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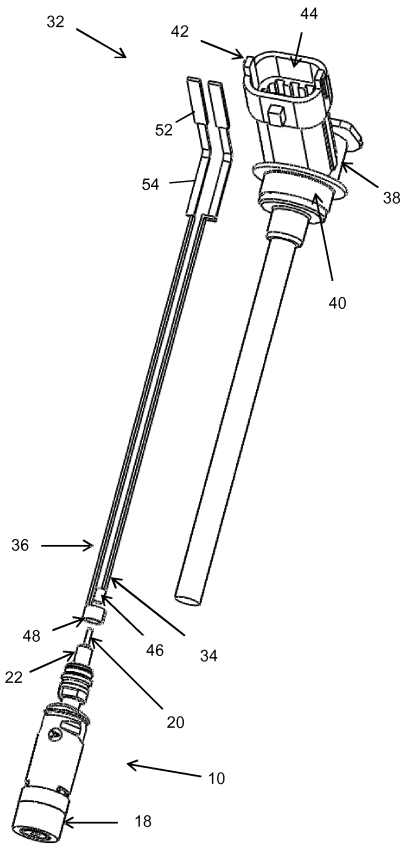
(54) **Electrical connector**

(57) An electrical connector (32) for an injector assembly (10) preferably of the type having a solenoid (18). The electrical connector (32) comprises first and second conductive elements (34, 36), means for receiving a first connection means to the solenoid (18), and a nonconductive overmould (38) which houses the first and second conductive elements and which defines an opening (44) for receiving a second connection means to a power source so as to enable electrical connection of the solenoid (18) to the power source.

FIGURE 2



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Description

Field of the Invention

[0001] The invention relates to an electrical connector for an injector. In particular, but not exclusively, the invention relates to an electrical connector for delivering power to an actuator assembly within a fuel injector, and particularly to a solenoid actuator assembly in a fuel injector for use in an internal combustion engine.

Background to the Invention

[0002] It is common for modern fuel injectors to include a solenoid as a means of opening and closing valves during the operation of the injector. In order for the solenoid to operate, electrical power must be supplied to it. This is challenging, as the solenoid may be situated deep within the injector. Also, at the top of the injector there are generally considerable height restrictions imposed by surrounding components of the engine environment, in terms of the space within which the electrical connection needs to fit. An additional challenge which the electrical connection must overcome is that it will need to be able to withstand a range of forces and vibrations that it will be subjected to when the engine is operating in order to maintain the electrical connection at all times.

[0003] The current solution to these challenges is to provide a pair of elongate metal conductor elements, or blades, which extend into the injector bore to connect to the solenoid. At the end where the blades meet the solenoid connection point, welds are created in order to ensure the connection remains sound when it is subjected to the vibrations and other forces that are inherent to the running of the engine. A plastic overmould is provided to encase the blades to insulate them electrically from the injector. At the top of the injector, the blades and the plastic overmould protrude from the top of the injector bore, with the top part of the blades left exposed. A connector can then be brought into contact with the blades in order to deliver electrical power. This connection is arranged to be perpendicular to the blade, so as to account for the height restriction.

[0004] The main problem with this solution is that, due to the proprietary nature of the blade to which a connection must be made, a bespoke connector is required to make the connection, which is expensive.

[0005] A second problem with this solution is that the process of creating the welds at the contact points is also expensive.

[0006] It is one object of the present invention to overcome, or at least mitigate, some of the shortcomings of the prior art.

Summary of the Invention

[0007] According to a first aspect of the invention, there is provided an electrical connector for an injector assembly having an actuator. The electrical connector comprises first and second conductive elements, means for receiving a first connection means to the actuator, and a non-conductive overmould housing the first and second conductive elements. The non-conductive overmould defines an opening for receiving a second connection means for connection to a power source so as to enable electrical connection of the actuator to the power source.

[0008] The invention provides the technical benefit that the opening which is defined by the non-conductive overmould may be arranged to receive a standard electrical connector, which negates any requirement for a bespoke connector in order to connect the electrical connector to the power source. Furthermore, the provision of a single, integrated overmould allows for a reduction in the space required for the connectors, which is beneficial in an engine environment where space is limited.

[0009] The electrical connector is of particular benefit when employed in an injector assembly having a solenoid actuator including a solenoid, but it may equally be used in an injector provided with a piezoelectric actuator to connect the piezoelectric actuator to a power source.

[0010] The opening may be arranged to receive a second connection means in the form of first and second terminals of a standard electrical connector for the power source. This is beneficial because there is no need to provide a bespoke connector, which significantly reduces the cost of using the invention.

[0011] The connection means may comprise first and second connection pins forming part of an actuator assembly. Each of the conductive elements may comprise a connecting portion at or towards an end thereof, such that the first and second conductive elements are arranged to connect to the first and second connection pins. This allows the electrical connector to make a reliable and robust electrical connection to a solenoid of a standard type which is arranged with connection pins.

[0012] It is preferable for the connecting portions to take the form of connecting rings, each of which receives a respective one of the connection pins of the actuator assembly.

[0013] The non-conductive overmould may be provided with means for aligning the electrical connector within the injector assembly. This allows for easy installation of the electrical connector, and prevents the conductive elements from becoming damaged by inserting the connector when not correctly aligned. It also ensures that the electrical connection is made correctly, with the connecting rings fitted over the first and second pins, and not merely touching them.

[0014] The first and second conductive elements may be arranged such that the connecting rings are concentric with each other. This allows the electrical connector to be inserted in any orientation relative to the injector assembly and ensures that a good electrical connection is always achieved. It also allows the electrical connector to be arranged in a position which is most convenient in terms of the surrounding components. For example, the

connector may be positioned such that the opening is facing the power source, such that the distance between them is minimised. This means a shorter cable or wiring may be used to connect the two together.

