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(71) Applicant: Y. S. SECURITIES LIMITED
Meanwood Road
Leeds West Yorkshire LS6 2BN(GB)

(72) Inventor: Oakes, Martin Christopher
Hornbeam Cottage White Gate
East Keswick Near Leeds West Yorkshire(GB)

(74) Representative: Geldard, David Guthrie et al,
URQUHART-DYKES AND LORD 11th Floor, Tower
House Merrion Way
Leeds, LS2 8PB West Yorkshire(GB)

(54) **An electrical high-voltage connector and connection assembly.**

(57) An electrical connector suitable for use with voltages of 3.3kv and over comprises a housing (1) moulded from insulating material and defining a body section (2) and a stem (3) projecting therefrom. A tapered socket (4) opens into the body section from one end thereof and is designed to receive a bushing or plug (12). A conductive terminal (6) is moulded in situ in the housing and has a part exposed at the inner end of the socket (4) to make electrical contact with the plug (12). The terminal passes through the stem (3) of the housing to terminate in a conductor connection section (8) lying externally of the housing, to which section the end of a conductor (11) may be mechanically and electrically secured.

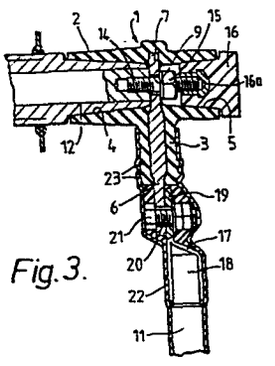

Fig.3.

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AN ELECTRICAL CONNECTOR AND CONNECTION ASSEMBLY

This invention relates to electrical connectors and to electrical connection assemblies utilising such connectors. The connectors of the invention are designed to connect high voltage conductors, for example cables and bus bars to electrical equipment such as transformers, switchgear, motors and other units. By high voltage in the context of this specification is meantvoltages of 3.3kv and over.

A number of forms of connection for high voltage or primary distribution cables have previously been proposed. Paper-insulated cable is usually terminated by a lug to which a conductor is electrically and mechanically secured. The conductor extends transversely from the cable to the equipment to which the cable is to be connected. The connection between the cable and the conductor is insulated either by a moulded boot that is heat shrunk onto the connection or by enclosing the connection in a steel casing subsequently filled with an insulating compound. Paper-insulated cables can only be terminated in one of these two ways, and it is recognised that such terminations by nature require a high level of skill in the operator effecting the termination.

The termination of plastics-insulated cables, particularly of cables insulated with a cross-linked polyethylene cover, is dealt with differently. Separable

connectors for use with such cable usually comprise a moulding defining a tapered opening and a cable entering port. The tapered opening is designed to fit onto a plug, while the cable to be connected to the equipment connected to the plug has a terminal secured to the trimmed end of the cable, the terminal being received in the cable entry port. The entry port is then closed by a plug which mates with the remainder of the moulding. By appropriate choice of the materials of the moulding, and particularly by incorporating conductive screening material into the moulding such a connector can be made safe to the touch even when the cable is live. However, such connectors are expensive and require to be provided in a range of different sizes and shapes for different sizes and types of cable. Furthermore, considerable care and skill is required to ensure a sound and reliable connection.

The present invention seeks to solve the problem of providing an inexpensive separable electrical connector suitable for use in high voltage situations and enabling reliable connections to be made between a wide range of cables, bus bars or other conductors without entailing the high degree of skill necessary in existing methods of cable termination.

According to the invention an electrical connector comprises a housing moulded from electrically insulating material and defining a body section and a stem projecting from the body section, an inwardly tapering socket opening into the body section from one end thereof, and a conductive terminal moulded in situ in the housing, the terminal having a part lying at the inner end of the socket and exposed to the socket and the terminal passing through the stem of the housing to terminate in a conductor connection section lying externally of the housing.

It will be apparent from the construction of a connector according to the invention that this can be manufactured inexpensively when compared with the presently used complex termination systems, and that sockets

can be designed to accommodate any given form of tapered bushing or plug on high voltage equipment to which the cable is to be connected. Furthermore, because the terminal has a cable connection section lying externally of the housing, and thus readily accessible, the connector can be used in conjunction with any size or type of cable, bus bar or other conductor, and a reliable connection can be effected simply and rapidly. This renders the connector very much more versatile than presently used types of connector and connecting systems.

The socket and stem may have their axes parallel so that the connector is of a straight through form, for connecting a plug to a conductor generally aligned with the plug. Alternatively the stem may extend from the body section transversely to the axis of the socket, to form an elbow or T-connector enabling, for example, a rising conductor to be connected to a horizontally aligned plug.

The connectors of the invention are preferably free of any conductive screening material within or surrounding the moulded material, and the housing is desirably homogeneous.

The moulded housing material preferably has a comparative tracking index measured in accordance with I.E.C. Standard Publication 112: 1979 of not less than 900 volts using brass electrodes. More desirably the material should be of classification B2.5 according to the inclined plane tracking test set forth in I.E.C. Standard Publication 587: 1977. Desirably also the material should have a dielectric strength measured in accordance with British Standard No. 2782 of not less than 6kv/mm and a dielectric loss angle (tan δ) at 20°C and 50 hertz not more than 0.04. The material is desirably also such that the connector can withstand a peak fault current of at least 8.75 kiloamperes followed by a symmetrical fault current of at least 3.5 kiloamperes for a period of one second. The material should preferably also be capable of use for

extended periods at temperatures in excess of 90°C without significant degradation of the aforementioned electrical properties or of mechanical properties such as Shore hardness, tensile strength and percentage elongation at break. Examples of suitable materials are certain castable elastomeric polyurethanes resins rubbers and . The terminal may be of any suitable conductive material, for example copper.

The cable connection section of the terminal may take any one of a number of forms. In a first embodiment the section may be a solid end section having at least one flat face, a hole extending through the end section transversely to the face and being designed to receive a bolt by way of which a connecting lug on a cable or other conductor may be secured to the section. There is thus a simple bolted connection between the conductor and the connector. In a second embodiment a solid end section of the terminal is designed to receive an external ferrule capable of being secured to the section and to the end of a conductor to be secured to the section. In a third embodiment the conductor connection section of the terminal comprises an open region, for example a tubular section, into which the end of a conductor may be inserted, the region being deformable to secure the region onto the conductor. By appropriate choice of the type of conductor connector section any type of conductor or cable in common use may simply and securely be joined to the connector.

