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(54) Wire Connector

(57) Connector comprising two or more IDCs 30, an actuator 20 for securing wires to IDCs 30, and a resilient element 55, the actuator 20 being mounted such that it can be moved from a first position to a second position relative to an IDC 30, thereby securing a wire to the IDC 30, and the actuator 20 and the resilient element 55 being mounted such that the resilient element 55 can move the actuator 20 from the second position to the first position, with the wire remaining secured to the IDC 30.

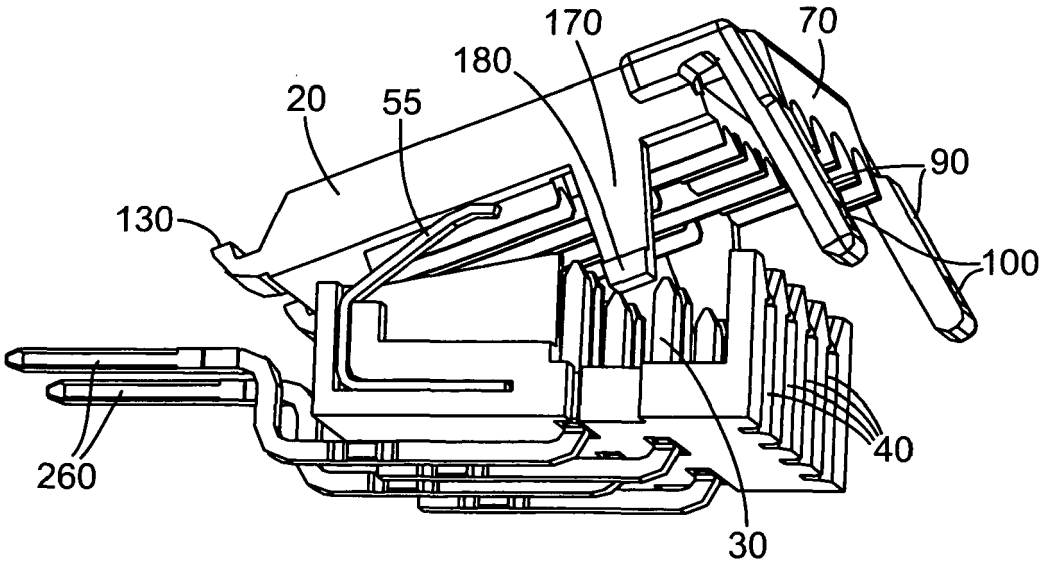


FIG. 6b

EP 2 408 067 A1

Description

[0001] This invention relates to electrical connectors and deals with connectors having insulation displacement contacts.

[0002] Cost pressure and fast growth in telecommunication, electrical and electronic infrastructure have created an increasing demand for accessories that facilitate quick and reliable installation of electrical systems, electronic systems and telecommunication network systems. The termination of several wires to one connector having insulation displacement contacts ("IDCs") occurs frequently in such installations. This step of an installation often requires manual labour. Hence several approaches have been made in the past to reduce labour cost by making this particular process quicker and more reliable.

[0003] An example of such an approach is the German patent application DE 3320440 A1, in which bosses on the inside of a hinged cover serve as tools for forcing individual insulated wires between the insulation displacement jaws of a corresponding contact. The cover has a pair of latching arms with inwardly projecting latching portions which engage under shoulders when the cover is fully closed.

[0004] Another example is Japanese patent application JP 2002-359015. The tip of a metal plate spring forming one end of a connecting electrode is pressed onto electric wires by a clamping plate pivotally attached to a base. After connecting an electrical wire, the electrical connection can be disrupted by raising the tip of the clamping plate by a fingertip.

[0005] Both of these prior art approaches provide connectors in which all incoming wires are connected to respective IDCs in a single step. In DE 3320440 A1, the cover can be used once for connecting wires to IDCs, because the cover is latched when it is fully closed for the first time. In JP 2002-359015, wires that are already connected to IDCs are removed from their IDCs when raising the clamping plate carrying the IDCs, and when connecting an additional wire, the wires that had previously been connected and had then been removed from their IDCs, will be connected again, at the same time as the new wires are connected.

[0006] W02006/036292 mentions a cap, pivotally mounted to the housing of an insulation displacement system, wherein an electrical conductor is inserted into IDC contacts by closing the cap, and once inserted, the cap can be reopened and a second electrical conductor is inserted into IDC contacts.

[0007] WO2009/029398 mentions an insulation displacement connector block comprising a termination tool, which has a body portion which is pivotable between an open and a closed position relative to the block, for urging at least one electrical conductor into an IDC element of the IDC block.

[0008] While those documents talk about pivotable elements for connecting wires to IDCs, those pivotable elements need to be actively returned into an open position by the installer, in order to be ready for connecting a further conductor to an IDC. This often requires pulling on the pivotable element, where it was previously pushed for connecting a conductor.

[0009] Hence there is a need for connectors that facilitate quicker sequential connection of wires to respective IDCs.

[0010] The present invention is addressing this need. It aims at reducing installation time of electrical and electronic installations.

[0011] The present invention provides a connector comprising two or more IDCs, an actuator for securing wires to IDCs, and a resilient element, the actuator being positioned such that it can be moved from a first position to a second position relative to an IDC, thereby securing a wire to the IDC, and the actuator and the resilient element being positioned such that the resilient element can move the actuator from the second position to the first position, with the wire remaining secured to the IDC.

[0012] An advantage of the connector of the present invention is that it may allow for quick sequential securing of wires to corresponding IDCs by repeatedly moving the actuator from its first into its second position. An individual wire can be positioned relative to an IDC and be secured by moving the actuator from its first into its second position. Thereafter, the actuator is automatically moved back into its first position by the resilient element, and is ready for securing a next wire to a corresponding IDC, while the previously secured wire remains secured to its IDC. The next wire may then be positioned individually relative to an IDC and be secured by moving the actuator again into its second position. The resilient element moving the actuator back into its first position prepares the actuator for securing of a further wire to an IDC. Because no separate action is required to move the actuator back into the first position, the installation process is less time consuming, particularly when many wires are to be secured to IDCs.

[0013] The present invention also provides a connector as described above, wherein the actuator is permanently attached to the connector. The actuator may thereby always be available to be operated, when a wire needs to be secured to an IDC. Installation time may be reduced if the installer does not need to identify the type of connector that he is presently working on and get a suitable actuator for it.

[0014] The present invention also provides a connector as described above, wherein the actuator is pivotably mounted. A pivotable mounting of the actuator may allow for a simple operation of the actuator and for a rugged mechanical layout of the connector, yet providing adequate guidance of the actuator when the actuator is moved with respect to an IDC.

