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(54) Electrical connector

(57) The present invention relates to multi-contact connectors with an improved sealing arrangement that can provide reliable sealing against environmental influences, even for very thin cables and densely arranged contacts, and a corresponding manufacturing method. The sealing arrangement includes a block seal with a plurality of relatively large openings for receiving the contacts and the corresponding cables. Prior to inserting the contacts into a housing of the connector and through the respective openings in the block seal, each contact is individually fitted with a cable seal. Each cable seal has a through hole into which the cable is inserted and an outer shape that fits tightly into the respective opening of the block seal. Using such a combination of two sealing components facilitates the use of small insulation diameter cables with existing contacts and housings, thereby maintaining maximum contact pitch density.

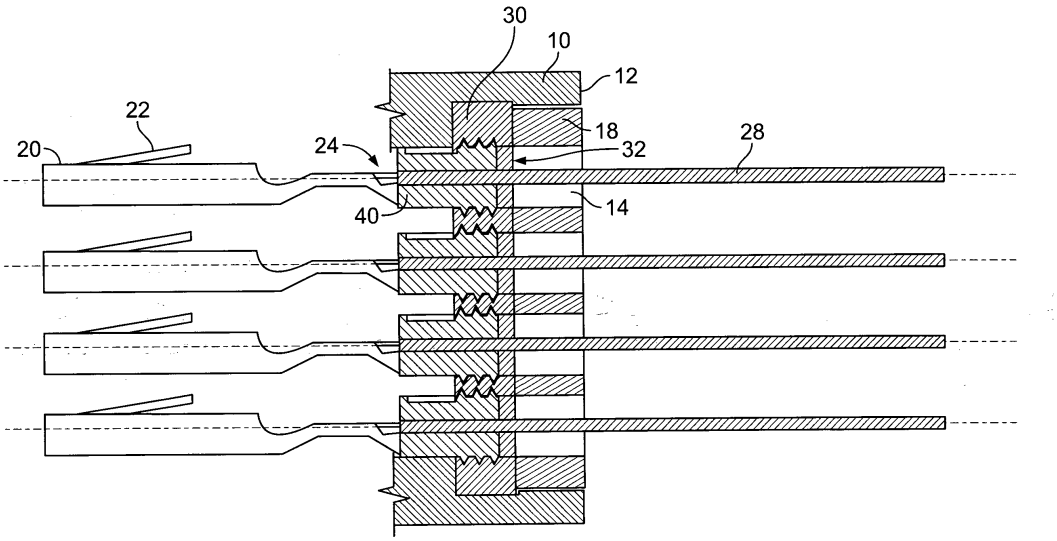


Fig. 1

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Description

TECHNICAL FIELD

[0001] This invention relates to an electrical connector having a sealing assembly for sealing a rear face of the connector through which contacts and cables are plugged when assembling the connector.

BACKGROUND OF THE INVENTION

[0002] Conventional multiple contact connectors comprise a plurality of contacts and an insulating housing having several openings or inserting slots on its rear face, i.e. the face opposite to the front face which couples to a corresponding connector. During manufacture of the connector, the contacts are crimped to a corresponding cable and inserted through the openings into the housing where they are kept in place by suitable latching members. The latching members are typically in the form of lances, i.e., small cantilever beams with one end joined to the contact and extending at an acute angle with the ends of the lances facing the rear of the contact. These so-called lanced contacts are generally stamped and formed out of suitable sheet material, e.g., copper, brass or phosphor bronze.

[0003] A high-density pin and socket electrical connector is known, for instance, from reference US 5,628,656, which discloses a pin and socket connector assembly with a stamped and formed pin contact and a stamped and formed socket contact received respectively in cavities of a cap housing and a matable plug housing. Both the pin and socket contacts have rigid retention ribs located on stabilization sections which cause the cylindrical stabilization sections to accurately inwardly deform as the contacts are inserted into the housing with the retention ribs engaging internal housing shoulders to lock the contacts in place. The socket contact has a socket terminal of generally triangular configuration with a seam formed by the terminal edges locate on one side and a slot stamped at the apex of the other sides of the terminal extending partially into the socket section. Rigid embossed dimples are located on the interior of the socket section to form fixed contact points for engaging a mating pin terminal.

[0004] Depending on the field of use, connectors need to be protected against environmental influences, in particular against dirt and humidity. Therefore, sealing is provided at the openings in the rear face of the housing, generally referred to as cable grommet seals.

[0005] Reference US 2006/189191 discloses an electrical connector comprising a block seal of an elastic material with a plurality of openings through which electrical contacts are plugged through or pierced through when assembling the electrical connector. The diameter of each opening is smaller than the external diameter of the cable to which the contact is fitted in order to ensure proper sealing.

[0006] However, the block seal configuration is problematic for very thin cables, i.e., cables with a diameter that is substantially smaller than the transverse dimensions of the contact, because the block seal can only be stretched to a certain extent when inserting the contacts. In fact, the cable diameter may not fall below a certain minimum cable diameter that is governed by the transverse dimensions of the contact and the elasticity of the block seal material.