When a conductor is electrically and mechanically connected to the cable connection section, the connection is conveniently shrouded by an insulated sleeve surrounding the end part of the conductor and at least the end part of the stem of the housing. Such sleeves may, for example, be simple slip-over or elastic sleeves, sleeves of heat-shrinkable material or sleeves built by winding self-amalgamating tape around the joint. Sleeves of heat-shrinkable material are initially positioned loosely

around the connection between the connector and conductor, subsequently being heat-shrunk into position after the electrical and mechanical connection is effected. The sleeve is required only around the region of the stem and cable end, in contrast to previous systems using heat-shrinkable sleeves which have surrounded not only the region just stated, but also the whole of the bushing and associated assembly forming the cable termination. The design and manufacture of appropriate heat-shrinkable sleeves is greatly simplified by the connector of the invention. Desirably the outer surface of the stem of the housing has at least one radial protrusion, which may preferably be in the form of a rib extending around the circumference of the stem. Such protrusions assist in anchoring the insulating sleeve in position on the connector.

The form of the terminal within the body section of the housing and its relationship with the socket may be designed to suit the particular application for the connector. In one embodiment the terminal is curved within the body section of the housing, and the exposed part of the terminal projects into the socket from the inner end thereof and is coaxial with the socket. In a different embodiment an auxiliary socket coaxial with the first said socket opens into the body section from a second end thereof, and the auxiliary socket has an inner end separated from the inner end of the first socket by the exposed part of the terminal. The exposed part of the terminal may then simply be formed with a hole extending through the terminal and coaxial with the sockets, the hole being capable of receiving a threaded stem on a plug fitting into the socket, a nut being engageable with the stem to tighten the plug into engagement with the terminal. An electrically insulating plug may be received in the auxiliary socket to close the opening thereto, so positively preventing accidental access to the

exposed part of the terminal. A plug in this location may be formed with an integral screen and means whereby the screen may be connected to a neon indicator, thereby giving indications of live connections in a particularly simple and convenient manner.

The basic embodiment of connector according to the invention provides a socket opening into said one end of the body section for receiving a single plug. The deceptively simple principle behind the invention does, however, make possible the provision of other forms of connector. Thus, in one variation, two or more inwardly tapering sockets may open into the body section from a common end thereof, the axes of all sockets being parallel and the conductive terminal having parts lying at the inner end of each socket and exposed to each socket. If the stem of the housing is considered as being at the lower part thereof then multiple sockets may be arranged one above another and/or one alongside another. Thus, a single moulding can provide multiple outlet sockets connected to a single input conductor. If required, each socket may have an associated auxiliary socket coaxial therewith, which auxiliary socket may, if required be closed by a plug.

In a further arrangement the housing may have an integral extension from the body section, at least one additional socket being formed in the extension and the terminal extending so that a further part thereof lies at the inner end of the or each additional socket. The axis of the or each additional socket need not be parallel to that of the first socket, and the or each additional socket need not be of the same shape as the first socket.

In yet another arrangement the second end of the body section of the moulded housing is formed with a male tapered part engageable in a socket of another axially aligned connector. In this way, two or more conductors may be connected to a single input or output.

The invention extends also to an electrical connection assembly comprising an electrical connector in any one of the forms previously set forth, a plug engaged in the or a socket of the connector and in electrical contact with the terminal, and a conductor electrically and mechanically connected to the cable connection section of the terminal. Desirably the connection between the conductor and the terminal is shrouded by an insulating sleeve surrounding the end part of the conductor and at least the end part of the stem of the housing. As already stated, the sleeve may suitably be of a material such that it can be heat-shrunk into position after being positioned loosely around the connection.

Even though the moulded housing is of insulating material it may well not be safe to the touch, and care must obviously be taken in safeguarding access to the connector. Accordingly, the connectors will usually be located within a metal-enclosed cable box which is connected to earth. There is, of course, no need to fill the box with insulating compound, thus leaving the connectors fully exposed so that they may readily be separated from the bushing or plug received in the socket, once power has been removed and the connector made electrically safe.

In order that the invention may be better understood, particular embodiments of connectors in accordance therewith will now be described by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a cross-section through a first form of connector;

Figure 2 is an end elevation of the connector of Figure 1;

Figure 3 shows an electrical connection assembly utilising the connector of Figure 1;

Figures 4 and 5 each show an electrical connection assembly utilising a further embodiment of connector

according to the invention;

Figure 6 is an isometric view showing in use a connection assembly similar to that of Figure 5;

Figure 7 shows an electrical connection assembly utilising yet another embodiment of connector according to the invention;

Figures 8 to 10 are cross-sections through other embodiments of connector; and

Figures 11 and 12 illustrate further electrical connection assemblies utilising the connector of Figure 1.

Referring now to Figures 1 and 2 there is shown an electrical connector comprising a moulded housing 1 defining a body section 2 and a stem 3 projecting transversely therefrom. An inwardly tapering socket 4 opens into the body section from one end thereof and an inwardly tapering auxiliary socket 5 opens into the body section from a second end thereof. The two sockets are coaxial. A conductive terminal 6 is moulded in situ in the housing, the terminal having an exposed part 7 lying between and separating the inner ends of the socket 4 and of the auxiliary socket 5. The terminal passes through the projecting stem 3 and terminates at an outer end 8 forming a conductor connection section lying externally of the housing. The end 8 is solid and of rectangular cross-section. The terminal is provided with holes 9 and 10 respectively at its exposed part and conductor connection section, the hole 9 being coaxial with the sockets.

The connector is moulded so that the socket 4 has a shape and size meeting recognised standards for high voltage separable connectors, and desirably so that the tolerances between the socket and a bushing or plug are such as to give a hermetically sealed joint that will completely exclude ingress of moisture into the socket. Obviously however, the socket may be of any desired size or shape to suit the bushing or plug by way of which it is connected to the equipment concerned.

The housing may conveniently be moulded from a flexible polyurethane elastomer formed from a resin that is a catalysed blend of polyether polyols containing dessicants and a chromium based inorganic pigment and from a hardener that is a prepolymerised form of diphenylmethane di-isocyanate.