[0015] The non-conductive overmould may be arranged to extend beyond the connecting portions of the conductive elements to define a further opening or cavity for receiving the first connection means. This feature provides the benefit that the conductive elements are completely shielded from surrounding components during installation and when in use.

[0016] In another embodiment of the invention, an end face of each conductive element is arranged to abut with a contact surface of the solenoid. This arrangement advantageously allows the electrical connector to be used with an actuator assembly of a standard type which includes contact surfaces rather than connection pins.

[0017] In one embodiment, at least one of the conductive elements may comprise an elastically compressible section which is arranged to allow axial compression of the conductive element. This allows for the electrical connector to be used with, for example, injector solenoid assemblies of differing sizes, where the depth of the first connection means within the injector assembly is variable. Equally, this allows for manufacturing tolerances, which may also affect the depth of the first connection means within the injector assembly. Furthermore, an axial biasing effect is provided, which ensures that an electrical connection is maintained when the injector assembly is in operation.

[0018] For example, a covering section of the non-conductive overmould which covers the elastically compressible section of the conductive element is relatively thin compared with the remainder of the covering section, thereby to increase the flexibility of the covering section. This allows the non-conductive overmould to extend and compress in the same way as the conductive elements which they cover.

[0019] In one embodiment, each of the conductive elements is individually covered with a layer of electrically insulating material, which ensures that an electrical short circuit is not formed.

[0020] The electrical connector may comprise an intermediate electrical connector which connects directly to the actuator, in use, and wherein the first and second conductive elements are arranged to connect to the intermediate electrical connector. This feature enables the electrical connector to be used with a range of injector assemblies, by simply choosing an intermediate connector which is appropriate for the type of first connection means that the actuator is arranged with.

[0021] The intermediate electrical connector may be electrically connected to the first and second conductive elements using wires, which gives the invention the ability to be used with injector assemblies of differing sizes, as the wires can be arranged to accommodate gaps of differing lengths between the conductive elements and the first connection means.

[0022] In one embodiment, each of the first and second conductive elements is formed with an upper portion and a lower portion, such that the upper portion extends substantially perpendicularly away from the lower portion. This means that the opening may be substantially perpendicular to a longitudinal axis of the actuator assembly, which means that the second connection means connects to the electrical connector from the side, rather than from above. This reduces the height of the overall injector assembly, which is a further benefit in view of the restricted space in the engine environment.

[0023] In other embodiments, the opening need not be perpendicular to the longitudinal axis of the actuator assembly and may make an alternative angle to the axis of the actuator assembly. According to a second aspect of the invention, there is provided a fuel injector comprising an injector actuator assembly and an electrical connector according to the first aspect of the invention, the fuel injector defining an injector bore within which the injector actuator assembly is received.

[0024] In one example, the non-conductive overmould is provided with a bush which is arranged to be a push fit into the injector bore for the retention of the electrical connector in the injector bore. The feature helps to ensure the electrical connector remains in position when the engine to which the injector assembly is a part is operating. This ensures that an electrical connection is maintained, and that damage is not caused to the electrical connector, or the surrounding components, by the electrical connector moving out of position.

[0025] In another aspect, an electrical connector assembly for providing power to an actuator assembly of a fuel injector includes first and second conductive elements, means for receiving a first connection means to the actuator, and a non-conductive overmould housing the first and second conductive elements. The non-conductive overmould defines an opening for receiving a second connection means of the electrical connector assembly so as to enable electrical connection of the actuator to the power source.

[0026] It will be appreciated that preferred and/or optional features of the first aspect of the invention may be incorporated alone or in appropriate combination in the other aspects of the invention also.

Brief Description of the Drawings

[0027] In order that the invention may be more readily understood, preferred non-limiting embodiments thereof will now be described with reference to the accompanying drawings, in which like reference numerals are used for like features, and in which:

Figure 1 is a schematic drawing of a part of an injector including a solenoid of the type with which the present invention may be used, showing the solenoid including connectors in the form of concentric pins;

Figure 2 is a first embodiment of an electrical connector of the invention, arranged with concentric ring connectors to connect to the solenoid in Figure 1;

Figure 3 is a variation of the embodiment in Figure 2, in which the connection blades of the connector are shorter than in Figure 2, for connection to a solenoid which is housed in a shorter injector bore;

Figure 4 is a second embodiment of the invention, in which the connection blades of the connector are parallel to each other, to connect to a solenoid with two parallel connection pins;

Figure 5 is a third embodiment of the invention, in which each of the connection blades has a flexible section, to bias the connection blade into contact with the solenoid connector;

Figure 6 is a view of a fuel injector assembly to which the electrical connector in Figure 5 has been fitted;

Figure 7 is an exploded view of the fuel injector assembly in Figure 6;

Figure 8 is a fourth embodiment of the invention, in which each of the connection blades includes a helical portion in place of the flexible section in Figure 5; and

Figure 9 is a fifth embodiment of the invention, in which the connection blades are in connection with an intermediate connector which makes the connection to the solenoid.