[0015] The present invention also provides a connector with a pivotable actuator as described above, wherein a pivot axis of the actuator is oriented perpendicularly to a direction defined by a long extension of a receiving slot of one of the IDCs. This orientation may allow for a wire

being pushed into the receiving slot of one of the IDCs from the direction into which the receiving slot of that IDC opens, resulting in a simple mechanical layout of the connector and the actuator.

[0016] The present invention also provides a connector with a pivotable actuator as described above, wherein a pivot axis is oriented perpendicularly to the direction defined by a long extension of the receiving slot of one of the IDCs, and wherein the pivot axis is further oriented parallel to the plane defined by edges of the receiving slot of the one of the IDCs. This orientation may allow for little space being required for the pivoting movement of the actuator, if the connector comprises a row of IDCs, mounted parallel to each other, i.e. with the planes defined by the edges of their respective receiving slots being parallel to each other.

[0017] The present invention also provides a connector as described above, wherein the actuator can be manually moved from the first position to the second position. Manual actuation may save time in installation of the connector and may make installation easy, because no tools may have to be brought in place to move the actuator.

[0018] The present invention further provides a connector comprising a resilient element, wherein the resilient element is firmly attached to the actuator. The firm attachment may help to provide guidance for the moving parts of the resilient element. It may also avoid loss of the resilient element when the actuator might be subject to irregular, unforeseen mechanical forces, e.g. when a wire got positioned inadvertently between resilient element and actuator, in which case the resilient element might remove itself from the connector, if it were not firmly to the actuator.

[0019] The present invention also provides a connector comprising a resilient element, wherein the resilient element is in slideable contact with the actuator. This arrangement may allow for a simpler mechanical design of the connector, because it may allow for differential movement between the resilient element and the actuator. Such differential movement may occur, for example, when the pivot axis of the actuator is not collinear with the pivot axis of the part of the resilient element, with which the resilient element touches the actuator.

[0020] In another aspect, the present invention provides a connector comprising a resilient element, wherein the resilient element and the actuator are one piece. In such an embodiment of the invention, the connector may require less parts to be assembled in manufacturing the connector. The resilient element and the actuator being one piece may increase the reliability of the connector, because in manufacturing the connector, there is no separate or additional mechanical connection between the two parts required, that might fail later.

[0021] The present invention also provides a connector comprising a resilient element, wherein the resilient element comprises a polymeric material. The resilient element may, for example, comprise polyethylene, polypropylene, or polyoxymethylene. Polymeric material lends itself to many current production processes of resilient articles. It may make manufacturing of the resilient element and of the connector as a whole less costly. Many polymeric materials are electrically non-conductive, and their use may make other measures to provide electrical insulation obsolete, thereby saving manufacturing cost.

[0022] The present invention also provides a connector comprising a resilient element, wherein the resilient element comprises metal. Metal may provide for a rugged and long-lasting resilient element. A resilient element comprising conductive metal may enhance the electromagnetic shielding of a shielded connector. The resilient element may, for example, be made of phosphor bronze or aluminium.

[0023] In yet another aspect, the present invention provides a connector, wherein the connector comprises a wire retention element for securing a wire relative to the connector in a direction along the wire. The wire retention element may act as a stress relief and may avoid forces like, for example, a pull force in a direction along the wire or a bending force which might tend to remove the wire from its IDC, being transmitted to an IDC. Such forces could result in a wire being pulled out of an IDC. A wire retention element may also help in limiting the directions from which pull forces could be exerted through the wire upon the IDC, so that only pull directions may be possible that are substantially perpendicular to the plane defined by the edges of the wire-receiving slot of the IDC. A wire retention element may thereby increase the reliability of the connection between the IDC and the wire secured to it. The wire retention element may, for example, comprise two edges, which frictionally engage between them the outer sheath of a wire. Alternatively, the wire retention element may, for example, comprise a clamp, which frictionally engages with the outer sheath of a wire and prevents it from slipping. The wire retention element may also, for example, comprise a cable tie or a wire strap.

[0024] In a further aspect, the present invention provides a connector, wherein the connector comprises a housing, mounted such that the IDCs are on all sides surrounded by the housing. A housing may provide mechanical protection to the elements of the connector, it may also contribute to the mechanical stability of the connector. If the housing is made of a electrically insulating material, it may also provide protection against accidental electrical contact between the IDCs and other electrical elements inside the housing and other electrical components in the vicinity of the connector.

[0025] The present invention also provides a connector comprising a housing, wherein the housing is mounted such that the IDCs are on all sides surrounded by the housing or the actuator. This design may allow to make the connector smaller and less costly to manufacture.

[0026] The present invention further provides a connector, wherein the connector further comprises locking means operable to secure the actuator in the second position. The locking means may prevent any further

movement of the actuator, for example a movement into the first position. Preventing further movement of elements of the connector is often desirable because moving parts might stick out of the connector and, during installation of a network system, get caught by cables, wires or other connectors in the vicinity of the connector. In embodiments, where the actuator, in its second position, prevents a wire from slipping out of the gap between two cable retention devices, the locking means contributes to holding the wire between the cable retention devices. Once a connector is locked by the locking means, this locked state may also be used as a signal of one installer to a second installer that the connector is finally connected and does not require connection of another wire. The locking means facilitates a quick and reliable installation of systems having a connector according to the present invention.

[0027] The locking means may comprise one or more arms that are attached, at one end, to the actuator, and at their respective other end, are provided with means to attach this other end to another part of the connector. The locking means may comprise one or more latches that can be brought into engagement with suitably shaped corresponding catches. The locking means may comprise one or more loops attached to the actuator that can be engaged with corresponding hooks on some other part of the connector.

Short description of the Figures

[0028] The invention will now be described in more detail with reference to the following Figures exemplifying particular embodiments of the invention.

Figure 1: Perspective view of a first embodiment of a connector according to the present invention, before securing of a wire;
Figure 2: Perspective view of the connector of Figure 1, with the actuator removed;
Figure 3: Perspective view of the actuator of the connector shown in Figure 1;
Figure 4: Perspective view of the connector of Figure 1, after securing a wire, unlocked;
Figure 5: Perspective view of the connector of Figure 1, after securing a wire, locked;
Figure 6a: Perspective view of the connector of Figure 1, with outer walls removed, in the second position, showing a resilient element;
Figure 6b: Perspective view of the connector of Figure 6a, in the first position;
Figure 7: Perspective view of a second embodiment of a connector according to the invention, comprising a different resilient element; and
Figure 8: Perspective view of a third embodiment of a connector according to the invention.

