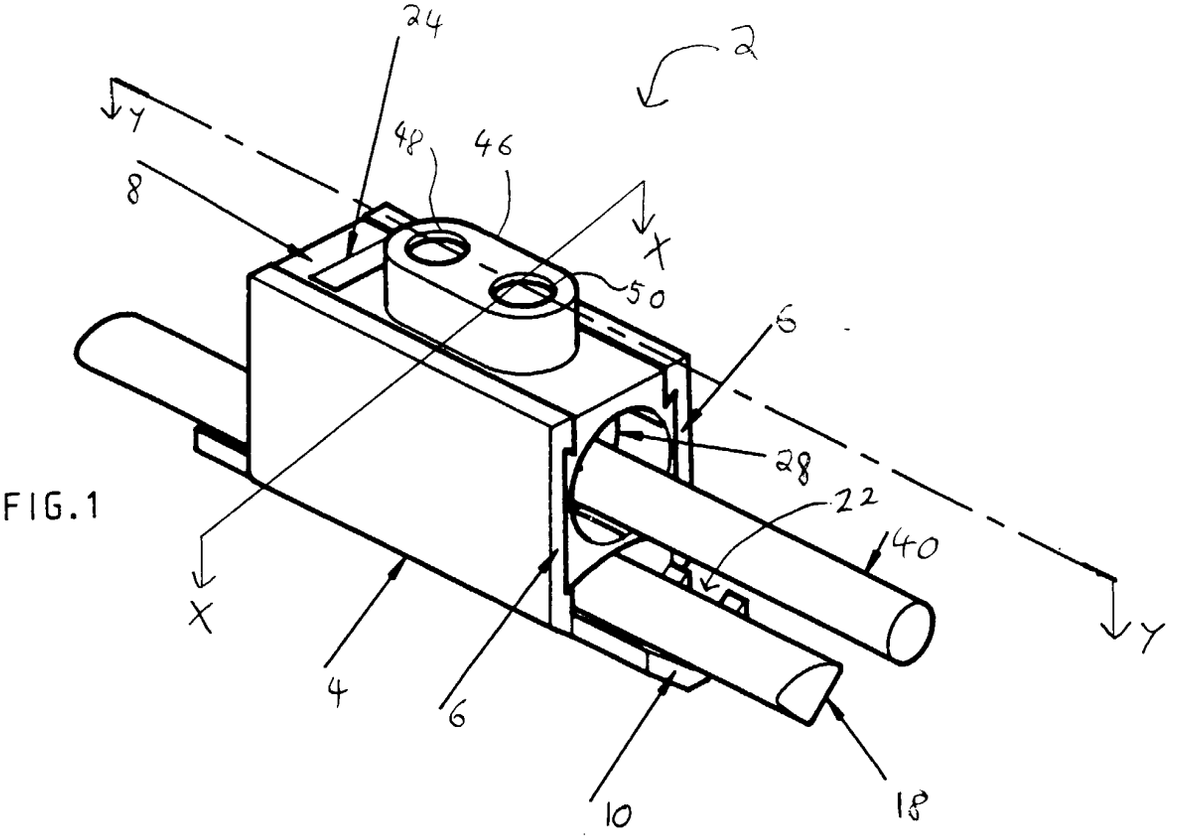
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FIG.1