Detailed Description of Embodiments of the Invention

[0028] With reference to Figure 1, there is shown an injector solenoid assembly 10 for a fuel injector (only a part 12 of which is shown) which has a nozzle holder body (NHB) 14 defining an injector bore 16, within which a solenoid 18 of an injector actuator assembly is housed. The solenoid 18 is fitted to an electrical connector of the invention (not shown in Figure 1). The solenoid 18 extends along a longitudinal axis and is generally cylindrical in form, including a first connection pin 20 and a second connection pin 22. The connection pins 20, 22 extend outwardly from an end of the solenoid 18 and are generally cylindrical and of circular cross section. The first and second connection pins together form a first connection means to the solenoid 18. The second connection pin 22 is arranged to form an annulus around the first connection pin 20, with a ring of insulating material 24 separating the two. The first connection pin 20 may extend further outwards than the second connection pin 22, as in Figure 1, in order to ease connection to the pins. On assembly, connection to the first pin 20 may be made first, rather than connection to both pins 20, 22 simultaneously being required. This arrangement helps to further isolate the connection pins 20, 22 from each other, in order to prevent an electrical short circuit from being formed. The connection pins 20, 22 are each provided with a chamfer, in order to ease fitment of the electrical connector. The first and second connection pins 20, 22 each have a wire 26, 28 attached to them, with the wires 26, 28 connecting the respective connection pins 20, 22 to either end of a solenoid winding 30 of the solenoid 18, to complete an electric circuit.

[0029] Referring now to Figures 2 and 3, a first embodiment of an internal electrical connector 32 is arranged to connect to the solenoid 18 in Figure 1, and includes first and second conductive elements in the form of first and second connection blades 34, 36, and a plastic housing 38 which is overmoulded to encase or house the first and second connection blades 34, 36. The main body of the plastic housing 38 may be generally cylindrical, and is arranged to be of complementary shape to the injector bore 16, such that it fits tightly into the bore 16.

[0030] The plastic housing 38 may be provided with a steel bush 40, which is embedded in the plastic housing 38 and enables retention of the internal electrical connector 32 in the injector 12 in that the bush 40 is a press fit in the injector bore 16 of the NHB 14. The plastic housing 38 further includes an extrusion 42 which extends away from the main body of the plastic housing 38. The extrusion 42 defines an opening 44 which receives a second connection means in the form of a standard electrical connector (not shown) having first and second terminals. The standard electrical connector delivers electrical power from a power source (also not shown) to the solenoid 18 via the internal electrical connector 32.

[0031] The first and second connection blades 34, 36 connect to the respective connection pins 20, 22 of the solenoid 18, and include connecting rings 46, 48 at one end. In this embodiment, the connecting rings 46, 48 are arranged to be concentric with each other, to correspond to the arrangement of the connection pins 20, 22 of the solenoid 18. The first connection blade 34 has a smaller connecting ring 46 than the second connection blade 36, as the first connection blade 34 connects to the first connection pin 20, which is smaller than the second connection pin 22 which surrounds it. The connecting rings 46, 48 are arranged to create a secure connection with the respective connection pins 20, 22 by being formed with an internal diameter which is less than the diameter of the connection pins 20, 22. Each of the connecting rings 46, 48 is provided with a slit 50, which enables the ring to extend in order to fit onto the connection pins 20, 22. The chamfer on the top of each connection pin 20, 22 eases this process, by gradually extending the connecting ring 46, 48 as it is pushed further down the chamfered section of the connection pin 20, 22. If the connecting rings 46, 48 are not provided with a slit 50, they are not able to expand in order to accommodate the increasing diameter of the associated pin as the ring moves over

the chamfer; the slit 50 in the ring allows for the ring to expand elastically as it is pushed onto the associated pin, thus ensuring a good connection.

[0032] The connecting rings 46, 48 can sit at any point along the length of the connection pins 20, 22 when in its final position. This allows for manufacturing tolerances, and also means that if there is some movement of the connection blade 34, 36 relative to the connection pin 20, 22 due to vibration when the engine is operating, the electrical connection is maintained at all times, as the connecting ring 46, 48 can slide up and down the pin without breaking contact.

[0033] Each connection blade 34, 36 is formed with a bend such that the connection blade 34, 36 is divided into an upper and a lower portion 52, 54, with the upper portion 52 extending perpendicularly away from the lower portion 54. The lower portion 54 of the blade 34, 36 has the connecting ring 46, 48, and extends into the injector bore 16. The length of the lower portion 54 of the blade 34, 36 is determined by the depth of the injector bore 16 into which the electrical connector 32 is to be fitted. The upper portion 52 of the blade 34, 36 protrudes into the opening 44 in the plastic housing 38. In this way the upper portion 52 of each blade 34, 36 acts as a pin, such that, together with the extrusion 42 on the plastic housing 38, they take the form of a standard male electrical connector, to which a standard female electrical connector may connect.

[0034] A benefit of this arrangement is that, due to the concentric arrangement of the connection blades 34, 36, the electrical connector 32 may be inserted into the injector bore 16 in any orientation relative to the fuel injector 12. This may be an advantage in terms of orienting the electrical connector 32 to point towards the power source within the engine environment, in order to minimise the length of cable that is required. This is desirable, as space is limited in the area surrounding the injector 12.

[0035] Figure 3 shows a variation of the first embodiment of the invention, in which the lower sections of the connection blades 34, 36 are shorter than those of the connection blades 34, 36 shown in Figure 2. This embodiment of the electrical connector 32 is arranged to fit onto an injector solenoid assembly 10 in which the first and second connection pins 20, 22 are not as deep within the injector bore 16. This can either be because the solenoid 18 is formed with a long module as in Figure 3, or because the injector bore 16 is not as deep. This variation is otherwise identical to that in Figure 2.