Detailed description of embodiments

[0029] Herein below various embodiments of the present invention are described and shown in the drawings wherein like elements are provided with the same reference numbers. **Figure 1** is a perspective view of one embodiment of a connector 1 according to an aspect of the present invention. It has a housing 10 and an actuator 20, which is pivotally mounted on the housing 10. The actuator 20 is in its first position, which is an "open" position, in which a wire 50 can be inserted into the housing 10 and positioned there.

[0030] The housing 10 supports four IDCs 30 in a staggered arrangement. The IDCs 30 are of a known design. Each IDC 30 comprises two resilient blades forming, between them, two parallel edges. The edges form, between them, a longitudinal receiving slot which is open at one end. A wire 50 can be inserted into the receiving slot of the IDC 30 at the open end, whereby the wire 50 is secured between the edges of the IDC 30. In the Figure, the parallel edges and the long extension of the receiving slots of all IDCs 30 are oriented vertically, i.e. parallel to the long extension of the wire retention elements 40.

[0031] The housing 10 also supports, at a front side of the connector 1, five arrow-shaped wire retention elements 40, arranged next to each other in a row. The respective distal portions 42 of the wire retention elements 40 are tapered such as to facilitate introduction of a wire 50 between two of them. The wire retention elements 40 are laterally sized and spaced such as to accommodate, in the space between two of them, a wire 50 of a certain diameter, by way of friction between their lateral faces and the surface of the wire 50.

[0032] The front side of connector 1 is the side that faces in the direction from which wires 50 can enter the connector 1. The top side of connector 1 is the side facing in the same direction as the direction towards which the receiving slots in the IDCs 30 are open to receive wires. The lateral faces of the middle and bottom portions 44 of wire retention elements 40 are bevelled in order to hold a wire 50 between two wire retention elements 40 and secure it against displacement in longitudinal direction and in lateral direction. The wire retention elements 40 are aligned in a lateral direction with respect to the IDCs 30 such that the space between two adjacent wire retention elements 40 is located opposite to the wire-receiving slot of an IDC 30.

[0033] A resilient element 55 is positioned in the housing 10 of the connector 1, next to a side wall 15 of the housing 10, and is slideably engaged with the actuator 20. It holds the actuator 20 in the first position relative to the IDCs 30. A second, identical resilient element 55, located on the other side of the housing 10, is not visible in this Figure.

[0034] The housing 10 supports separating walls 60 (shown more clearly in Figure 2) which prevent the ends of wires 50 to touch each other in the connector 1 and create short-circuits. The separating walls 60 are aligned

in a lateral direction with respect to the IDCs 30 in that the space between two adjacent separating walls 60 is located opposite to the position of the slot of an IDC 30.

[0035] The lateral alignment of wire retention elements 40, IDCs 30, and separating walls 60 is such that a wire 50 can run in an essentially straight path from the space between two adjacent wire retention elements 40 to an IDC 30 and further into the space between separating walls 60. This lateral alignment facilitates positioning of a wire 50 for securing to an IDC 30 by the actuator 20.

[0036] The actuator 20 has a front wall 70, which comprises four semi-circular recesses 80 for pushing respective wires 50 from the top into the space between the wire retention elements 40, and secure them there, when the actuator 20 is moved into the second position.

[0037] The actuator 20 has locking means 90 that secure the actuator 20 in the second position. In this embodiment, the locking means comprise two resilient latch arms 90 extending parallel to its front wall 70 at the right and left sides of the front wall 70, each of which is provided with an opening 100. When the actuator 20 is in its second position (shown in Figure 4), the openings 100 can be brought into engagement with corresponding hooks 110 mounted at the bottom of the front wall of the housing 10. The openings 100 of latch arms 90 do not engage automatically with hooks 110 when the actuator 20 is brought into its second position. They require a separate manual action in order to become engaged. They can only engage when the actuator 20 is in its second position.

[0038] In the first position of the actuator 20 shown in this Figure, the connector 1 is open. A wire 50 can be positioned over the slot of an IDC 30, over the space between two adjacent wire retention elements 40 and over the space between two adjacent separating walls 60. Pressing the actuator 20 down towards the IDCs 30 brings the actuator 20 into its second position, whereby the wire 50 is pressed into the receiving slot of the IDC 30 and thereby secured to the IDC 30. Figure 4 shows the connector 1 with the actuator 20 in its second position.

[0039] **Figure 2** is a perspective view of the connector 1 of Figure 1, with the actuator 20 removed. Both resilient elements 55 are visible. They are shown and described in more detail in connection with Figures 6a and 6b. Two laterally-extending hinge openings 120, through which the actuator 20 is pivotally mounted to the housing 10, are integrally formed with the housing 10, they extend from a respective side wall 15 of the housing 10 in a direction perpendicular to the side walls 15 on a common axis.

[0040] The pivot axis of the actuator 20 is oriented perpendicularly to a direction defined by a long extension of a receiving slot of one of the IDCs 30. In other words, while the receiving slots of the IDCs 30 are oriented vertically in this Figure, the pivot axis is in a horizontal plane. More specifically, the pivot axis is oriented parallel to a plane defined by edges of the receiving slots of the IDCs 30. In other words, the pivot axis, in this Figure, is oriented parallel to the front side of the connector 1.

[0041] **Figure 3** is a perspective view of the actuator 20 of the connector 1 of Figure 1, showing in more detail the bottom side. Four wire huggers 140 extend longitudinally from a front wall 70 comprising the semi-circular recesses 80 towards the rear side of the actuator 20. The wire huggers 140 are positioned such that an end of each of them is located opposite to one of the semi-circular recesses 80. On the rear side of the actuator, two hinge protrusions 130 are arranged. The hinge protrusions 130 engage with the hinge openings 120 in the housing 10 such that the actuator 20 can be pivoted about a pivot axis defined by the hinge openings 120.

[0042] The space 160 between the front wall 70 and the front end portions of the wire huggers 140 is to accommodate the distal portions 42 of the wire retention elements 40, when the actuator 20 is in the second position.

[0043] Each wire hugger 140 has a concave profile in order to accommodate a wire 50 and to keep it in a laterally fixed position, once the actuator 20 is in its second position. The space between adjacent wire huggers 140 is sized such as to accommodate a part of a separating wall 60 in the housing 10, when the actuator 20 is in its second position. In this second position, the separating walls 60 and the wire huggers 140 cooperate such as to essentially prevent lateral movement of wires 50 in the connector 1.