[0007] Moreover, there is a risk that the block seal is damaged when the contacts are pierced through. This is particularly problematic if the outer dimensions of the contacts are substantially larger than the cable diameter, if the contact has sharp features, such as lanced contacts do, or if the contact is stamped so that the edges of the contact may have burrs which can damage portions of the block seal that come into contact with these edges. Cuts and tears in the profile of the block seal compromise its sealing performance.

[0008] Instead of providing a common block seal for all contacts, each contact may individually be fitted with a cable seal before inserting the contact into the housing. This is particularly advantageous for very small cable insulation diameters, because the contact itself does not need to pass through the cable seal aperture.

[0009] Reference EP 0599329 (A2), for instance, discloses a cable seal arrangement for waterproof electrical connectors. The cable seal is formed of an elastic material and is fitted with an electrical cable to be inserted into a housing of a waterproof electrical connector. The cable seal is then inserted into a cylindrical portion of the connector housing. The cable seal includes a seal body having a through aperture through which the electrical cable is inserted and a cover piece integrally formed on the seal body to project peripherally of the seal body. The cover piece is in contact with the whole peripheral edge of the circular opening in the housing through which the electrical cable is inserted.

[0010] Individual cable seals, however, are not the optimum solution for multi-contact connectors. Apart from the additional expenses for fitting each cable with an individual cable seal, there is also the problem that a pitch of the contacts within the connector has to be increased in order to make room for the cable seals.

[0011] Fig. 3 is a schematic diagram illustrating a longitudinal cross-section through a multi-contact connector with a conventional block seal. The connector comprises a housing 10 with an integrated block seal 30. The block seal is provided with a plurality of apertures through which contacts 20 and corresponding cables 28 have been inserting as part of the manufacturing process. A keeper plate 18 is arranged at the rear face of the connector in order to keep the block seal 30 in place. Each contact is provided with a cantilever 22 for locking the contact in the housing and with a crimping section 24 for crimping the contact to the conductor of the end of an insulated wire from which the insulation has been removed at the end of the wire, i.e., to the cable 28.

[0012] Figures 4A-C are schematic diagrams illustrating the pitch density of conventional multi-contact connectors without sealing, with block sealing, and with individual cable seals, respectively.

[0013] Figure 4A schematically shows a transverse cross-section through the housing of an unsealed multi-contact connector with 3-by-3 openings 14 for a total of nine contacts (not shown). The contacts are arranged in three rows, each row having three positions (openings) for inserting the corresponding contact. Each opening 14 is substantially rectangular with a recess 14a for latching the contact by means of the cantilever 22.

[0014] Figure 4B shows, in a manner similar to that of Fig. 4A, a transverse cross-section through the housing of a multi-contact connector with a block seal 30. The block seal 30 is provided with a plurality of apertures 32 for inserting the contacts (not shown), as explained above in conjunction with Fig. 3. As it is apparent from Fig. 4B, the pitch density of the unsealed connector can be maintained by using a suitably configured block seal.

[0015] Figure 4C shows, in a manner similar to that of Fig. 4B, a transverse cross-section through the housing of a multi-contact connector with individual cable seals 50. Each cable seal 50 is provided with an aperture 52 in which the cable (not shown) is inserted. As explained above, individual cable seals are especially suitable for thin cables.

[0016] As it is apparent from Fig. 4C in comparison to Figs. 4A and 4B, the density of the contacts has to be decreased (i.e., the pitch has to be enlarged) if individual cable seals are employed. The reason is that the diameter of cylindrical openings in the connector housing, into which the cable seals will be inserted, has to be large enough so that the (rectangular) contacts can be inserted. Hence, the diameter of the cylindrical openings, and therewith the outer diameter of the cable seals, is governed by the maximum transverse dimensions of the contacts.

SUMMARY OF THE INVENTION

[0017] The aim of the present invention is to overcome the above problems and to provide a multi-contact electrical connector with high contact density that is reliably protected against dirt and humidity, even if thin cables are employed.

[0018] This is achieved by the features as set forth in the independent claims.

[0019] Preferred embodiments are the subject matter of dependent claims.

[0020] It is the particular approach of the present invention to provide the electrical connector with a block seal having a plurality of apertures that are wide enough to allow the contacts to be inserted from the rear side of the connector and to provide each contact individually, prior to the insertion, with a cable seal that fits into an aperture of the block seal. In this manner, a dense contact arrangement and a safe sealing of the connector can be achieved, irrespective of the cable diameter.

[0021] According to a first aspect of the present invention, an electrical connector is provided. The electrical connector comprises a plurality of electrical contacts, a housing, and a sealing arrangement. Each electrical contact is fitted to a cable. A rear face of the housing is provided with at least one opening for inserting the plurality of electrical contacts when assembling the connector. The sealing assembly, which seals the at least one opening in the rear face of the housing, includes a block seal with a plurality of apertures, one aperture for each electrical contact of the plurality of electrical contacts, and a plurality of cable seals, each cable seal being fitted to the cable of one of the plurality of electrical contacts and into one of the plurality of apertures of the block seal.