In one particular example, the material exhibited the following properties. The comparative tracking index measured in accordance with I.E.C. Standard Publication 112:1979 after being newly cast and after ageing for 240 hours at 120°C was 110 v, using brass electrodes. When subjected to the inclined plane tracking test set forth in I.E.C. Standard Publication 587:1977 the material proved to be of classification B2.5, both before and after ageing. The dielectric properties measured in accordance with British Standard 2782 were dielectric strength of 8.33 kv/mm, volume resistivity of 2.3 X 10^{11} ohms and surface resistivity of 8.9 X 10^{12} ohms. The dielectric loss angle (tan δ) at 20°C and 50 hertz was 0.015. After standing at room temperature for one week after casting the tensile strength of the material was 17.9 N/mm^2, the elongation at break 250% and the Shore A hardness 90°. After ageing in air for 430 hours at 120°C the tensile strength was 20.7 N/mm^2, the elongation at break 300% and the Shore A hardness 70°. The material thus exhibits excellent ageing properties. A wide range of connectors as described herein have been moulded from this material and have proved to be capable of handling high electrical loads, and in particular of withstanding a peak fault current of at least 8.75 kiloamperes followed by a symmetrical fault current of at least 3.5 kiloamperes for a period of one second. Other materials tested having a comparative tracking index in excess of 900 volts, a dielectric strength in excess of 6 kv/mm and a dielectric loss angle of less than 0.04 have proved to be capable of forming connectors that can transmit high power at voltages over 3.3 kv with good fault current properties.

One normal method of use of the connector shown in

Figures 1 and 2 is illustrated in Figure 3. In this embodiment the connector is slightly modified from that of Figures 1 and 2 in that the conductor 6 is of circular cross-section within the stem 3 of similar cross-section the upper and lower ends of the conductor being flattened in the connection regions. The connector forms an elbow connector capable of connecting a rising cable 11 to a tapered bushing or plug 12 capable of carrying an electrical load to any required equipment. The plug 12 is a mating fit within the socket 4 and seals onto the taper thereof. A silicone, petroleum or ester grease may usually be applied to the plug in order to ensure an air-tight seal and prevent flashover or surface discharge. The end of the plug is formed with an internally threaded bore receiving a threaded stud 14 which passes through the hole 9 in the exposed part 7 of the terminal 6 and is engaged by a nut 15. A sealing plug 16 fits into the auxiliary socket, the sealing plug desirably being of insulating material which may be rigid when the housing is of flexible material. The plug has a threaded insert 16a engageable with the end of the stud 14. The nut 15 may be used either to draw the plug 12 into secure electrical contact with the terminal 6 or to release it from such contact, the sealing plug insulating that contact area.

The upper end of the cable 11 is suitably stripped and a connecting lug 17 is crimped or otherwise secured to the conducting core 18 of the cable. The lug has a flattened end 19 through which is formed an opening 20 which can be aligned with the hole 10 in the outer end of the terminal, the lug then being secured to the terminal by a suitable nut and bolt arrangement 21. Prior to effecting this connection a loose sleeve 22 of a heat-shrinkable material has been slipped over the free end of the cable. After effecting the connection the sleeve is pulled over the connection and over the stem 3 of the housing. When in position heat shrinkage of the sleeve

is effected so that it contracts round the stem 3, the connection and the upper part of the cable to protect and insulate the connection. Any suitable heat-shrinkable material may be used for this sleeve. The stem is formed with two circumferential ribs 23 (or other suitable form of radial protrusion) to assist in anchoring the sleeve 22.

A connection assembly as shown in Figure 3, the housing of the connector having been moulded from the flexible polyurethane elastomer previously described, was tested as follows. The assembly was placed in a sealed enclosure and subjected to an A.C. voltage of 12.9 kv for 1000 hours. During the test water having a conductivity of 800 μsiemens/cm was continuously sprayed onto the assembly at a rate of 4 litres/hr/m^3. After the 1000 hours had passed the power was cut off and the connector inspected. No tracking had been experienced and no erosion of the housing was evident. A similar connection assembly was then immersed in a tub of water having a conductivity of 800 μsiemens/cm. An A.C. voltage of 12.9 kv was applied and maintained for three weeks without any problems being experienced.

The joint between the cable and the connector will generally be made before the socket is engaged with the plug 12. Thus the working area around the joint is not constrained by a fixed location of the connector and application of heat uniformly to all regions of the heat-shrinkable sleeve is thereby facilitated. A similar degree of access and manoeuverability is available for fitting sleeves other than heat-shrinkable sleeves, for example for building a sleeve by wrapping self-amalgamating tape around the joint.

If it is desired to use a rigid housing and a rigid plug, or in any other context where sealing may be difficult between the tapered surfaces of the plug and the socket, the plug may be formed with an integral flange and a sealing ring trapped between that flange and the

face of the housing when the plug is tightened into electrical contact. In any embodiment if it is desired to effect additional sealing in the socket 4, the radially inner face of that socket may be provided with one or more circumferentially extending sealing rings, or with an annular sealing sleeve of suitable material. If the housing is rigid then the sealing plug will generally be of flexible material. Again, one or more sealing rings or a sealing sleeve may be incorporated in the auxiliary socket.

Figure 4 shows in use an alternative embodiment of connector, parts of which have the same form as the connector of Figure 1 and are thus given the same reference numeral with the suffix a. In this embodiment the conductor 6a is of tubular form, one end being flattened to form the exposed part 7a lying at the inner end of the socket 4a. The hollow tubular part of the conductor terminates at an outer end 8a forming a conductor connection section lying externally of the housing. The stripped end 18a of a cable may be inserted into the end of the terminal, the terminal then being crimped as at 25 to secure the terminal and the cable together. An insulating sleeve 22a covers the region of the connection.

Figure 5 shows a dead break elbow connector particularly designed to handle currents of up to 400 amps at 36 kv. The moulded housing defines a body section 31 and a stem 32 projecting transversely therefrom. An inwardly tapering socket 33 opens into the body section from one end thereof. A conductive terminal 34 is moulded in situ in the housing, the terminal extending through the stem and projecting therefrom to form a solid, circular cross-section end part 35 forming a conductor connecting section. Within the body section of the housing the terminal is curved as at 36 and it terminates in an exposed part 37 projecting into the socket 33 from the

inner end thereof and coaxial with the socket. The projection 37 and socket 33 are designed to receive a standard circuit bushing for the design current. The section 35 may be secured to the stripped end 38 of a cable 39 by a ferrule 40, secured by crimping, grub screws, brasing, sweating or any other convenient means to the section 35 and to the cable. The region of the connection will again be covered by an insulating sleeve, not shown in the drawings.

Figure 6 shows a connector 41 similar to that of Figure 5 but having a blade-like conductor connection section 42, with its socket engaged in position on a circuit bushing formed at the end of a cable 43. The cable 43 has a collar 44 behind which is engaged a clip 45 from which extends a strap 46 of nylon or other non-metallic material, both ends of the strap being anchored to the clip 45. A wing nut 47 engages an internally threaded insert 48 moulded into the strap and engages a hardened pad 49 received in a recess 49a (Figure 5) on the connector. The wing nut can be tightened to hold the connector firmly onto the bushing.