[0044] In the longitudinal direction, each wire hugger 140 is interrupted by a recess 150, which divides the wire hugger 140 into a front part and a rear part. The recess 150 is sized and positioned suitably to accommodate the upper part of an IDC 30, when the actuator 20 is in the second position.

[0045] When the actuator 20 is in the first position, and a wire 50 is to be connected to an IDC 30, an end portion of the wire 50 is loosely positioned over the receiving slot of an IDC 30 and over the corresponding space between two wire retention elements 40. When the actuator 20 is brought into the second position, a wire hugger 140 pushes the portions of the wire 50, that are adjacent to the recess 150, downwards towards the open end of the receiving slot of the IDC 30, such that the portion of the wire 50 below the recess 150 and above the receiving slot of the IDC 30 is urged from the top into the receiving slot of the IDC 30. At the same time, a semi-circular recess 80 in the front wall 70 of the actuator 20 pushes the wire 50 into the space between two wire retention elements 40.

[0046] The depth of the recess 150 is chosen such that the wire 50 can be pushed sufficiently deep into the receiving slot of the IDC 30 for securing it in the IDC 30. The dimension of the recess 150 in longitudinal direction of the wire hugger 140 is chosen as short as possible, but large enough to accommodate an IDC 30. The recess 150 should be short in order to prevent the wire 50 from bending when the wire 50 is pushed into the IDC 30.

[0047] The profile of the wire huggers 140 is a widely

open concave shape. This shape ensures that a wire hugger 140 can not transmit any force onto a wire 50 that might pull the wire 50 out of an IDC 30 to which it was secured, when the actuator 20 is brought back from the second position into the first position.

[0048] The actuator 20 further comprises two stops 170, located at the sides of the actuator 20 and protruding in a direction parallel to the latch arms 90. Their function is to prevent the actuator to open too far. The stops are resilient in a lateral direction. At their free ends they have noses 180 that abut respective protrusions 125 (shown in Figure 2) when the actuator 20 is in its first position, and that prevent the actuator 20 from pivoting further beyond its first position.

[0049] **Figure 4** is a perspective view of the connector according to an aspect of the present invention, with two wires 50 connected. Actuator 20 is in the second position, which is a closed position, in which the wires 50 are secured to respective IDCs 30, in which wire huggers 140 hold the wires 50 in the space between the separating walls 60, and in which the semi-circular recesses 80 of the actuator 20 hold the wires 50 between wire retention elements 40 (not visible in this Figure). The openings 100 in latch arms 90 have not been brought into engagement with latch hooks 110, the connector 1 is thus not locked and the actuator 20 can be moved by the resilient elements 55 (not shown) into the first position in order to be ready for securing a further wire 50 to an IDC 30, for example.

[0050] The resilient elements 55 can move the actuator 20 into the first position only when the actuator 20 is free to move. The resilient elements 55 are, for example, not strong enough to move the actuator 20 into the first position against the pressure of a finger or of a thumb. Also, the resilient elements 55 can not move the actuator 20 into the first position when the connector 1 is locked by the latch arms 90. The resilient elements 55 are, however, designed to be strong enough to move the actuator 20 into the first position against the force of the weight of the actuator 20 itself and against normal frictional forces that might exist between the actuator 20 and the housing 10.

[0051] In the embodiment shown in this Figure, the IDCs 30 are on five sides surrounded by the housing 10, while they are covered by the actuator 20 on the sixth, top side. Thereby, the IDCs 30 are on all sides surrounded by the housing 10 or the actuator 20.

[0052] **Figure 5** shows the connector 1 of Figures 1 and 4 in its locked state. Actuator 20 is in the second position. Both wires 50 are secured to a corresponding IDC 30. The openings 100 in latch arms 90 have been brought into engagement with latch hooks 110 by pushing the resilient latch arms 90 towards the front side of the housing 10 until their openings 100 engage with the latch hooks 110 on the housing 10. In this state, the connector 1 is thus locked and the actuator 20 can not any more be moved by the resilient elements 55 into the first position.

[0053] **Figures 6a and 6b** are perspective views of the connector 1 shown in Figure 1, in which, for clarity, some outer walls of the housing 10 have been removed. In this view, contacts 260 are visible, which are electrically connected to corresponding IDCs 30.

[0054] The connector 1 comprises two identical resilient elements 55, one on each side of the connector 1. One resilient element 55 is visible in this Figure. The resilient element 55 is essentially U-shaped and has two arms. It is arranged such that one of its arms is fixed to the housing 10, whereas the other arm can move with respect to the housing 10. This other arm slideably contacts a downward-facing surface of the actuator 20. The part of the resilient element 55 between the arms is located towards the back side of connector 1, and the open side of the "U" being located further towards the front side of connector 1.

[0055] Without any compression force present, the free ends of the arms of the resilient element 55 would be spaced apart by a certain distance. When the resilient element 55 is compressed, i.e. when its arms are pushed towards each other, they generate a force in the opposite direction, that would drive them away from each other. This force is due to the resilience of the resilient element 55.

[0056] **Figure 6a** shows connector 1 in the second position. The resilient elements 55 are compressed, their respective arms forming a tightly closed "U". The openings 100 in latch arms 90 have not been brought into engagement with latch hooks 110, the connector 1 is thus not locked. By trying to return into its uncompressed shape, the arms of the resilient elements 55 exert a force onto the housing 10 and the actuator 20 that drives them away from each other. This force pivots the actuator 20 about a pivot axis formed by the hinges 120 on the housing 10, thereby moving the actuator 20 from the second position into the first position relative to the IDCs 30, shown in Figure 6b. When the actuator 20 is moved from the second position back into the first position, any wires that had been secured to respective IDCs 30 when the actuator 20 had been moved from the first position to the second position, remain secured to those IDCs 30.

[0057] **Figure 6b** shows the connector 1 of Figure 6a, with the actuator 20 being in the first position, relative to the IDCs 30 and the housing 10. The resilient elements 55 are not compressed or less compressed than they are in Figure 6a, their respective arms forming an open "U". For each of the two resilient elements 55, the arm that contacts the actuator 20 holds the actuator 20 in the first position.

[0058] The resilient elements 55 are made and mounted such that the actuator 20 can be brought from the first position into the second position by finger pressure, such as when the connector 1 is held and pressed, for example, between thumb and index finger of one hand.