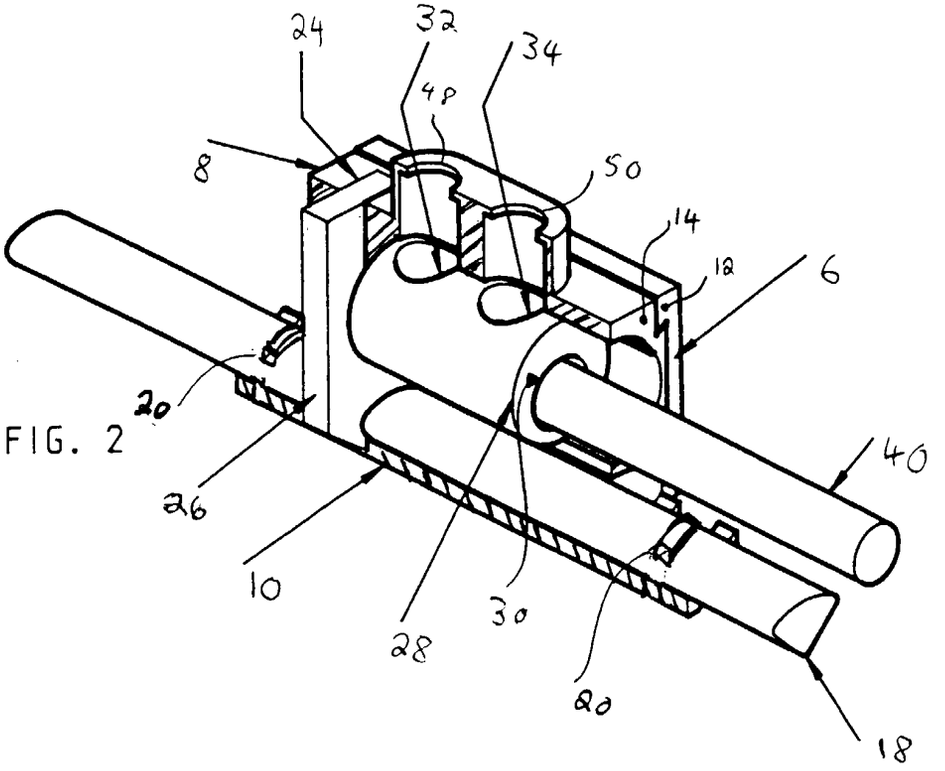
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FIG. 2

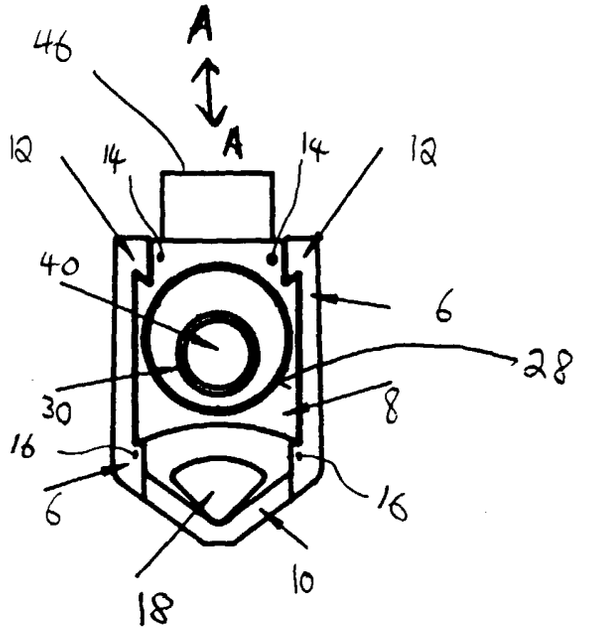
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FIG.3

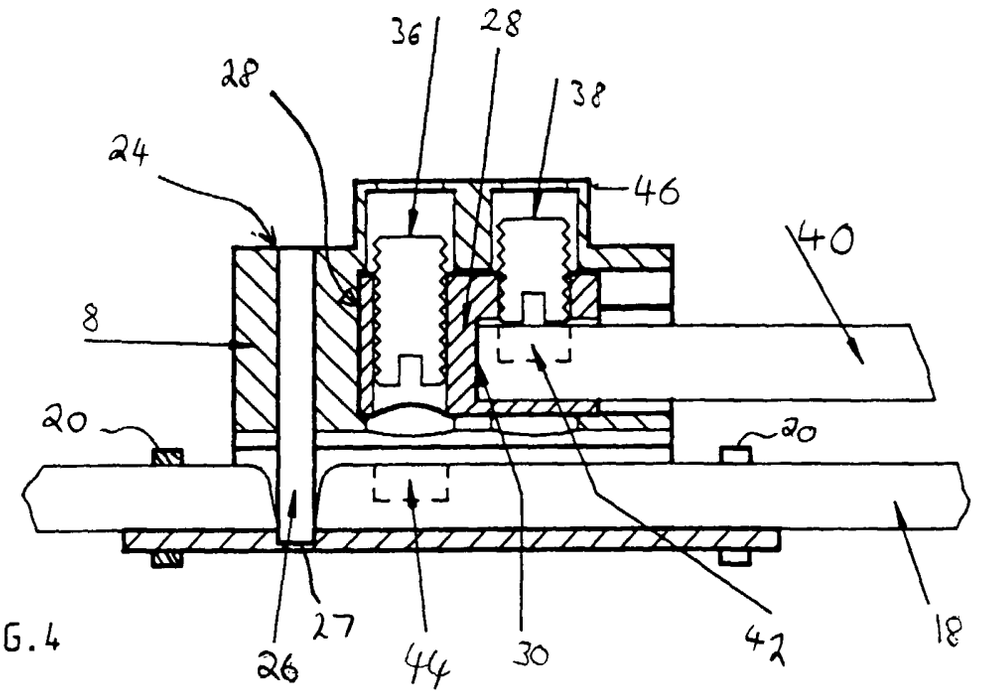
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FIG.4