[0022] According to a further aspect of the present invention, a method for manufacturing an electrical connector is provided. The method comprises the steps of fitting each of a plurality of electrical contacts with a cable and a cable seal, fitting a block seal into a housing, and inserting the plurality of electrical contacts into the housing so that each cable seal is fitted in the block seal. To this end, the block seal has a plurality of apertures, one aperture for each electrical contact of the plurality of electrical contacts, and the housing has a rear face with at least one opening. The plurality of electrical contacts is then inserted through the at least one opening in the rear face of the housing so that each cable seal is fitted into a corresponding one of the plurality of apertures in the block seal.

[0023] Preferably, the block seal and/or the cable seals are formed of an elastic material in order to ensure tight fit. Due to the combination of two sealing elements, however, the requirements for elasticity are relatively low and a comparatively hard elastic material may be used.

[0024] In a preferred embodiment, each electrical contact comprises a crimping section for crimping the electrical contact to a conductor of the cable and to an end portion of the cable seal. In this manner, both the cable and the cable seal can be fitted jointly or consecutively to the connectors in an simple process.

[0025] In a preferred embodiment, each cable seal is rotational symmetric (or substantially cylindrical) with an outer diameter that is greater than or equal to an inner diameter of the corresponding aperture in the block seal and has a through hole for inserting the corresponding cable, the through hole having a diameter that is smaller than or equal to an outer diameter of the corresponding cable. In this manner, a tight fit both of the cable seal within the aperture of the block seal and of the cable within the cable seal can be achieved.

[0026] In a preferred embodiment, a maximum transverse dimension of an electrical contact of the plurality of electrical contacts is substantially larger than an outer diameter of the corresponding cable, preferably at least twice or three times as large. Due to the combination of two sealing elements, a reliable sealing is provided even for very thin cables, i.e., cables that substantially thinner

than the corresponding electrical contact.

[0027] In a preferred embodiment, a maximum transverse dimension of an electrical contact of the plurality of electrical contacts is equal to or smaller than an inner diameter of the corresponding aperture in the block seal. With this configuration, the electrical contact can be inserted through the block seal aperture without incurring the risk of damaging the sealing arrangement.

[0028] In a preferred embodiment, a circumferential surface of a cable seal of the plurality of cable seals and an internal surface of a corresponding aperture in the block seal are profiled so that the cable seal is locked in place when being fitted into the aperture.

[0029] In a particularly preferred embodiment, the plurality of electrical contacts comprises a first electrical contact fitted to a first cable and a second electrical contact fitted to a second cable, an outer diameter of the first cable being different from an outer diameter of the second cable. Further, the plurality of cable seals comprises a first cable seal fitted to the first cable and a second cable seal fitted to the second cable, an outer diameter of the first cable seal being equal to an outer diameter of the second cable seal, each of the first and the second cable seal having a through hole for inserting the respective cable, a diameter of the through hole of the first cable seal and a diameter of the through hole of the second cable seal being different from each other and adapted to the outer diameter of the respective cable. In this manner, the connector can readily be fitted with cables having different insulation diameters without any need of modifying the common block seal or the housing.

[0030] Preferably, the contacts are configured as stamped and formed male contacts or as stamped and formed female sockets. Also, the contacts are preferably lanced-type contacts. In this manner, the existing contacts and housings can be employed.

[0031] Preferably, the contacts are arranged at multiple positions in multiple rows. Due to the combination of two sealing elements, the pitch density of conventional multi-contact connectors can be maintained.

[0032] The above and other objects and features of the present invention will become more apparent from the following description and preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a schematic diagram illustrating a longitudinal cross-section through a multi-contact connector according to an embodiment of the present invention,

Fig. 2 is a schematic diagram illustrating the pitch of contacts in a transverse cross-section of a multi-contact connector according to an embodiment of the present invention,

Fig. 3 is a schematic diagram illustrating a longitudinal cross-section through a multi-contact connector with a conventional block seal;

Fig. 4A is a schematic diagram illustrating the pitch of contacts in a transverse cross-section of a conventional unsealed multi-contact connector;

Fig. 4B is a schematic diagram illustrating the pitch of contacts in a transverse cross-section of a multi-contact connector with a conventional block seal;

Fig. 4C is a schematic diagram illustrating the pitch of contacts in a transverse cross-section of a multi-contact connector with conventional cable seals; and

Fig. 5 is a flowchart illustrating a process for manufacturing sealed multi-contact connectors according to an embodiment of the present invention.

DETAILED DESCRIPTION

[0033] Fig. 1 is a schematic diagram illustrating a longitudinal cross-section through a sealed multi-contact connector according to an embodiment of the present invention. The drawing is similar to that of Fig. 3, wherein like elements are denoted by like reference numerals.

[0034] The connector in Fig. 1 comprises a housing 10 with an integrated block seal 30. The block seal is provided with a plurality of apertures 32 that are wide enough to allow contacts 20 to be inserted via openings 14 in a rear face 12 of the housing. A keeper plate 18 is arranged at the rear face 12 of the connector in order to keep the block seal 30 in place. Each contact is provided with a cantilever 22 for locking the contact in the housing and with a crimping section 24 for crimping the contact to the conductor of the cable 28.

[0035] In addition to the common block seal 30, each contact is individually provided with a cable seal 40 that fits tightly into a corresponding one of the apertures 32 in the block seal 30. Each cable seal 40 has a through hole into which the cable 28 is inserted. The diameter of the through hole is adapted to the diameter of the cable insulation and may be substantially smaller than the dimensions of the respective aperture 32 in the block seal 30. In this manner, even connectors with very thin cables, i.e., cables with an insulation diameter that is substantially smaller than the transverse dimensions of the respective contact, can be reliably sealed.