[0059] In this embodiment, the resilient elements 55 are made from metal, however, they might as well be made of resilient polymeric material or any other suitable

resilient **material.**

[0060] **Figure 7** is a perspective view of a different embodiment of the connector 1 according to an aspect of the present invention. The connector 1 comprises a resilient element 55, which is mounted above the actuator 20. The resilient element 55, in this embodiment, is a resilient plate 55 made of sheet metal. It is firmly attached to the housing 10 at a rear portion 260 of the resilient element 55. A front portion 270 of the resilient element 55 is attached to a top portion of the actuator 20. The resilient element 55 has no hinge at its rear portion 260, because its front portion 270 can be bent with respect to the rear portion 260, thereby allowing a pivoting movement of the actuator 20. Once bent downwards towards the bottom of the housing 10, the front portion 270 of the resilient element 55 will strive to return to its equilibrium position due to its resilience. It is mounted such that when it strives to return to its equilibrium position, it moves the actuator 20 into the first position. The actuator 20 shown in this Figure is in its first position.

[0061] The actuator 20 can be brought into its second position by manually pressing the front portion of the resilient element 55 towards the bottom of the housing 10, whereby also the actuator 20 is moved from its first position towards the bottom of the housing 10 into its second position. The elements on the lower surface of the actuator 20, which is shown in Figure 3, press a wire 50 into the slot of an IDC 30 and secure it to the IDC 30.

[0062] The resilient element 55 has two resilient latch arms 90 attached to it in its front portion 270. They extend downwards on the front face of the connector 1. Each latch arm 90 has, in one of its edges at its bottom end, a latch recess 280 for mechanical engagement with a corresponding latch hook 110 on the housing 10. However, the latch recesses 280 of latch arms 90 do not automatically engage with corresponding latch hooks 110 when the actuator 20 is brought into its second position. They require a separate manual action in order to become engaged. They can only become engaged when the actuator 20 is in its second position. In the locked state, the latch recesses 280 are engaged with latch hooks 110, and hold the latch arms 90 and the resilient element 55 in the locked state, so that the resilient element 55 can not return into the direction of its equilibrium position.

[0063] In this embodiment of the invention, the resilient element 55 is made from sheet metal and covers the upper side of the housing. The metal is conductive and can therefore contribute to electrical shielding of the connector 1. In other embodiments, both the housing 10 and the actuator 20 may be conductive or have conductive surfaces, so that more effective electrical shielding of the connector 1 can be achieved.

[0064] **Figure 8** shows, in a perspective view, a further embodiment of a connector 1 according to an aspect of the present invention. On its upper side, which is the side facing upwards in this Figure, the connector 1 comprises thirteen upper IDCs 30 in a staggered arrangement. On this upper side, twelve upper wire retention elements 40 are located in an upper front portion of the housing 10. On the lower side, which is facing downwards in this Figure, additional thirteen lower IDCs 30 and additional twelve lower wire retention elements 40 are located. The connector 1 comprises an upper actuator 20 and a lower actuator 20, located on the upper and the lower side of the connector 1, respectively, and arranged symmetrically about a central plane of the connector 1, The actuators 20 are permanently attached to the connector 1 and are pivotably mounted. Their pivot axes are indicated in the Figure by two solid-dotted lines. Both pivot axes are oriented perpendicularly to the direction defined by the long extension of the receiving slots of the upper IDCs 30, and oriented parallel to a plane defined by the edges of the receiving slots of any of the upper IDCs 30.

[0065] The upper actuator 20 can be pivoted relative to the upper IDCs 30. The Figure shows the actuator 20 in the first position. In this first, "open" position, the front wall 70 of the upper actuator 20 is located further away from the distal portions 42 of the upper wire retention elements 40 than in the second, "closed" position. In this first position, a wire can be inserted into the upper part of the connector 1 as described above. The upper actuator 20 can be moved into the second position by manually pushing the front portion of the upper actuator 20 downwards towards the distal portions 42 of the upper wire retention elements 40, thereby securing one or more inserted wires to respective corresponding upper IDCs 30.

[0066] The lower actuator 20, located on the lower side of the connector 1 is similar to the upper actuator 20 described above, and can also be pivoted relative to the lower IDCs 30. It is shown in its second, "closed" position. In its first, "open" position, the front wall 70 of the lower actuator 20 is located further away from the distal portions 42 of the lower wire retention elements 40 on the lower side of the connector than in the second, "closed" position. In this first position, a wire can be inserted into the lower part of the connector 1 as described above. The lower actuator 20 can be pivoted from the first, "open" position into the second position by manually pushing the front portion of the lower actuator 20 upwards towards the distal portions 42 of the lower wire retention elements 40 of the lower side, thereby securing one or more inserted wires to respective corresponding lower IDCs 30.

[0067] Two resilient elements 55, one of which is visible in this Figure, can move the upper actuator 20 from the second position into the first position. The resilient elements 55 are mounted in the upper part of the housing 10, close to its side walls 15. They are in slideable contact with the upper actuator 20 in a portion of the upper actuator 20 located adjacent to the stops 170. Two further resilient elements 55 in the lower part of the connector 1, which are not visible in this Figure, can move the lower actuator 20 from the second position into the first position. They are mounted in corresponding positions in the lower part of the housing 10, close to its side walls 15. They are in slideable contact with the lower actuator 20 in a

portion of the lower actuator 20 located adjacent to the stops 170 of the lower actuator 20.

List of reference numerals

[0068]

1	Connector
10	Housing
20	Actuator
30	IDC (Insulation Displacement Contact)
40	Wire retention element
42	Distal portion of wire retention element
44	Middle and bottom portion of wire retention element
50	Wire
55	Resilient element
60	Separating wall
70	Front wall of actuator
80	Semi-circular recess
90	Latch arm
100	Opening in latch arm
110	Latch hook
120	Hinge opening
125	Protrusion
130	Hinge protrusion on actuator
140	Wire hugger
150	Recess in wire hugger
160	Space between wire huggers and front wall
170	Stop
180	Nose
260	Rear portion of resilient element
270	Front portion of resilient element

Claims

1. A connector comprising

- two or more IDCs (30),
- an actuator (20) for securing wires (50) to IDCs (30), and
- a resilient element (55),

the actuator (20) being positioned such that it can be moved from a first position to a second position relative to an IDC (30), thereby securing a wire (50) to the IDC (30), and
the actuator (20) and the resilient element (55) being positioned such that the resilient element (55) can move the actuator (20) from the second position to the first position, with the wire (50) remaining secured to the IDC (30).