Figure 7 shows in use an alternative embodiment of connector, parts of which have the same form as the connector of Figure 1 and are thus given the same reference numeral with the suffix b. In this embodiment the connector is moulded to have an integral extension 50 from the body section 2a and an additional socket 51 is formed in the extension. The material of the terminal 6b is extended at 52 to pass through the extension so that a part 53 thereof lies at the inner end of the additional socket 51. Additional equipment can thus be connected to an input cable 11b by a connection 54 cooperating with the socket 51, a sealing ring 55 being incorporated if required. The additional socket may be made of any required shape or size appropriate to the auxiliary equipment and its connecting means that will be associated

with the auxiliary socket. Figure 4 also shows a sealing plug 15b having an integral internally threaded insert 56 engageable with a stud 14b of the plug, the sealing plug thus being used to effect anchoring of the plug. Obviously these two forms of anchorage are interchangeable. Furthermore, the sealing plug 15b also incorporates a screen 57 and means whereby the screen may be connected to a neon indicator. Similar plugs may be used in other of the illustrated embodiments.

Figures 8 to 10 show alternative forms of connectors and in each case parts common to the connector of Figure 1 are shown by the same reference numerals in that Figure with the suffix c, d or e respectively for the three Figures. The connector shown in Figure 8 is moulded to have two inwardly tapering sockets 4c and 60 opening into the body section from one end thereof, the socket 60 being positioned above the socket 4c if the stem 3c is considered as lying to the bottom of the connector. The socket 60 has an associated inwardly tapering auxiliary socket 61 and the terminal 6c extends through the housing so that it separates the inner end of the socket 4c from the inner end of the auxiliary socket 5c and also the inner end of the socket 60 from the inner end of the socket 61. In the latter region the terminal is formed with a further hole 62 providing a connection point for a further plug that can be fitted into the socket 60.

In the embodiment of Figure 9 the moulding is extended so as to include a second socket 63 lying alongside the socket 4d and extending into the body from the same end as the socket 4d. Again, the second socket 63 has an auxiliary socket associated therewith in the same way as the first socket 4d. In this embodiment the material of the terminal 6d has a transverse extension 64 which extends through the body to separate the inner end of the socket 63 from the inner end of its auxiliary socket.

The embodiment of both Figures 8 and 9 shows connectors wherein multiple outlets can be taken from a single output cable or bus bar.

Figure 10 shows a straight-through connector whereby a bushing received in the socket 4e may be connected to a conductor secured to the end 8e of the conductor 6e, which extends through a stem 3e coaxial with the socket 4e.

There are installations where it is necessary to secure more than one cable or bus bar to a single outlet. In such cases each cable may be terminated to a connector of any suitable type shown, the connectors being in axial alignment. Such an arrangement is illustrated in Figure 11. Adjacent connectors 70, 71 are in turn electrically connected to each other by a member 72 having male tapered parts 73, 74 at each end which may be received in the facing auxiliary sockets of the connectors.

Alternatively, as shown in Figure 12, a connector 75 may be moulded to have a socket 76 at one end thereof and a male tapered part 77 at the other end thereof. One cable 78 is secured to the terminal 79 of this connector 75 and a further cable 80 to the terminal 81 of a connector 82 similar to that shown in Figure 1. These junctions are each similar to the cable junction shown in Figure 3. The two connectors 75, 82 are axially aligned and the part 77 engages into the auxiliary socket 83 of the connector 82. A tapered circuit bushing 84 is received in the mains socket 85 and a threaded stud 86 extends through the terminal 81, through a conductive sleeve 87 in the connector 75, and through the terminal 79 to be secured by a nut 88. The socket 76 of the connector 75 is closed by an insulating sealing plug 89. Thus, the two cables 78, 80 are both electrically connected to the bushing 85.

It will be appreciated that any of the embodiments of connectors shown herein may be modified to have any of the other forms of conductor connection section shown herein, or indeed any other suitable form of conductor

connection section. Connectors can be manufactured in forms other than those shown in the drawings, all having the virtue of simplicity both in manufacture and in the way in which connections are made to the connectors. In particular, it will be noted that even for the high current and high voltage uses that are contemplated it is not necessary to include any screening in the moulded housings. Clearly, materials other than those specifically described can be used. For example, the housing may be moulded from a rigid polyurethane elastomer, an EPDM rubber, a silicone rubber, an epoxy resin or a dough moulding material such as a polyester glass, the material in each case having the required electrical properties and mechanical properties rendering them suitable for use in the connectors of the invention. The terminal, rather than being of copper, may be of aluminium or other conductive material.

CLAIMS:

1. An electrical connector comprising a housing moulded from electrically insulating material and defining a body section and a stem projecting from the body section, an inwardly tapering socket opening into the body section from one end thereof, and a conductive terminal moulded in situ in the housing, the terminal having a part lying at the inner end of the socket and exposed to the socket and the terminal passing through the stem of the housing to terminate in a conductor connection section lying externally of the housing.

2. An electrical connector according to claim 1 in which the moulded housing material has a comparative tracking index measured in accordance with I.E.C. Standard Publication 112:1979 of not less than 900 volts, using brass electrodes.

3. An electrical connector according to claim 1 in which the moulded housing material is of classification B2.5 according to the inclined plane tracking test set forth in I.E.C. Standard Publication 587:1977.

4. An electrical connector according to any one of the preceding claims in which the moulded housing material has a dielectric strength measured in accordance with British Standard No.2782 of not less than 6kV/mm.

5. An electrical connector according to any one of the preceding claims in which the conductor connection section of the terminal comprises a solid end section having at least one flat face, and a hole extending through the section transversely to the face for receiving a bolt by way of which a connecting lug on the conductor may be secured to the section.

6. An electrical connector according to any one of claims 1 to 4 in which the conductor connection section of the terminal comprises a solid end section receiving an external ferrule capable of being secured to the section and to the end of a conductor to be secured to the section.

7. An electrical connector according to any one of claims 1 to 4 in which the conductor connection section of

the terminal comprises an open region into which the end of a conductor may be inserted, the region being deformable to secure the region onto the conductor.

8. An electrical connector according to any one of the preceding claims in which the outer surface of the stem of the housing has at least one radial protrusion thereon.