[0036] A second embodiment of the invention is shown in Figure 4 and is arranged to fit a solenoid 18 which has two connection pins 20,22 which are positioned next to each other, rather than being concentric to each other. Therefore, the lower portions 54 of the connection blades 34, 36 extend parallel to each other, and each blade 34, 36 has a similarly sized connecting ring 46, 48 for connecting with a respective one of the connection pins 20, 22 of the solenoid assembly 10. The length of the blades 34, 36 in Figures 3 and 4 will be determined by the connections pins 20, 22 to which they are to be connected, and the space that is available to accommodate the connector parts.

[0037] As with the previously described embodiment, the connecting rings 46, 48 may be slightly undersized and provided with slits 50 in order to ensure secure attachment to the connection pins 20, 22.

[0038] In contrast to the above described embodiments in which the connection blades 34, 36 are concentrically arranged, the electrical connector 32 in Figure 4 may be sensitive to alignment; if the electrical connector 32 is not inserted into the injector bore 16 in the correct orientation, the connection blades 34, 36 will not line up correctly with the connection pins 20, 22, and therefore a good connection will not be made. Furthermore, pushing the electrical connector 32 into the injector bore 16 when the alignment is not correct could cause damage to the connection blades 34, 36 and also the connection pins 20, 22. For this reason, in this embodiment the plastic housing 38 of the electrical connector 32 may be provided with a pocket 56, which is arranged to accept a key 58 which is provided on the solenoid 18. The key 58 is longer than the connection pins 20, 22, which means that the electrical connector 32 will meet the key 58 before it meets the connection pins 20, 22 as it is pushed into the injector bore 16. The electrical connector 32 will therefore be prevented from being pushed further down into the injector bore 16, such that the connection blades 34, 36 connect with the connection pins 20, 22, until correct alignment of the electrical connector 32 has been achieved by lining the key 58 up with the pocket 56. Once correctly aligned, the electrical connector 32 can be pushed further into the injector bore 16 to connect the connection blades 34, 36 with the connection pins 20, 22.

[0039] For this embodiment, the upper portions 52 of the connection blades 34, 36, together with the opening 44 defined by the extrusion 42 of the plastic housing 38, take the form of a standard male electrical connector for receiving a standard female electrical connector, as with the previously described embodiments. Also, as with other embodiments, the plastic housing 38 may be provided with a steel bush 40 for connecting with the NHB 14.

[0040] For the above described embodiments, shown in Figures 2, 3 and 4, the plastic housing 38 may extend beyond the connecting rings 46, 48, in order to create a cavity or recess which receives the connection pins 20, 22 of the solenoid 18.

[0041] Figures 5, 6 and 7 show a further embodiment of the invention, which is arranged to connect to a solenoid 18 which is provided with a first contact surface 60 and a second contact surface 62 in the place of the first and second connection pins 20, 22. The first and second contact surfaces 60, 62 are separated by the provision of a ring of insulating material 24 therebetween. The contact surfaces 60, 62 may be positioned either side by side, or concentrically, as in Figure 5. A concentric arrangement is preferred, as it means that the electrical connector 32 may be inserted into the injector bore 16 in

any orientation, as with the embodiments in Figures 2 and 3.

[0042] The connection blades 34, 36 are not provided with connecting rings 46, 48 in this embodiment; instead the first and second connection blades 34, 36 are arranged to abut the corresponding contact surface 60, 62 on the solenoid 18 in order to create a connection. In order to ensure that the connection blades 34, 36 remain in contact with the contact surfaces 60, 62 when the engine is in operation, each connection blade 34, 36 is axially biased towards the corresponding contact surface 60, 62. This is achieved by means of a flexible, elastically compressible section 64 of the blade 34, 36 which is arranged to allow for axial compression of the lower portion 54 of the blade 34, 36 to create a biasing force when an axial force is applied by pushing the connection blade 34, 36 up against the contact surface 60, 62. The connection blade 34, 36 will exert an equal and opposite reaction force against the contact surface 60, 62, meaning the contact between the connection blade 34, 36 and the contact surface 60, 62 is maintained so long as the connection blade 34, 36 remains in a state of compression.

[0043] The flexibility of this section of the blade 34, 36 may be achieved by forming the blade 34, 36 with a series of opposing bends, as illustrated in Figure 5. In one embodiment, the lower portions 54 of the connection blades 34, 36 are slightly longer than they are required to be in order to reach the contact surfaces 60, 62 of the solenoid 18, such that when the electrical connector 32 is fitted into the injector bore 16 to connect with the solenoid 18, the connection blades 34, 36 are pushed into compression by the contact surfaces 60, 62. In this situation, when the engine is running, if the solenoid 18 should momentarily move away from the electrical connector 32 due to vibration from the engine, the connection blades 34, 36 will extend towards their initial uncompressed length, and therefore maintain contact with the contact surfaces 60, 62 of the solenoid 18. The flexibility of the connection blade 34, 36 also allows for manufacturing tolerances in the assembly.

[0044] The plastic housing 38 may be thinner in the section which overmoulds the elastically compressible sections 64 of the connection blades 34, 36, and it may also take the same form as the connection blades 34, 36, in order for the plastic housing 38 to be flexible also.

[0045] An intermediate housing 66 in the form of a secondary overmould may be provided, as shown in Figures 6 and 7, such that the ends of the connection blades 34, 36 are protected and held in the correct alignment, but the elastically compressible sections 64 of the connection blades 34, 36 remain free to compress as required.

[0046] For this embodiment, the upper portions 52 of the connection blades 34, 36, together with the opening 44 defined by the extrusion 42 of the plastic housing 38, take the form of a standard male electrical connector for receiving a standard female electrical connector, as with the previously described embodiments. Also, as with other embodiments, the plastic housing 38 may be provided with a steel bush 40 for connecting with the NHB 14.