[0036] The contacts 20 may be provided with a crimping section 24 for crimping the contact to the conductor of the cable 28. In a preferred embodiment, also the cable seal 30 is fixed to the contact by means of crimping. To this end, the crimping section may comprise two crimping portions for crimping the contact both to the conductor of the cable and to an end portion of the cable seal.

[0037] The cable seals may have a substantially cylindrical shape with an axial through hole for inserting the cable. More specifically, the cable seals may be rotationally symmetric with one or more sealing lips arranged along a circumferential line in order to improve sealing properties, as it is generally known in the art. An end portion of the cable seal may deviate from a main body of the cable seal in terms of its outer diameter or shape in order to facilitate its attachment to the contact, e.g. via crimping. The cable seals may also be provided with ring-shaped protrusions that lock the cable seal in place when properly fitted into the block seal.

[0038] The block seal 30 is provided with a plurality of apertures or openings 32 that are wide enough to allow the contacts 20 to be squeezed through when they are inserted during assembly of the connector. Therefore, the actual size of the apertures depends both on the transverse dimensions (diameter) of the contacts 20 and the flexibility of the block seal 30.

[0039] The shape of each aperture in the block seal may be adapted to the shape of the corresponding cable seal. In a preferred embodiment, all apertures are substantially circular and have the same diameter. The internal surface of the apertures may be profiled, e.g. with one or more circumferential recesses or ribs, in order to improve sealing properties. The inner profile of the apertures may correspond to an outer profile of the cable seals, e.g., so that the cable seal is locked in place when properly inserted.

[0040] The block seal and the cable seals may be made from any suitable material. In preferred embodiments, a permanently elastic material is selected, as it is commonly used in the art for sealing purposes, such as rubber, silicone, or another elastomer.

[0041] Figure 2 is a schematic diagram illustrating the pitch density of multi-contact connectors according to an embodiment of the present invention. Fig. 2 is similar to Figs. 4A-C, wherein like elements are denoted by like reference numerals.

[0042] Figure 2 schematically shows a transverse cross-section through the housing of a multi-contact connector with 3-by-3 openings 14 for a total of nine contacts (not shown), a block seal 30 (hatched), and a plurality of cable seals 40 (doubly hatched). The contacts are arranged in three rows, each row having three positions (openings) for inserting the corresponding contact. Each opening 14 is substantially rectangular with a recess 14a for latching the contact 20 by means of the cantilever 22 depicted in Fig. 1. It goes without saying that the present invention is neither restricted to the specific number of contacts and rows nor the particular arrangement of the contacts and openings, nor the particular form of the openings shown in Fig. 2.

[0043] The block seal 30 is provided with a plurality of apertures 32 for inserting the contacts (not shown), as explained above. A reliably sealing, even for very thin cables, is achieved by employing suitable cable seals 40. Each cable seal 40 has a through hole 42 with a diameter adapted to the respective cable (not shown). The outer dimensions of the cable seal 40 are adapted to the inner dimensions of the apertures 32 in the block seal 30 so that a tight fit is achieved.

[0044] As it is apparent from a comparison of Fig. 2 and Fig. 4A, the maximum pitch density of the unsealed connector can be maintained even for very thin cables by using a combination of a suitably configured block seal and a plurality of cable seals. Moreover, the combination of the two sealing elements facilitates the use of small diameter cables with existing contacts and housings.

[0045] In comparison to the conventional block seal-only configuration shown in Figs. 3 and 4B, the apertures in the block seal of the present invention may be made wider so that the block seal needs to provide only a very limited amount of elasticity in order to allow the contacts to be inserted. This facilitates the use of relatively hard elastomers for the block seal and the cable seals, therewith providing improved resistance against any deformation of the sealing due to side loads on the cable, as well as against deformations of the block seal into and occlusion of apertures in neighboring as yet unpopulated circuit positions. Moreover, the risk of tearing is substantially reduced, even with relatively large and sharp featured contacts, such as lanced-type contacts, and relatively hard elastomers. Further, depending on circumstances, the apertures in the block seal may even be made wide enough to afford a contact-free insertion of the electrical contacts.

[0046] Fig. 5 is a flowchart illustrating a process for manufacturing sealed multi-contact connectors according to an embodiment of the present invention.

[0047] The process may start in step S10, wherein each of a plurality of electrical contacts is fitted with a cable and a cable seal. In step S20, a block seal is fitted into a housing of the connector. As explained above, the block seal may have a plurality of apertures, one aperture for each electrical contact of the plurality of electrical contacts, and the housing may have a rear face with at least one opening. It is to be noted that step S10 and step S20 may also be performed concurrently or in reverse order.

[0048] Finally, in step S30, the plurality of electrical contacts is inserted through openings in the rear face of the housing so that each cable seal is fitted into a corresponding one of the plurality of apertures in the block seal.