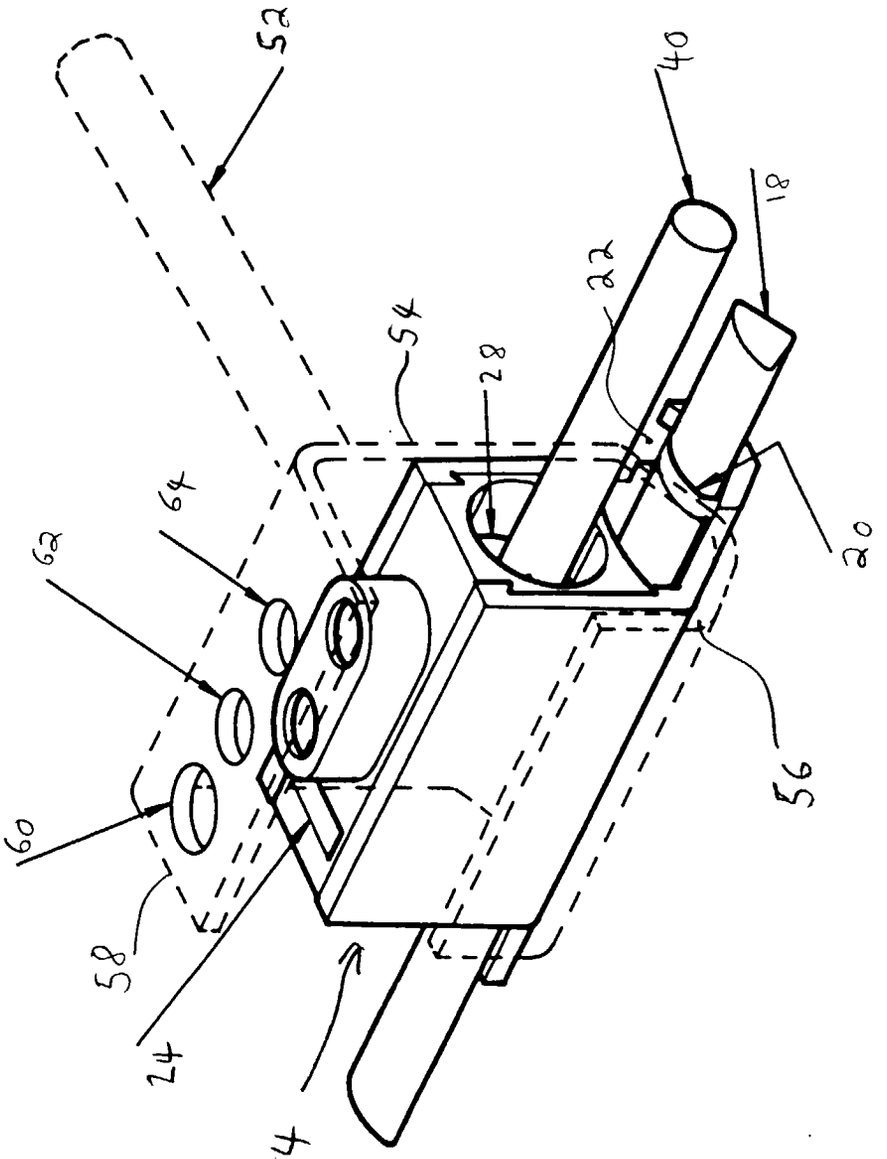

FIG 5