[0047] Figure 8 shows a variation of the embodiment in Figure 5, in which the elastically compressible section 64 of the connection blades 34, 36 is formed as a helical coil, to take the form of a spring, thereby achieving the same effect of axially biasing the end of the connection blade 34, 36 into contact with the contact surfaces 60, 62 of the solenoid 18 as in the previously described embodiment.

[0048] As the connection blades 34, 36 may be tightly coiled relative to each other in this embodiment, it may be difficult to encase the connection blades 34, 36 in a plastic overmould as with the other embodiments. Therefore each connection blade 34, 36 may be provided with an individual plastic covering in order to insulate them electrically from each other, to prevent the blades 34, 36 from coming into direct contact with each other, thereby creating an electrical short circuit. The plastic covering may be thin in order to maintain flexibility.

[0049] In this embodiment the connection blades 34, 36 may be either circular or square in cross section.

[0050] For this embodiment, the upper portions 52 of the connection blades 34, 36, together with the opening 44 defined by the extrusion 42 of the plastic housing 38, take the form of a standard male electrical connector for receiving a standard female electrical connector, as with the previously described embodiments. Also, as with other embodiments, the plastic housing 38 may be provided with a steel bush 40 for connecting with the NHB 14.

[0051] In another embodiment, as shown in Figure 9, the electrical connector 32 includes a first insulated wire 68 and a second insulated wire 70, and an intermediate connector 72 in addition to the connection blades 34, 36. The connection blades 34, 36 in this embodiment are short, and the lower portions 54 of the blades 34, 36 do not extend far into the injector bore 16 when the plastic housing 38 is fitted, and so do not connect directly to the solenoid 18. Instead, one wire 68, 70 is attached to each connection blade 34, 36, and the wires 68, 70 are then connected to the intermediate connector 72. The intermediate connector 72 connects to the solenoid 18 in any one of the previously described methods of the other embodiments of the invention, according to the type of connections that are provided by the solenoid 18; connection pins 20, 22 or contact surfaces 60, 62. The pair of wires 68, 70 may be twisted around a guide 74, to allow for some axial flexibility. This flexibility will compensate for manufacturing tolerances, and it also allows for vibration when the engine is operating. It also allows the electrical connector to be used with injectors of differing heights. The wires are attached at either end by welding or by crimping. Both the plastic housing 38 and the intermediate connector 72 may be provided with windows for the welding or crimping of the wires.

[0052] It will be appreciated by a person skilled in the art that the invention could be modified to take many alternative forms to that described herein, without depart-

ing from the scope of the appended claims.

Claims

1. An electrical connector (32) for an injector assembly (10) having an actuator (18), the electrical connector (32) comprising:

   first and second conductive elements (34, 36);
   means for receiving first connection means of the actuator (18); and
   a non-conductive overmould (38) which houses the first and second conductive elements and which defines a first opening (44) for receiving a second connection means to a power source so as to enable electrical connection of the actuator (18) to the power source.

2. An electrical connector (32) according to Claim 1, wherein the non-conductive overmould (38) extends beyond the ends of the first and second conductive elements (46, 48) to define a further opening for receiving the first connection means.

3. An electrical connector (32) according to Claim 1 or Claim 2, wherein the first opening (44) is arranged to receive a second connection means in the form of first and second terminals of a standard electrical connector for the power source.

4. An electrical connector (32) according to any of Claims 1 to 3, wherein the first connection means comprises first and second connection pins (20, 22) forming part of the injector assembly (10), and wherein each of the first and second conductive elements (34, 36) comprises a connecting portion (46, 48) at an end thereof which connects to a respective one of the first and second connection pins (20, 22), in use.

5. An electrical connector (32) according to Claim 4, wherein the first and second connecting portions take the form of rings (46, 48), each for receiving a respective one of the first and second connection pins (20, 22).

6. An electrical connector (32) according to Claim 5, wherein the non-conductive overmould (38) is provided with means (56, 58) to allow alignment of the electrical connector (32) within the injector assembly (10).

7. An electrical connector according to Claim 5, wherein the first and second connecting rings (46, 48) are concentric with each other.

8. An electrical connector (32) according to any of Claims 1 to 4, wherein an end face of each conductive element (34, 36) is arranged to abut with a contact surface (60, 62) of the actuator (18).

9. An electrical connector (32) according to Claim 8, wherein at least one of the conductive elements (34, 36) comprises an elastically compressible section (64) which is arranged to allow axial compression of the conductive element (34, 36).

10. An electrical connector (32) according to Claim 9, wherein a section of the non-conductive overmould (38) which covers the elastically compressible section (64) of the conductive element (34, 36) is relatively thin to increase the flexibility thereof.

11. An electrical connector (32) according to Claim 9 or Claim 10, wherein each of the conductive elements (34, 36) is individually covered with a layer of electrically insulating material.

12. An electrical connector (32) according to any of Claims 1 to 4, further comprising an intermediate electrical connector (72) which connects directly to the actuator (18), in use, and wherein the first and second conductive elements (34, 36) are arranged to connect to the intermediate electrical connector (72).

13. An electrical connector (32) according to any one of Claims 1 to 12, wherein each of the first and second conductive elements (34, 36) is formed with an upper portion (52) and a lower portion (54), such that the upper portion (52) extends substantially perpendicularly away from the lower portion (54).

14. A fuel injector (12) comprising an injector assembly (10) and an electrical connector (32) according to any one of Claims 1 to 13, the fuel injector (12) defining an injector bore (16) within which the injector assembly (10) is received.