9. An electrical connector according to claim 8 in which at least one of the radial protrusions is in the form of a rib extending around the circumference of the stem.

10. An electrical connector according to any one of the preceding claims in which the stem extends from the body section transversely to the axis of the socket.

11. An electrical conductor according to claim 10 in which the terminal is curved within the body section of the housing and the exposed part of the terminal projects into the socket from the inner end thereof and is coaxial with the socket.

12. An electrical connector according to any one of claims 1 to 10 in which an auxiliary socket coaxial with the first said socket opens into the body section from a second end thereof, the auxiliary socket having an inner end separated from the inner end of the first socket by the exposed part of the terminal.

13. An electrical connector according to claim 12 in which the exposed part of the terminal is formed with a hole extending through the terminal and coaxial with the sockets.

14. An electrical connector according to claim 12 or claim 13 and including an electrically insulating plug received in the auxiliary socket to close the opening thereto.

15. An electrical connector according to claim 14 in which the plug has an integral screen and means whereby the screen may be electrically connected to a neon indicator.

16. An electrical connector according to claim 12 or

claim 13 in which the auxiliary socket tapers inwardly into the body section.

17. An electrical connector according to any one of the preceding claims in which two or more inwardly tapering sockets open into said one end of the body section, the axes of all such sockets being parallel and the conductive terminal having parts lying at the inner end of each socket and exposed to each socket.

18. An electrical connector according to any one of the preceding claims in which the housing has an integral extension from the body section, at least one additional socket being formed in the extension and the terminal extending so that a further part thereof lies at the inner end of the or each additional socket.

19. An electrical connector according to any one of claims 1 to 9 in which the second end of the body section is formed with a male tapered part engageable in a socket of another axially aligned connector.

20. An electrical connection assembly comprising an electrical connector according to any one of the preceding claims, a plug engaged in the or a socket of the connector and in electrical contact with the terminal, and a conductor electrically and mechanically connected to the cable connection section of the terminal.

21. An electrical connection assembly according to claim 21 in which the connection between the conductor and the terminal is shielded by an insulating sleeve surrounding the end part of the conductor and at least the end part of the stem of the housing.

22. An electrical connection assembly according to claim 22 in which the sleeve has been heat shrunk into position.

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Fig.1.

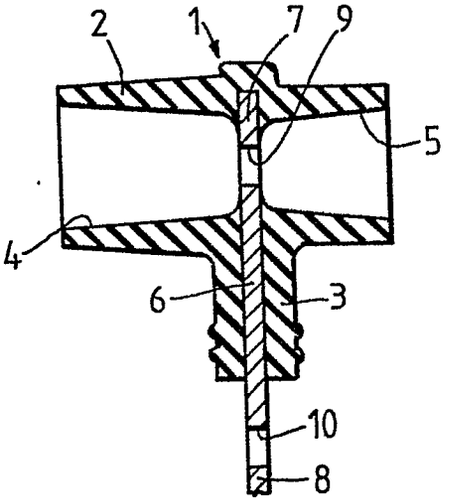
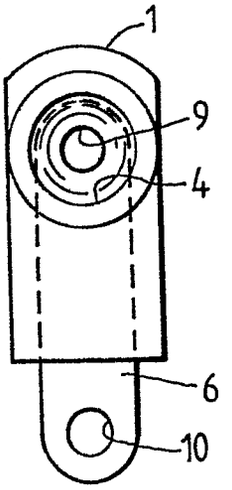


Fig.2.



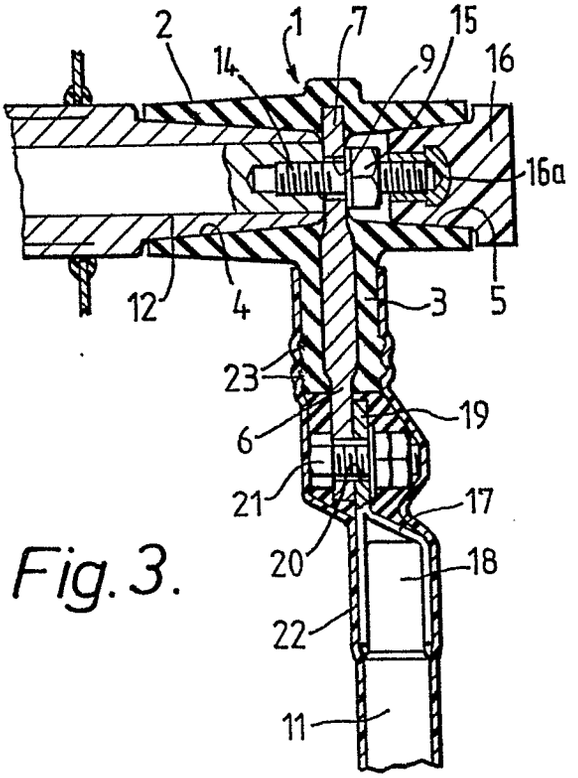


Fig.3.

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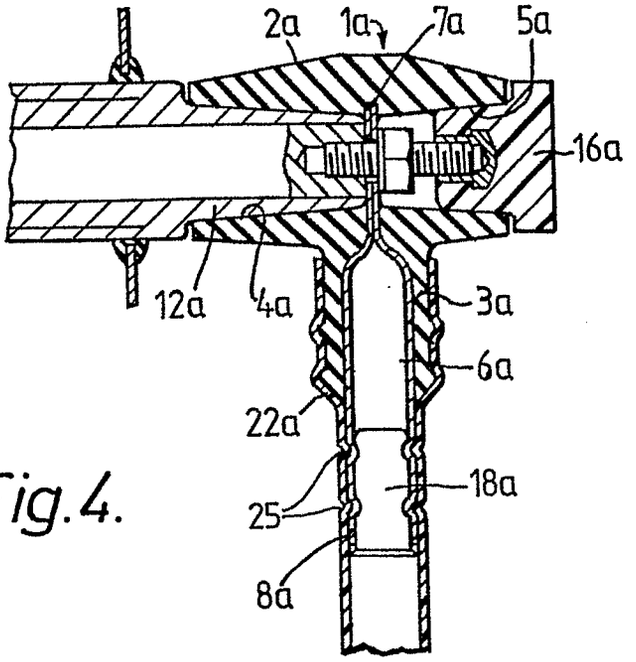

Fig.4.