[0049] Although in the above embodiments all block seal apertures and cable seals are of uniform shape and size, the present invention is not limited in this respect. While all apertures in the block seal may preferably be identical, the cable seals - in particular the diameter of their through holes - may actually differ in order to accommodate different types of cable, in particular cables with different diameter. In this manner, a highly flexible connector system may be provided that can be fitted with different types of cable merely by fitting each cable with the appropriate cable seal. The cable seal thus assumes

the function of an adapter that allows contacts to be inserted at any arbitrary position within the connector, irrespective of the type of cable attached. This degree of flexibility translates directly into reduced manufacturing costs.

[0050] Summarizing, the present invention relates to multi-contact connectors with an improved sealing arrangement that can provide reliable sealing against environmental influences, even for very thin cables and densely arranged contacts, and a corresponding manufacturing method. The sealing arrangement includes a block seal with a plurality of relatively large openings for receiving the contacts and the corresponding cables. Prior to inserting the contacts into a housing of the connector and through the respective openings in the block seal, each contact is individually fitted with a cable seal. Each cable seal has a through hole into which the cable is inserted and an outer shape that fits tightly into the respective opening of the block seal. Using such a combination of two sealing components facilitates the use of small insulation diameter cables with existing contacts and housings, thereby maintaining maximum contact pitch density.

Claims

1. An electrical connector, comprising
a plurality of electrical contacts (20), each electrical contact being fitted to a cable (28);
a housing (10) with a rear face having at least one opening (14) for inserting the plurality of electrical contacts (20) when assembling the connector; and
a sealing assembly (30, 40) for sealing the at least one opening (14) in the rear face of the housing,
characterized in that
the sealing assembly includes:

    a block seal (30) with a plurality of apertures (32), one aperture for each electrical contact of the plurality of electrical contacts; and
    a plurality of cable seals (40), each cable seal being fitted to the cable of one of the plurality of electrical contacts and into one of the plurality of apertures (32) of the block seal (30).

2. An electrical connector according to claim 1, wherein the block seal and/or the cable seals are formed of an elastic material.

3. An electrical connector according to any of the preceding claims, wherein each electrical contact (20) comprises a crimping section (24) for crimping the electrical contact (20) to a conductor of the cable (28) and to an end portion of the cable seal (40).

4. An electrical connector according to any of the preceding claims, wherein each cable seal (40) is rotationally symmetric with an outer diameter that is greater than or equal to an inner diameter of the corresponding aperture (32) in the block seal (30) and has a through hole (42) for inserting the corresponding cable (28), the through hole (42) having a diameter that is smaller than or equal to an outer diameter of the corresponding cable (28).

5. An electrical connector according to any of the preceding claims, wherein a maximum transverse dimension of an electrical contact of the plurality of electrical contacts (20) is substantially larger than an outer diameter of the corresponding cable (28), preferably at least twice or three times as large.

6. An electrical connector according to any of the preceding claims, wherein a maximum transverse dimension of an electrical contact of the plurality of electrical contacts (20) is equal to or smaller than an inner diameter of the corresponding aperture (32) in the block seal (30).

7. An electrical connector according to any of the preceding claims, wherein a circumferential surface of a cable seal of the plurality of cable seals (40) and an internal surface of a corresponding aperture (32) in the block seal (30) are profiled so that the cable seal (40) is locked in place when being fitted into the aperture (32).

8. An electrical connector according to any of the preceding claims,
wherein the plurality of electrical contacts (20) comprises a first electrical contact fitted to a first cable and a second electrical contact fitted to a second cable, an outer diameter of the first cable being different from an outer diameter of the second cable, and
wherein the plurality of cable seals (40) comprises a first cable seal fitted to the first cable and a second cable seal fitted to the second cable, an outer diameter of the first cable seal being equal to an outer diameter of the second cable seal, each of the first and the second cable seal having a through hole for inserting the respective cable, a diameter of the through hole of the first cable seal and a diameter of the through hole of the second cable seal being different from each other and adapted to the outer diameter of the respective cable.

9. An electrical connector according to any of the preceding claims, wherein the contacts are configured as stamped and formed male contacts or as stamped and formed female sockets.

10. An electrical connector according to any of the preceding claims, wherein the contacts are arranged at multiple positions in multiple rows.

11. An electrical connector according to any of the preceding claims, wherein the contacts are lanced-type contacts.

12. A method for manufacturing an electrical connector, comprising the steps of fitting each of a plurality of electrical contacts (20) with a cable (28) and a cable seal (40); fitting a block seal (30) into a housing (10), the block seal (30) having a plurality of apertures (32), one aperture for each electrical contact of the plurality of electrical contacts (20), the housing (10) having a rear face (12) with at least one opening (14); inserting the plurality of electrical contacts (20) through the at least one opening (14) in the rear face (12) of the housing (10) so that each cable seal is fitted into a corresponding one of the plurality of apertures (32) in the block seal (30).