15. A fuel injector (12) according to Claim 14, wherein the non-conductive overmould (38) is provided with a bush (40) which is arranged to be a push fit into the injector bore (16), for the retention of the electrical connector (32) in the injector bore (16).

FIGURE 1

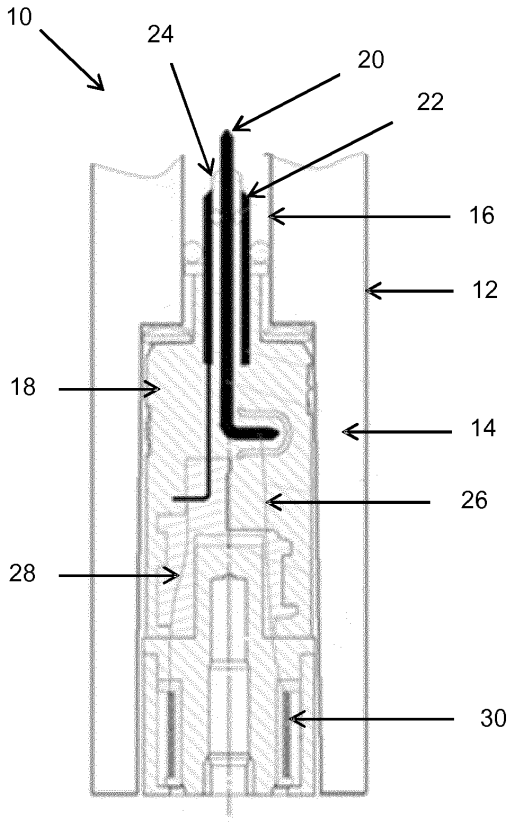
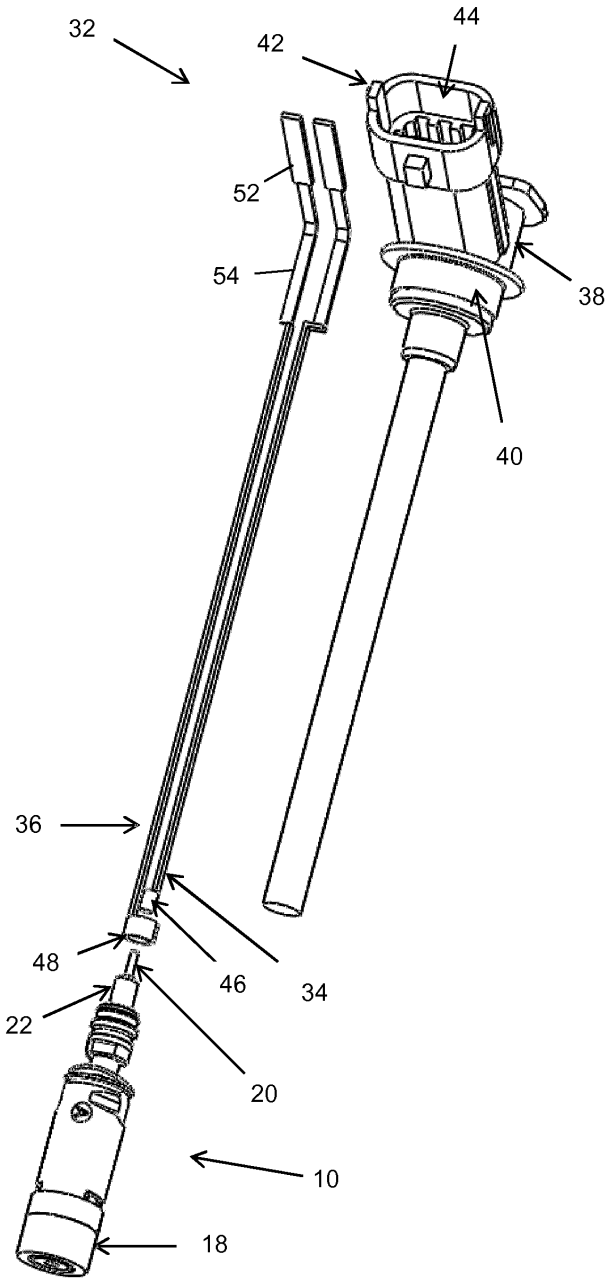