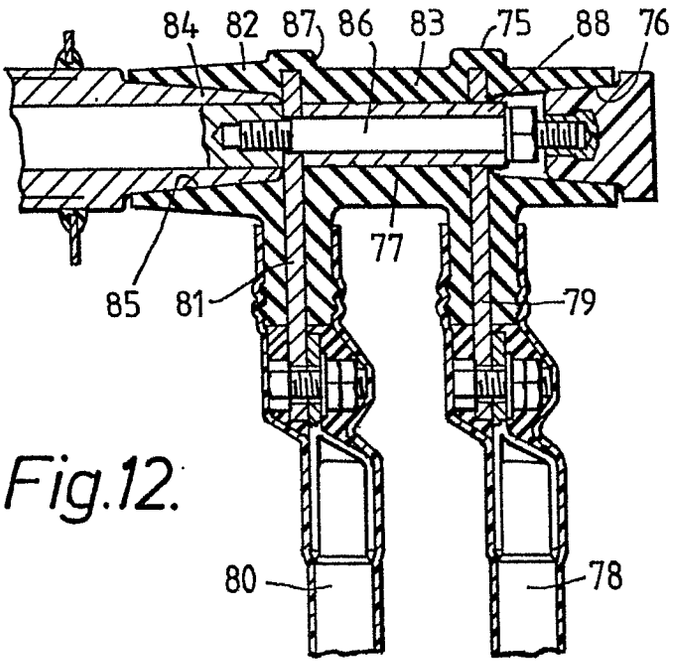

Fig.12.

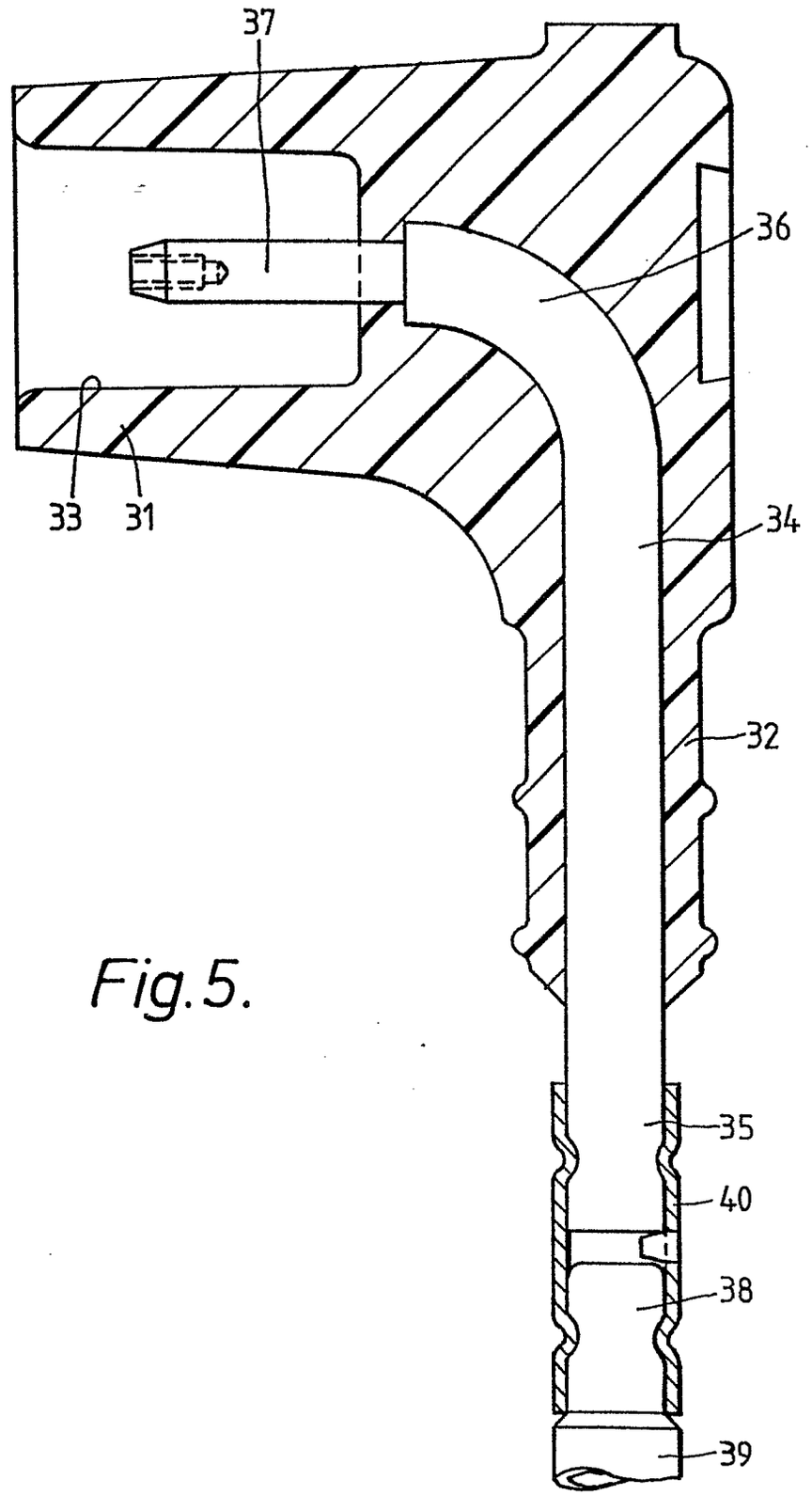

Fig.5.