2. Connector according to claim 1, wherein the actuator (20) is permanently attached to the connector (1).

3. Connector according to claims 1 or 2, wherein the actuator (20) is pivotably mounted.

4. Connector according to claim 3, wherein a pivot axis of the actuator (20) is oriented perpendicularly to a direction defined by a long extension of a receiving slot of one of the IDCs (30).

5. Connector according to claim 4, wherein the pivot axis is oriented parallel to a plane defined by edges of the receiving slot of the one of the IDCs (30).

6. Connector according to any of the previous claims, wherein the actuator (20) can be manually moved from the first position to the second position.

7. Connector according to any of the previous claims, wherein the resilient element (55) is firmly attached to the actuator (20).

8. Connector according to any of claims 1 to 6, wherein the resilient element (55) is in slideable contact with the actuator (20).

9. Connector according to any of claims 1 to 6, wherein the resilient element (55) and the actuator (20) are one piece.

10. Connector according to any of the previous claims, wherein the resilient element (55) comprises a polymeric material.

11. Connector according to any of the previous claims, wherein the resilient element (55) comprises metal.

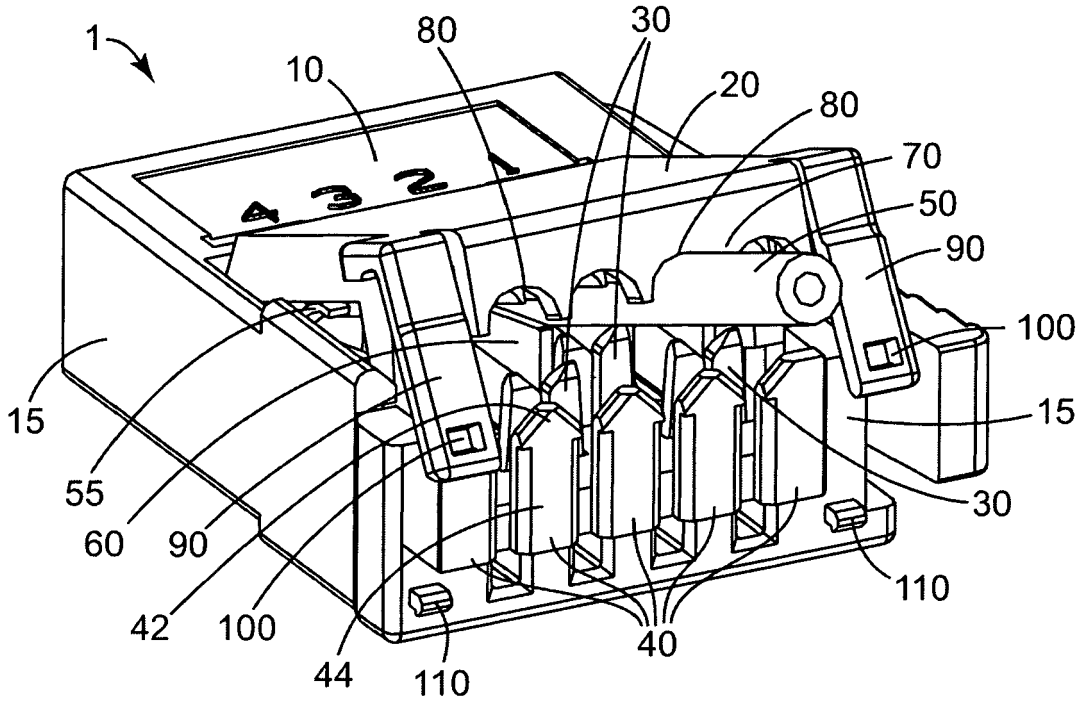
12. Connector according to any of the previous claims,

wherein the connector (1) comprises a wire retention element (40) for securing a wire (50) relative to the connector (1) in a direction along the wire (50).

13. Connector according to any of the previous claims, wherein the connector (1) comprises a housing (10), mounted such that the IDCs (30) are on all sides surrounded by the housing (10).

14. Connector according to any one of claims 1 to 12, wherein the connector (1) comprises a housing (10), mounted such that the IDCs (30) are on all sides surrounded by the housing (10) or the actuator (20).

15. Connector according to any one of the previous claims, wherein the connector (1) comprises locking means (90) operable to secure the actuator (20) to the housing (10) in the second position.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4 3 2 1

FIG. 1

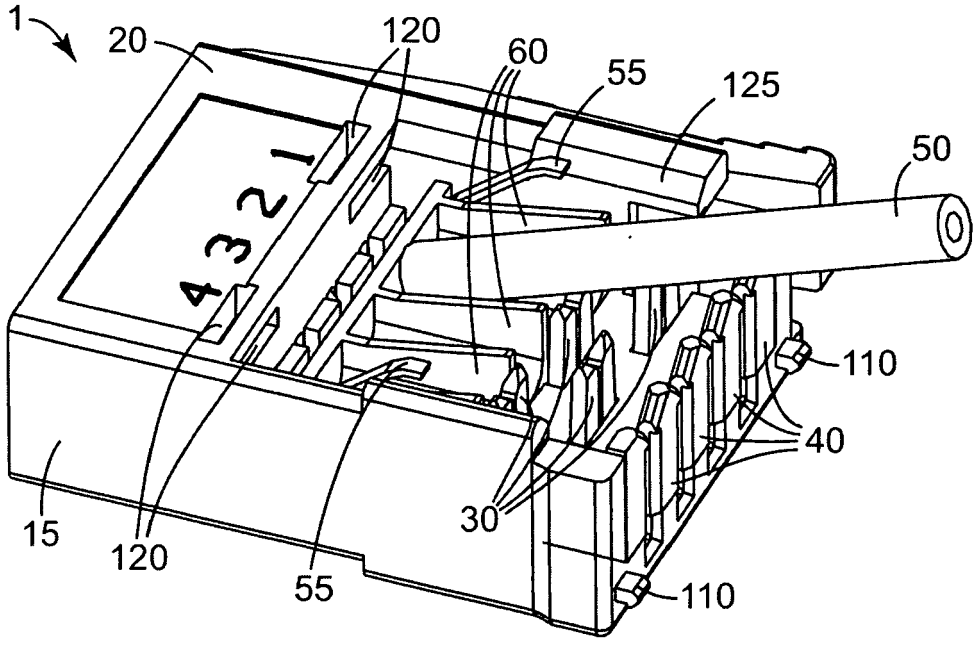
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FIG. 2