FIGURE 2



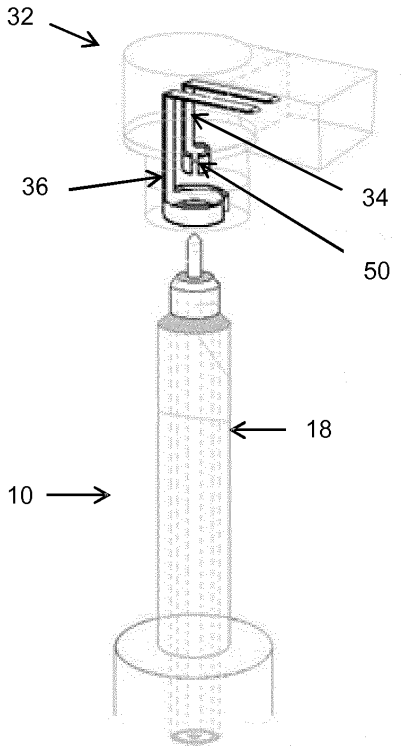


FIGURE 3

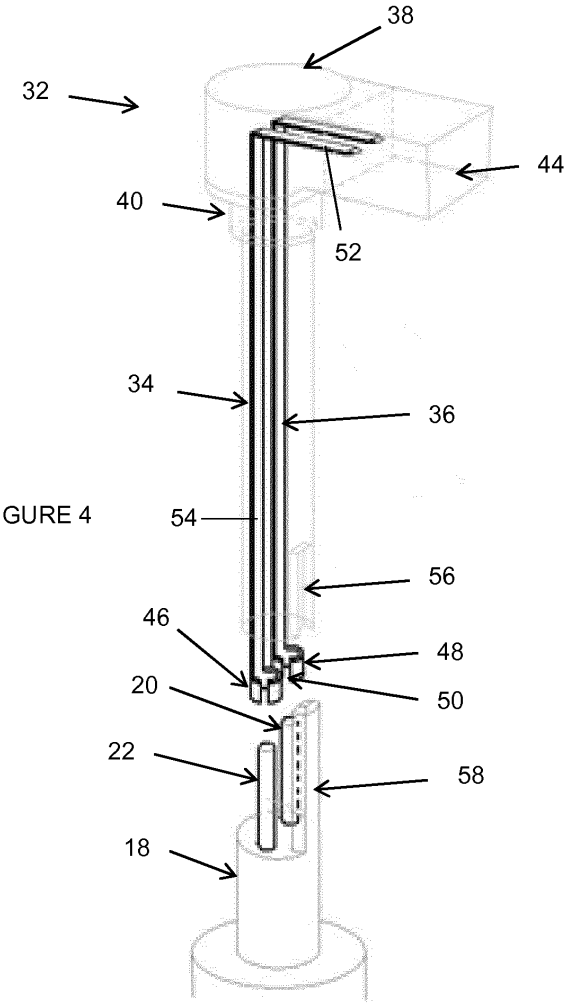


FIGURE 4

FIGURE 5

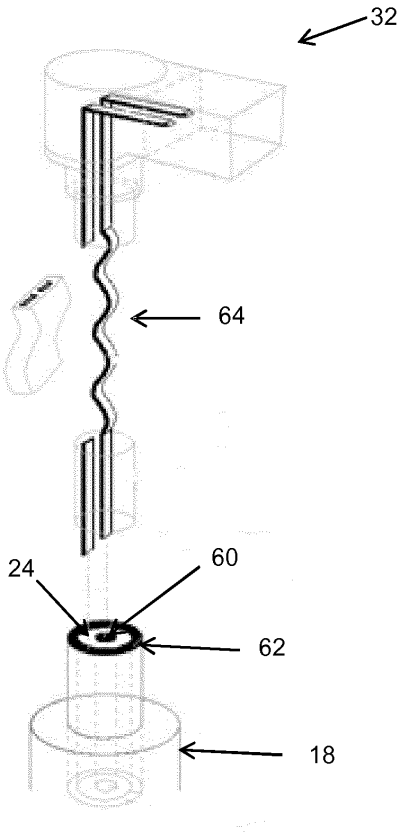


FIGURE 6

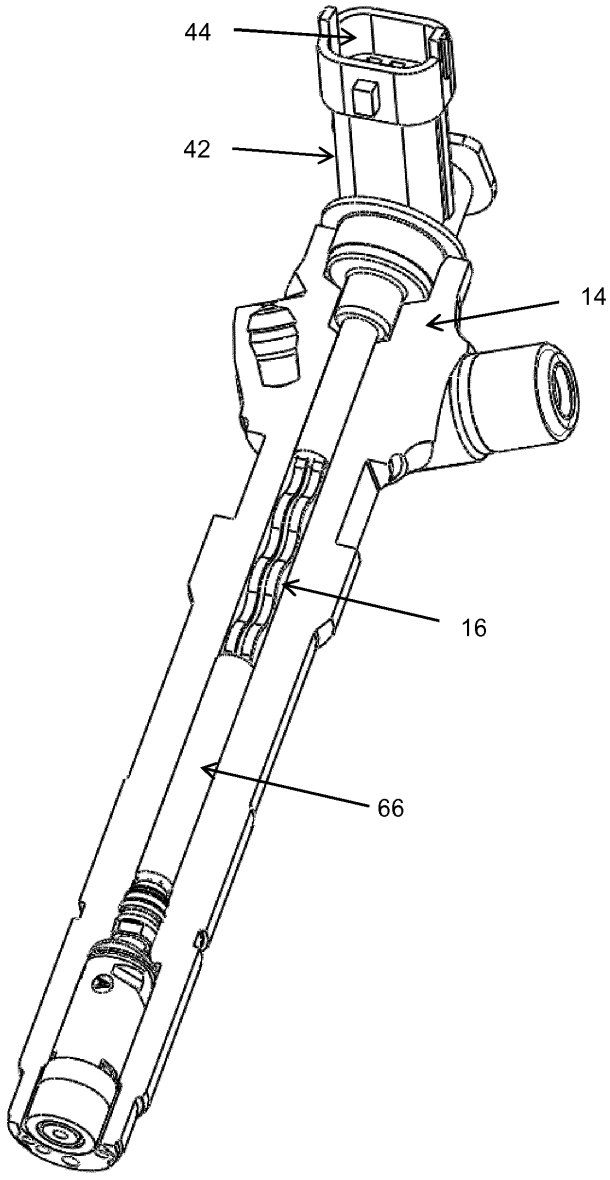


FIGURE 7

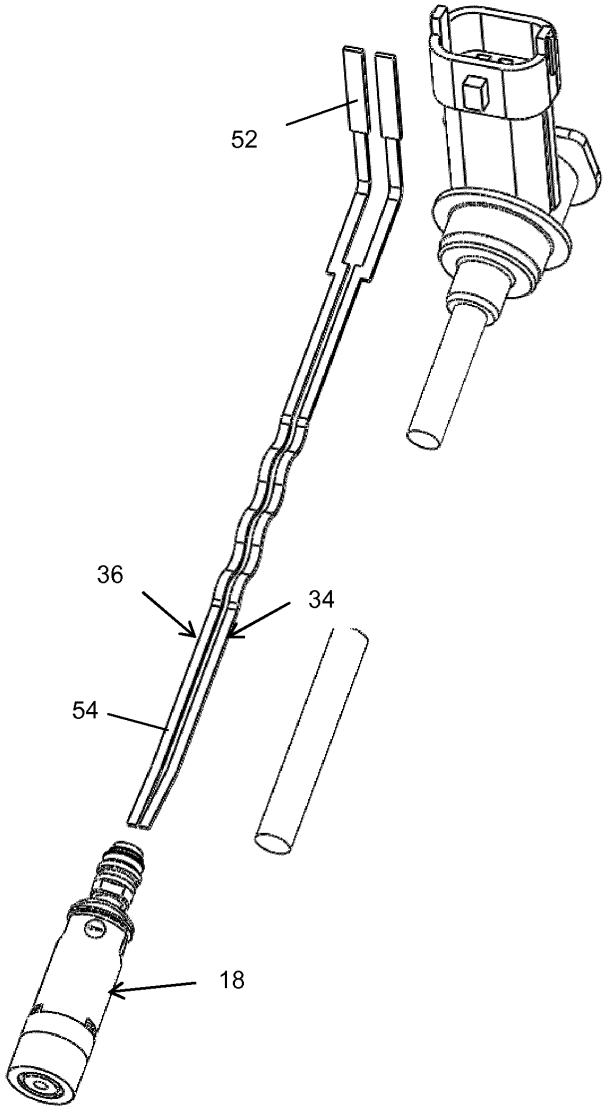
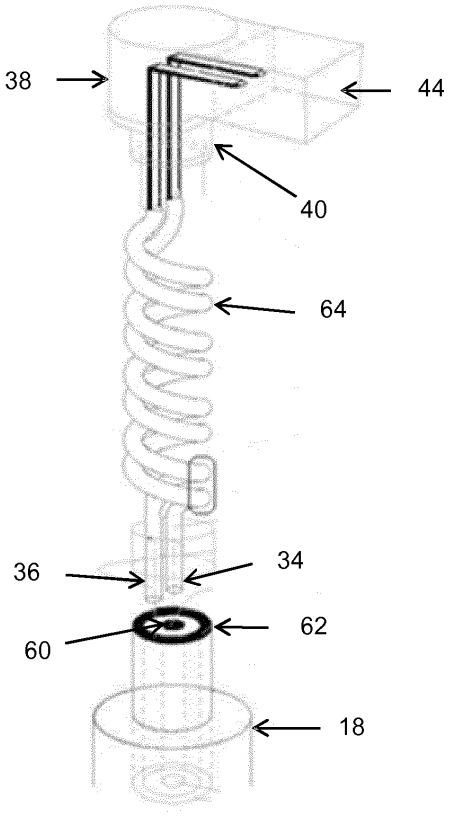


FIGURE 8