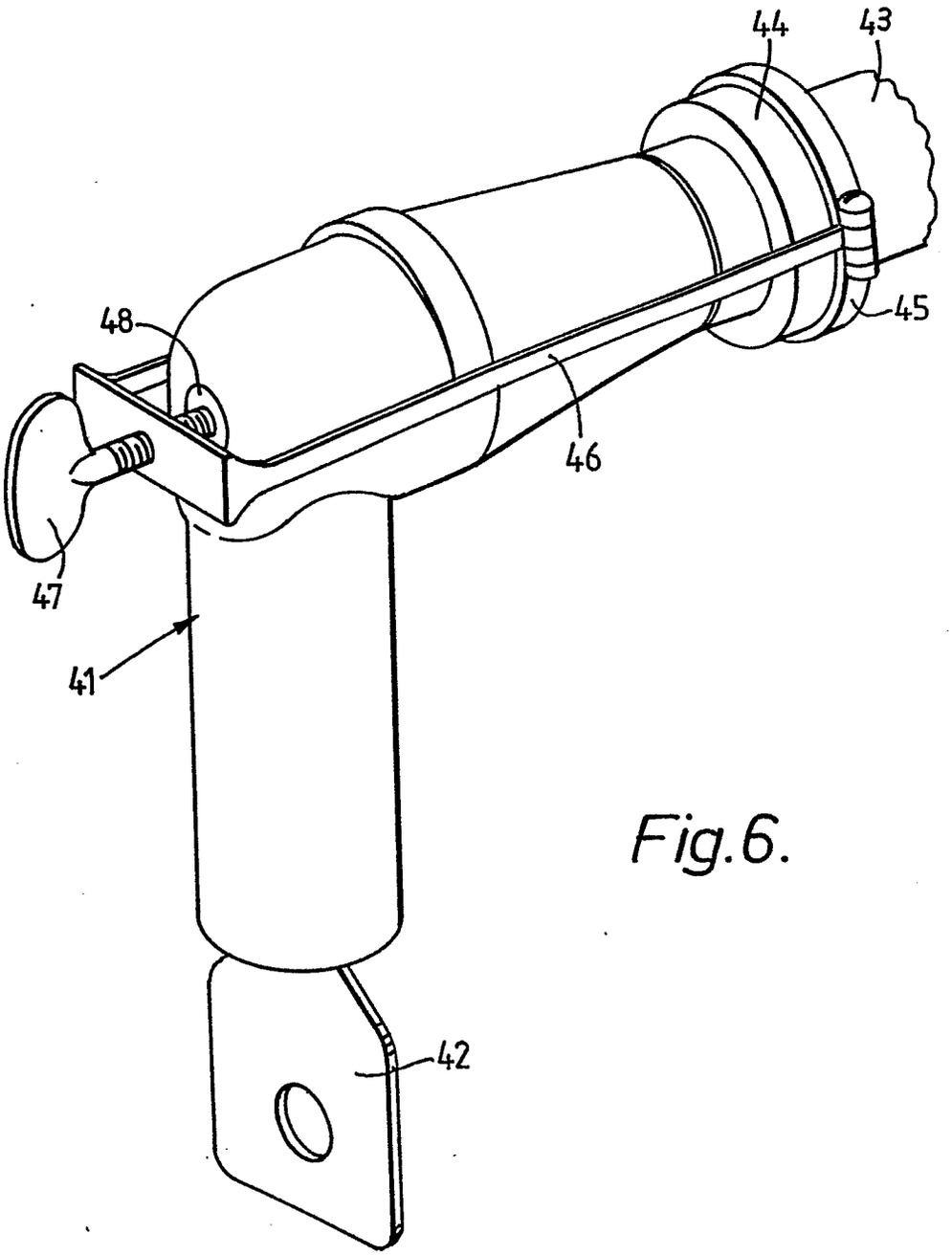

Fig.6.

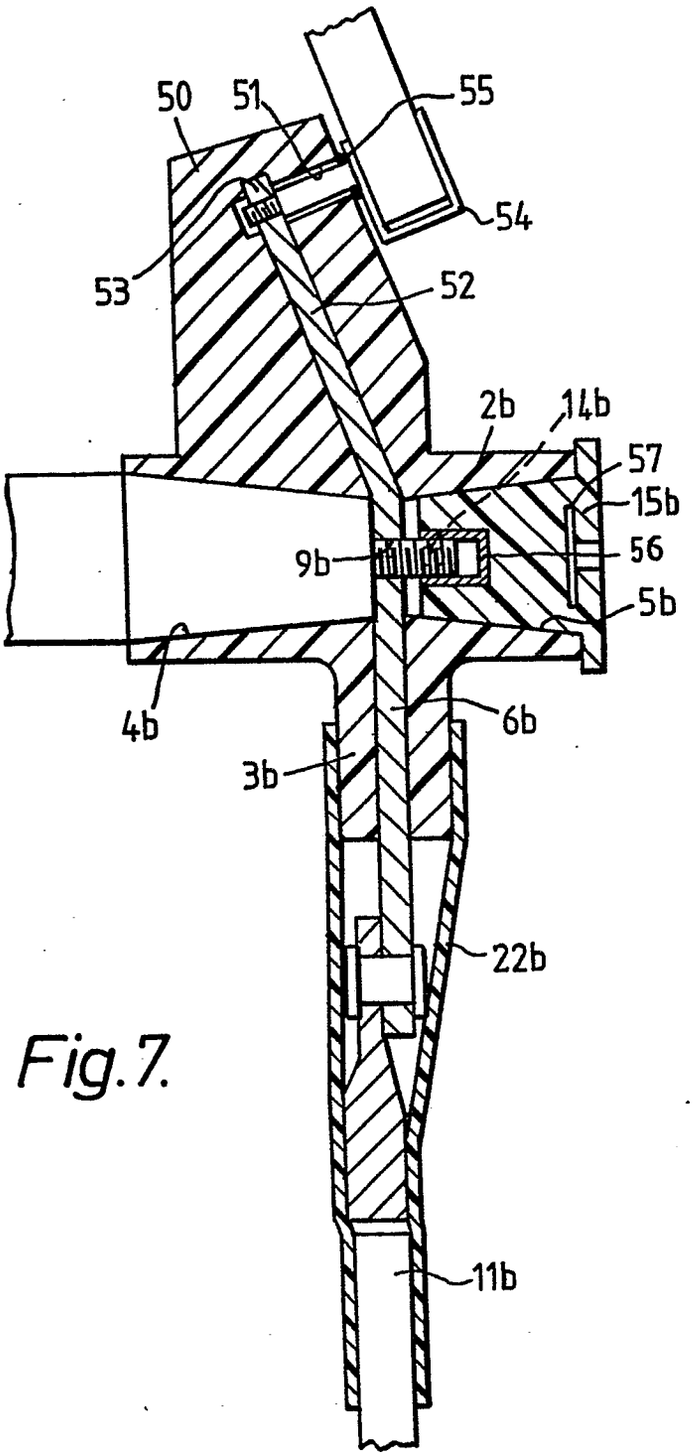

Fig.7.