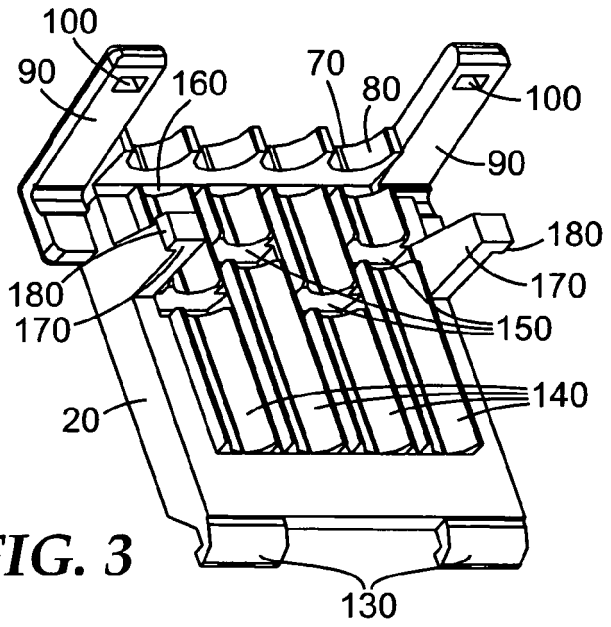
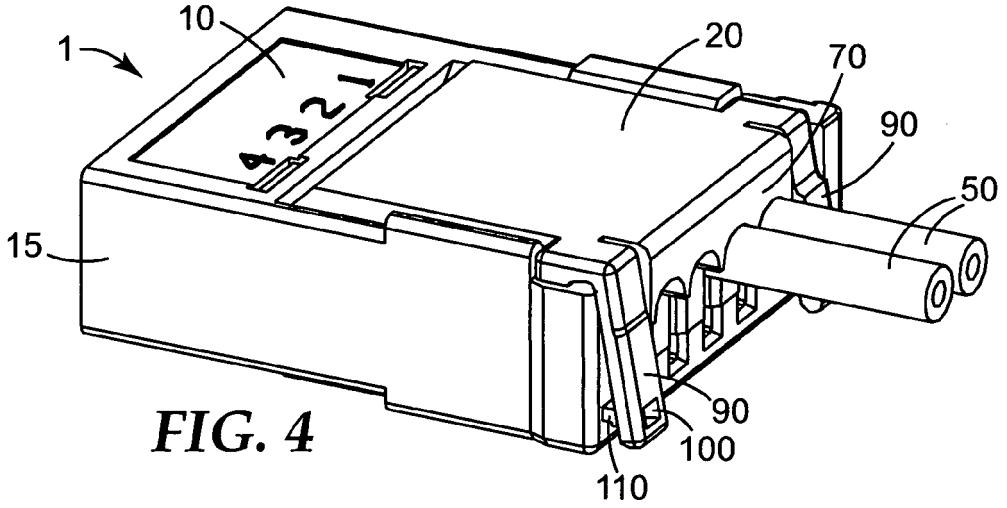


FIG. 3



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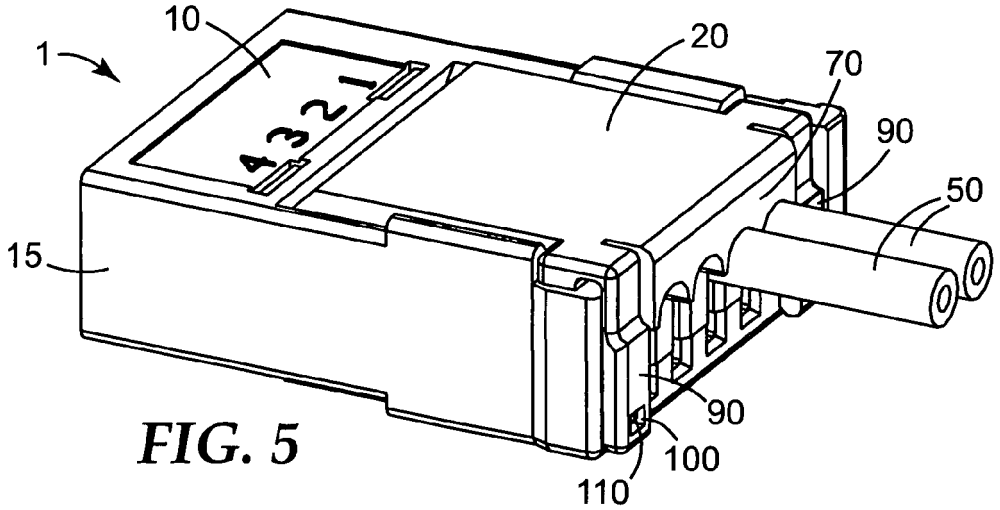
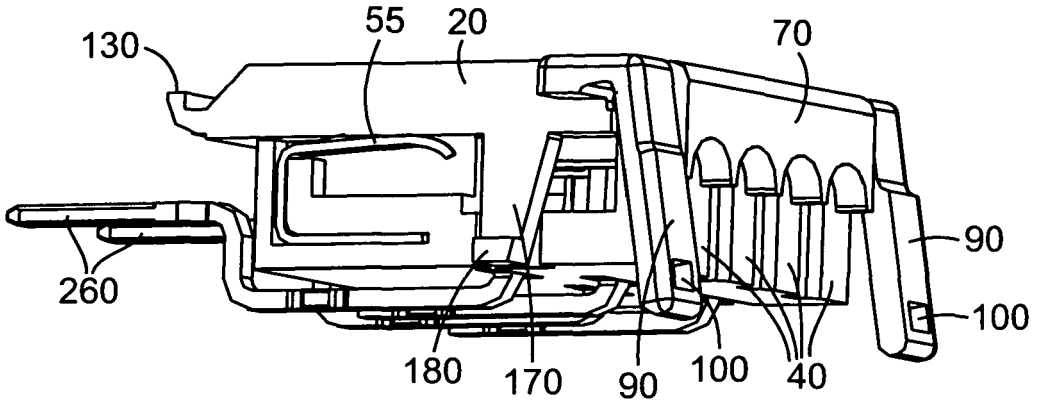