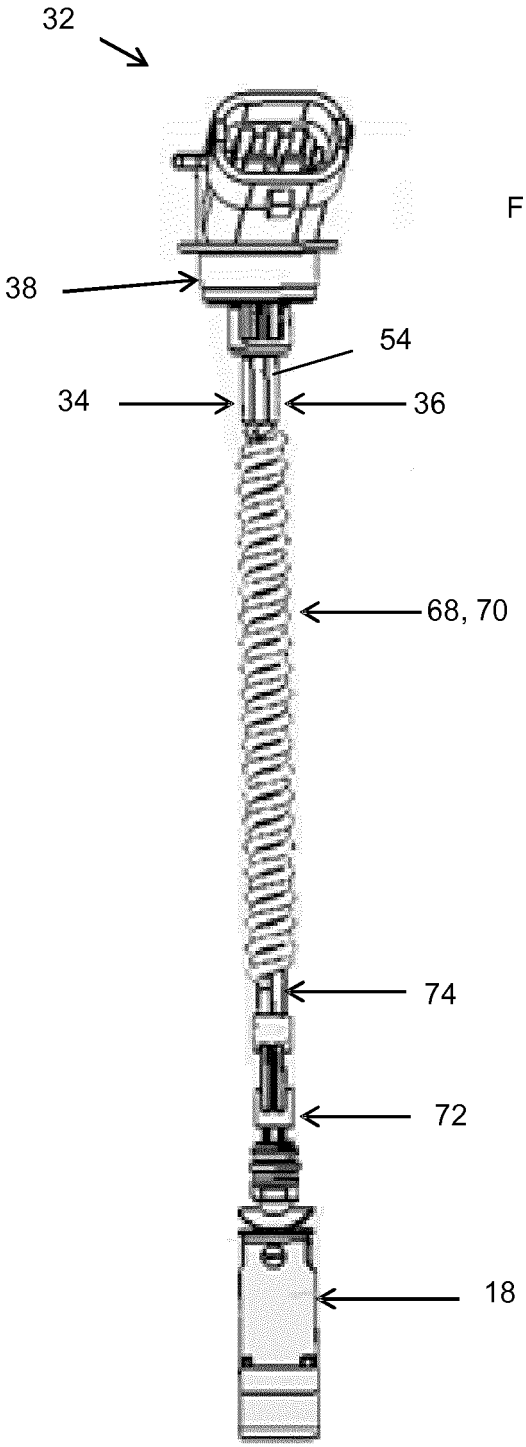


FIGURE 9

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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 6060

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Place of search	Date of completion of the search	Examiner
Munich	12 February 2013	Torle, Erik

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