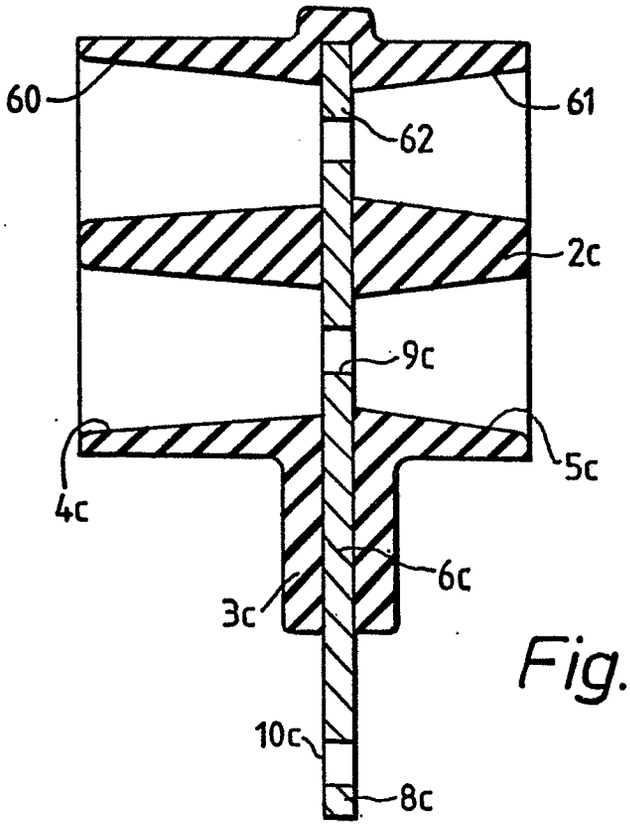

Fig.8.

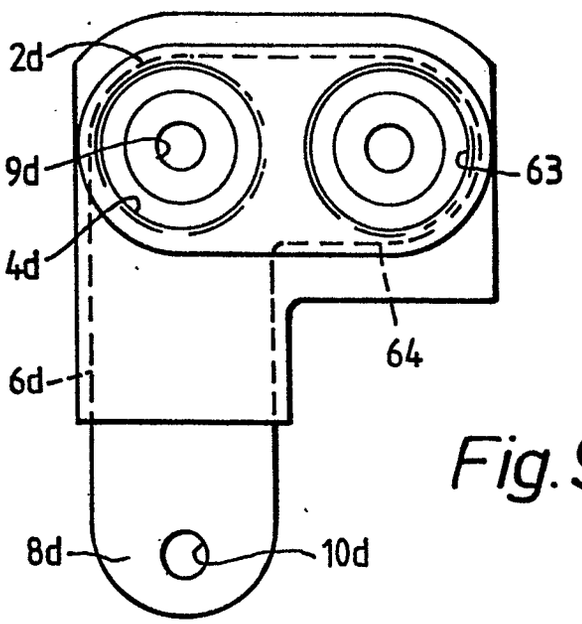

Fig.9.

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Fig. 10.

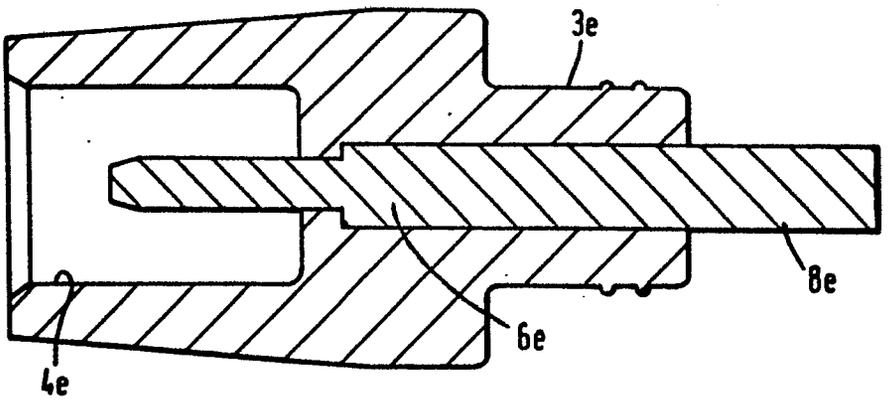
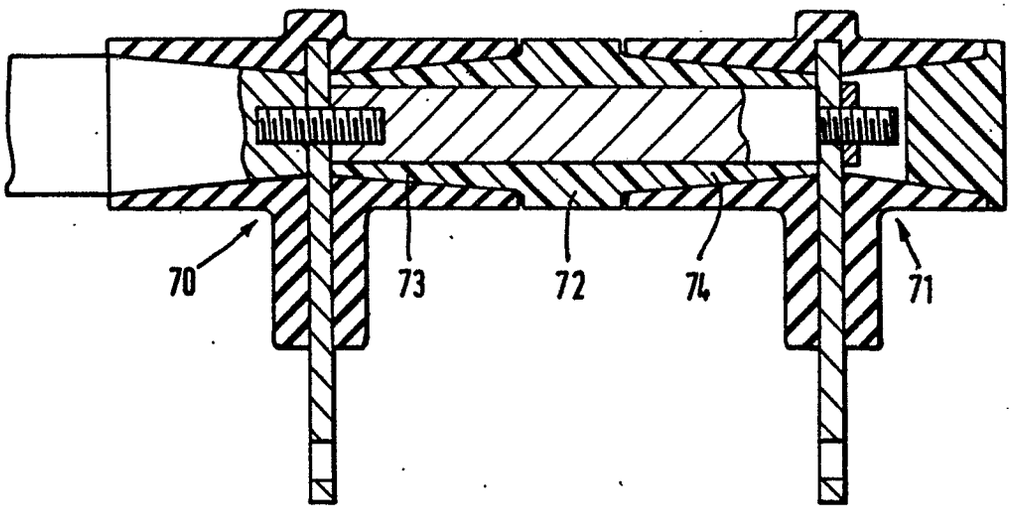


Fig. 11.



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EUROPEAN SEARCH REPORT

0087267
Application number

EP 83 30 0781

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
			H 01 R 13/53
A	CH-A- 356 177 (S.A. PARTICIPATIONS APPAREILLAGE GARDY) * Figures 3,4; page 1, line 41 - page 2, line 6 *	1,5-7, 10,13, 20	
A	DE-A-2 610 672 (GUTEHOFFNUNGSHÜTTE) * Figures 1,2; page 3, line 26 - page 5, line 12 *	1,10, 12,14, 20	
A	US-A-3 924 919 (ESCO MANUFACTURING) * Figure 1; column 2, lines 6-68 *	1,7,10 ,14,20 ,21	
			TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
A	US-A-3 883 208 (RTE) * Figures 1,3; column 1, line 62 - column 2, line 7; column 2, line 51 - column 3, line 7 *	1,5,10 ,14,16	H 01 R 13/00 H 01 R 4/00
A	GB-A-1 242 069 (JOSLYN MFG. AND SUPPLY CO.) * Figures 6-8; page 5, lines 57-111 *	1,18	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	30-05-1983	WAERN G.M.

CATEGORY OF CITED DOCUMENTS

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