FIG. 5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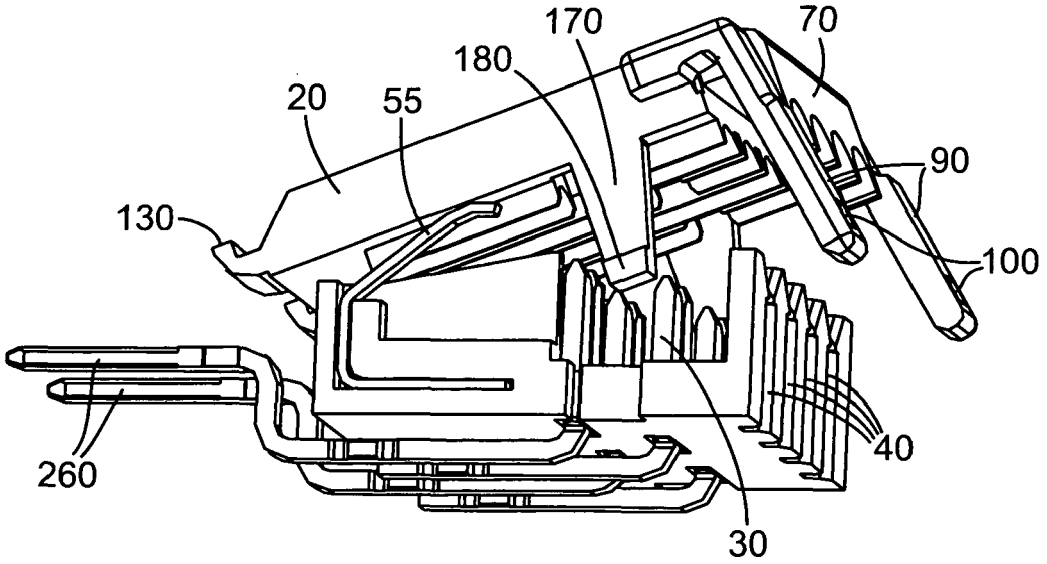
40

FIG. 6a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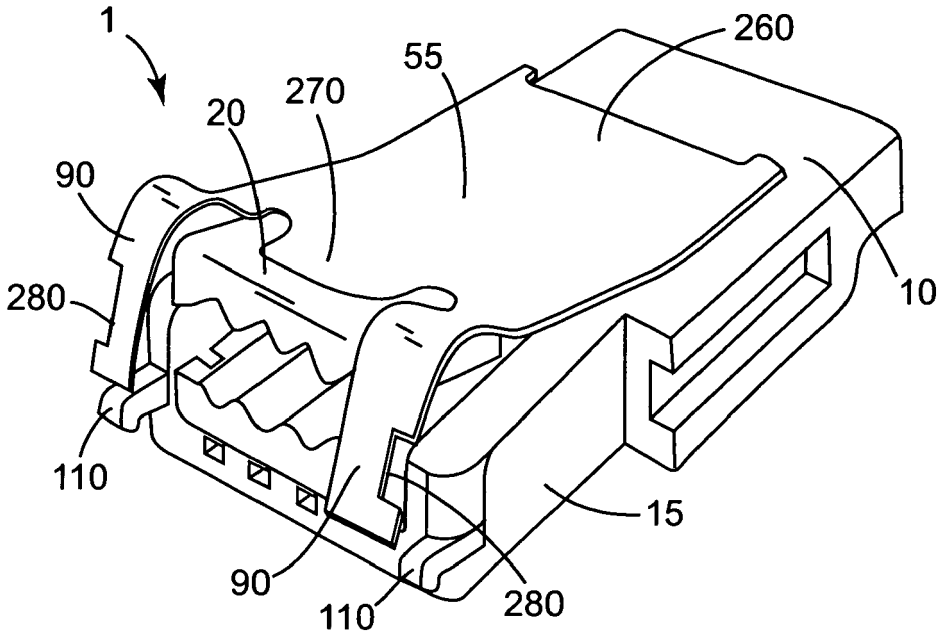
260
30

FIG. 6b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110
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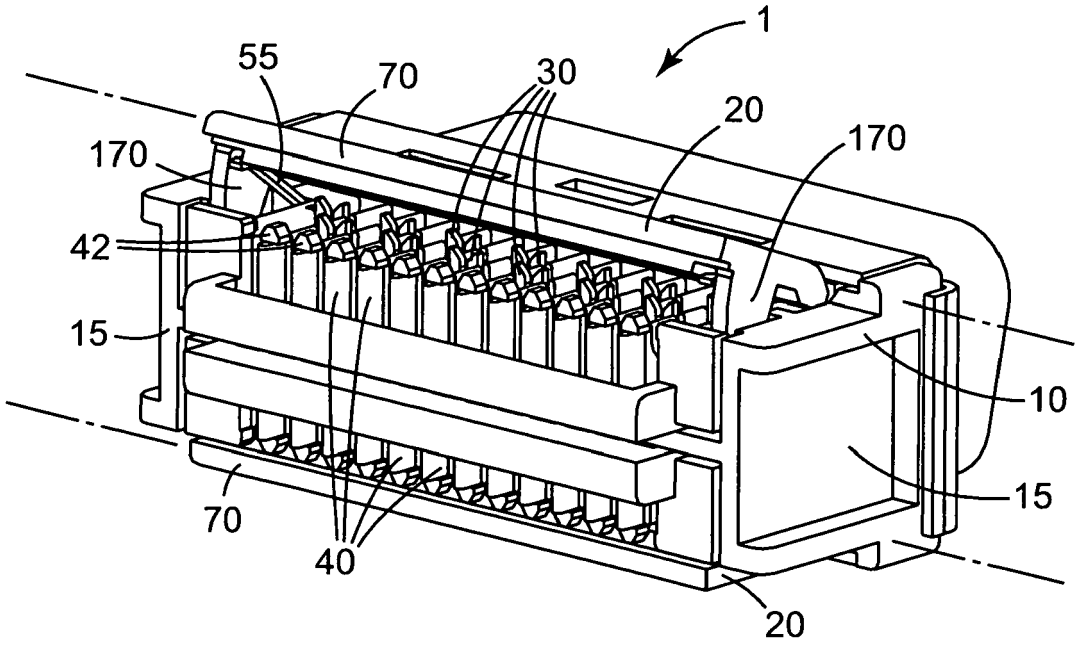
90
110
280

FIG. 7


1
55
70
30
20
170
170
42
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10
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70
40
20

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 10 16 9488

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 197 00 600 A1 (PSI PRODUCTS GMBH [DE]) 16 July 1998 (1998-07-16) * figures 1-4,8-10 *	1-15	INV. H01R4/24
A	US 2007/004273 A1 (PRATT JEROME A [US]) 4 January 2007 (2007-01-04) * claim 19; figure 1 *	1-15	
A	US 6 319 046 B1 (FEYE-HOHMANN JUERGEN [DE] ET AL) 20 November 2001 (2001-11-20) * figures 8-9 *	1-15	

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H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 October 2010	Vautrin, Florent

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1

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13-10-2010

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