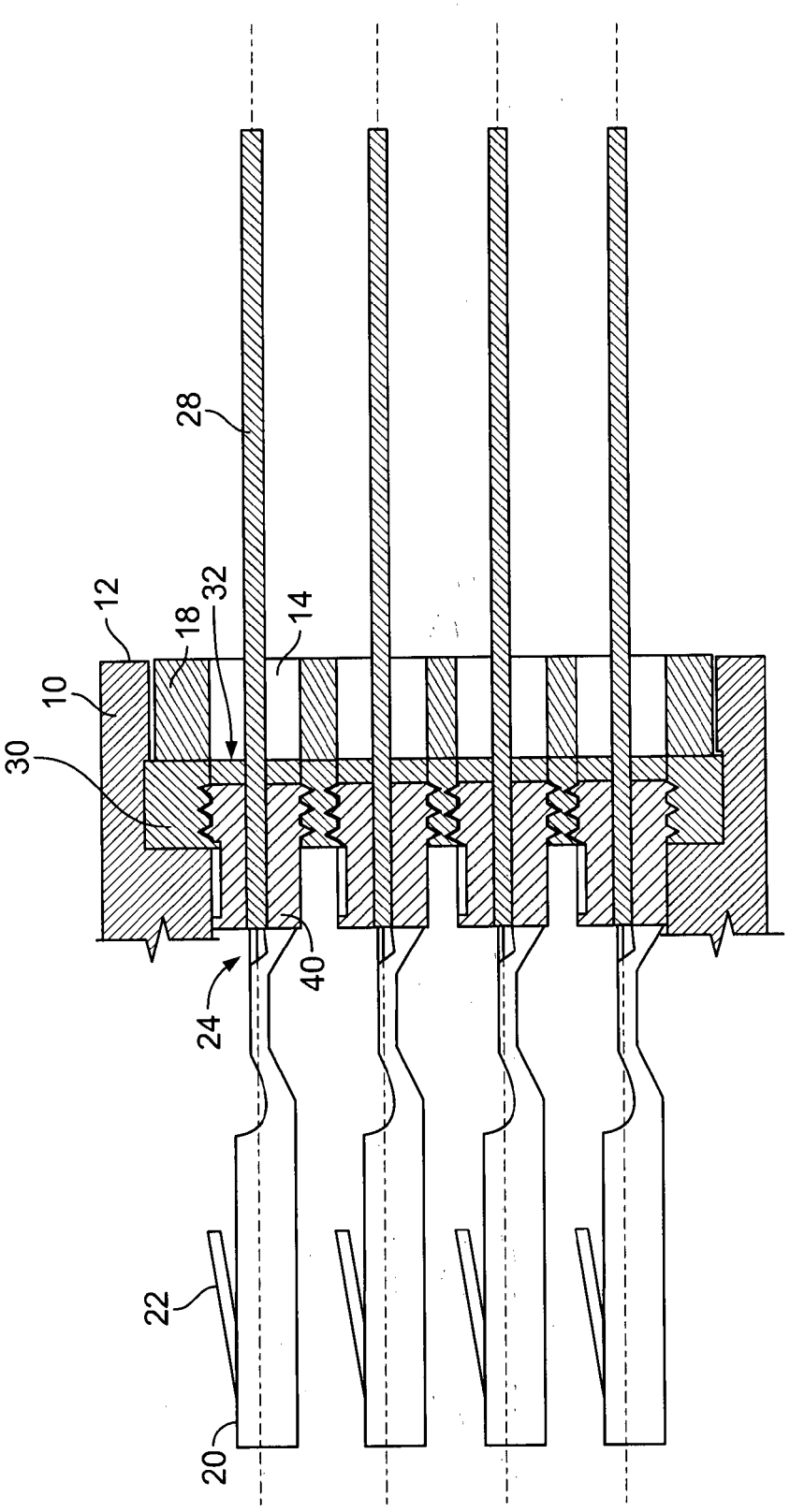


Fig. 1

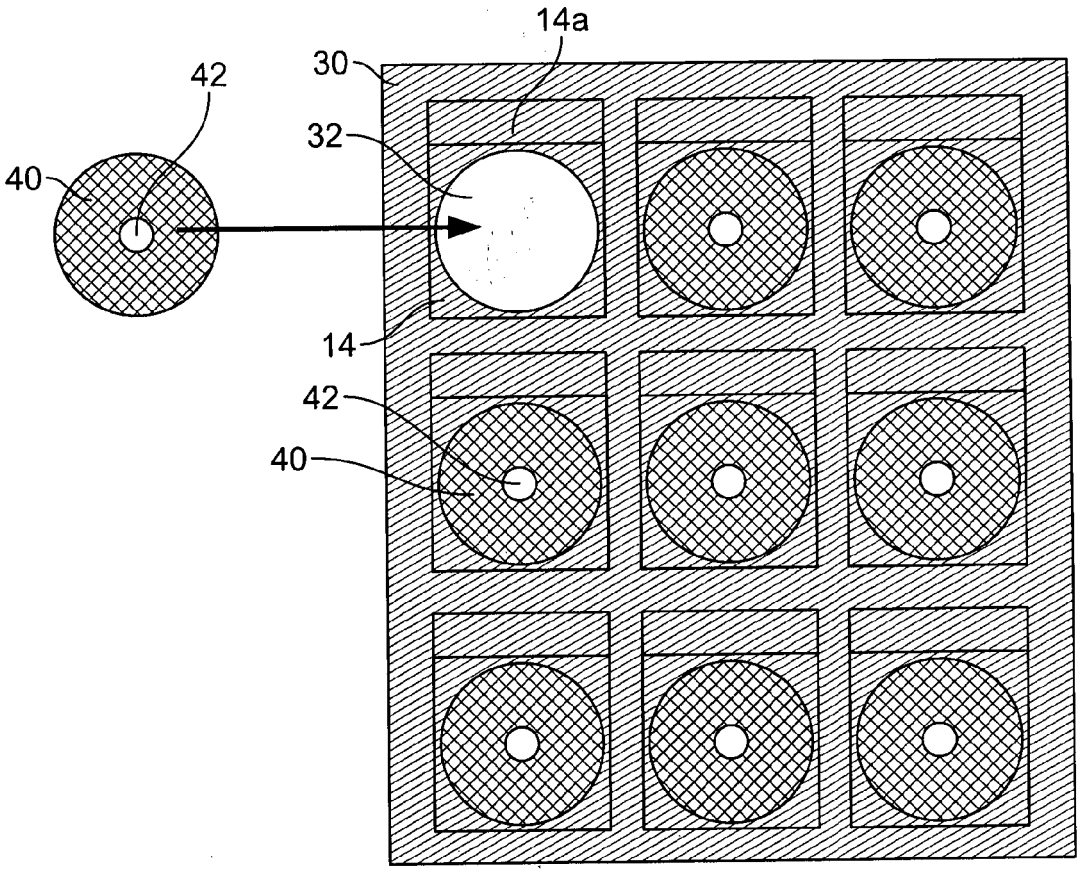


Fig. 2

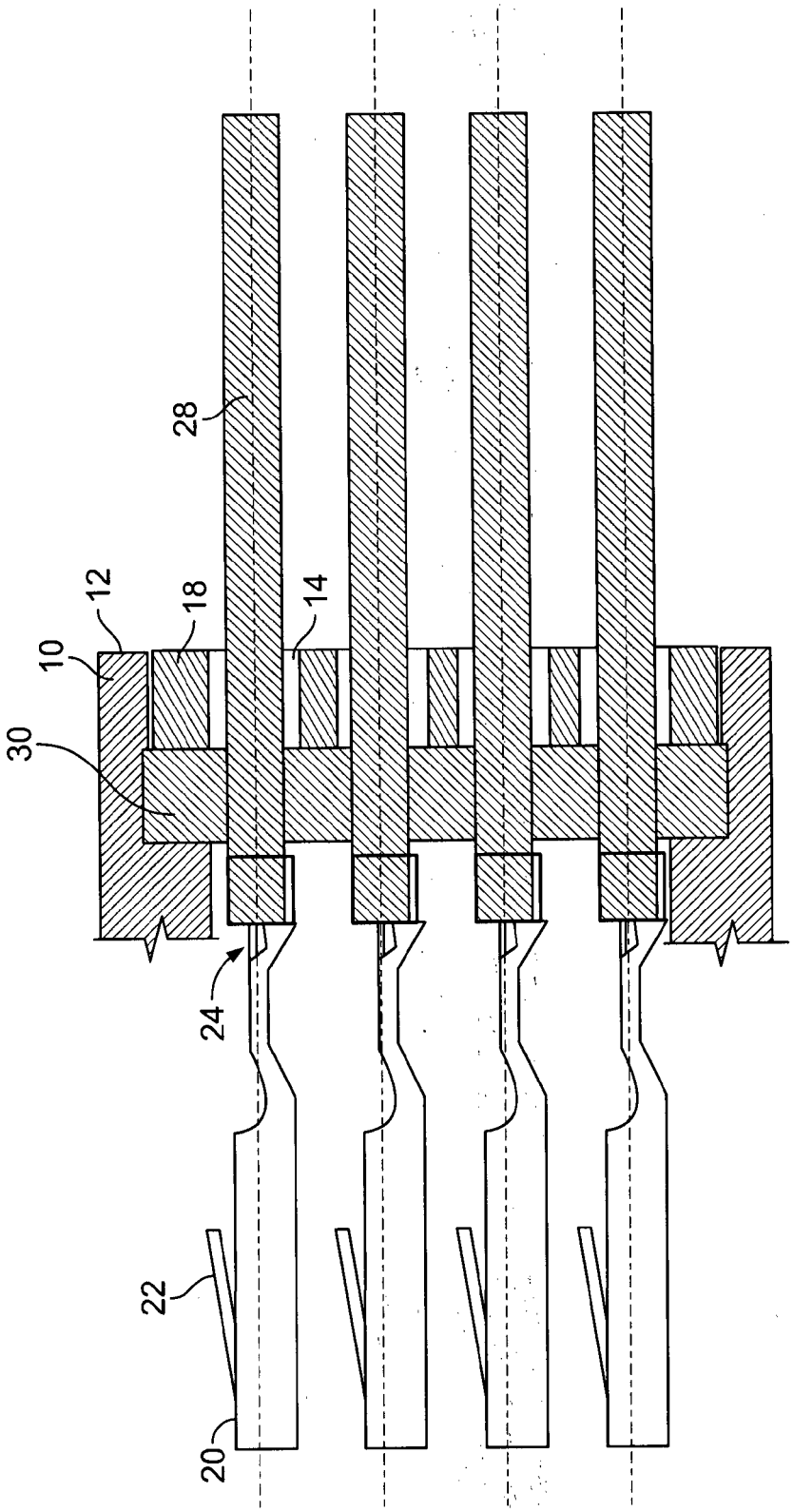


Fig. 3

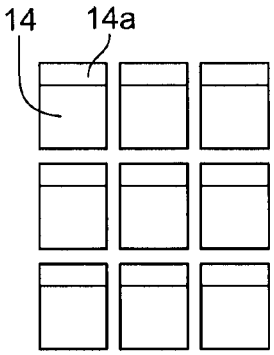


Fig. 4A

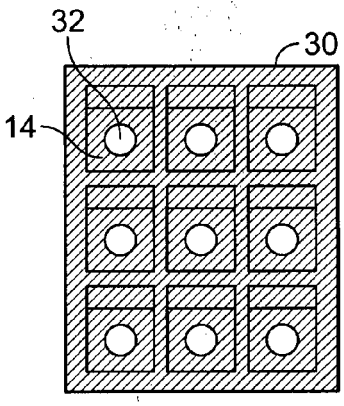


Fig. 4B

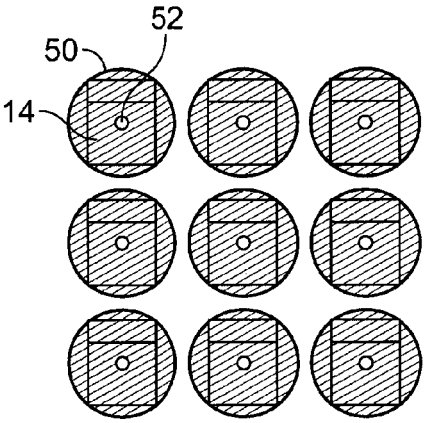


Fig. 4C

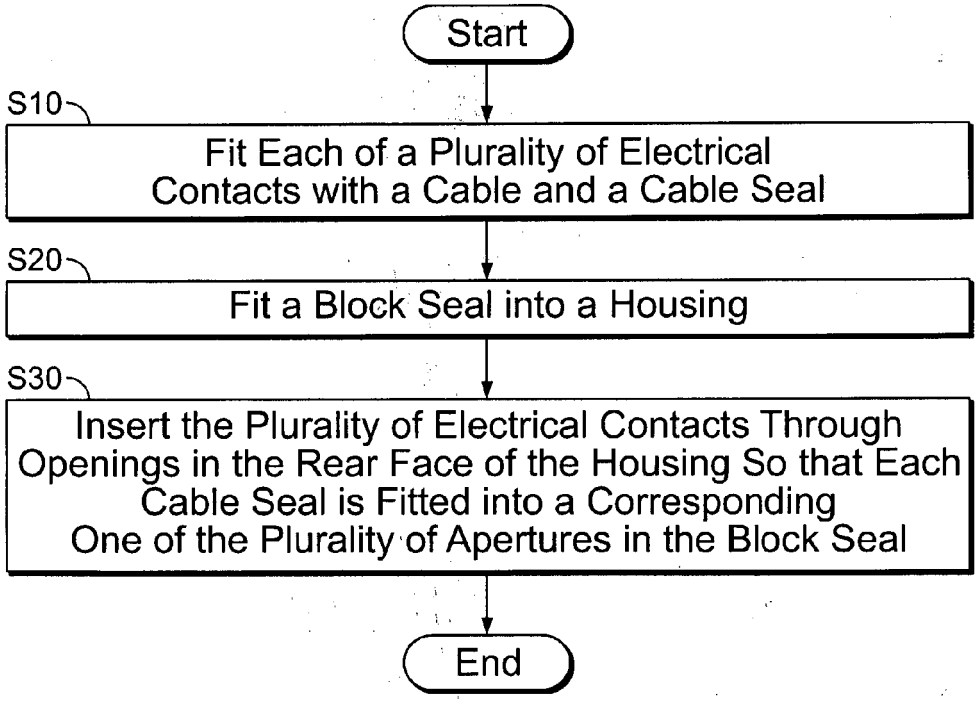


Fig. 5

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European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 9810

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 463 964 A1 (DELPHI TECH INC [US]) 13 June 2012 (2012-06-13) * paragraph [0025] - paragraph [0032]; claims 1-6; figures 1-6 *	1-12	INV. H01R13/52
X	EP 2 337 161 A1 (BOSCH GMBH ROBERT [DE]) 22 June 2011 (2011-06-22) * figures 1-6 *	1-12	
X	US 2011/086545 A1 (ISHIDA KEIKO [JP]) 14 April 2011 (2011-04-14) * paragraph [0037] - paragraph [0052]; figures 1-3 *	1-7,9-12	
X	WO 2004/025787 A1 (FRAMATOME CONNECTORS INT [FR]; CASSES CLAUDE [FR]; MULOT GERARD [FR]) 25 March 2004 (2004-03-25) * page 4 - page 6; figures 2-6 *	1-7,9-12	
X	EP 1 536 527 A1 (SUMITOMO WIRING SYSTEMS [JP]) 1 June 2005 (2005-06-01) * figures 1-5 *	1-7,9-12	
			TECHNICAL FIELDS SEARCHED (IPC) H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 December 2013	Vautrin, Florent

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 17 9810

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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12-12-2013

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