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(54) **PIN POPULATION DEVICE**

(57) The present invention relates to a pin population device for inserting connector pins, each connector pin comprising an internal mounting hollow at one end and a tip at the other, into a pin contact socket with an array of addressable holes, the pin population device comprising: a base; and one or more protrusions extending from the base, wherein the one or more protrusions are arranged

such that each protrusion corresponds with an addressable hole in the pin contact socket, and the shape and size of each protrusion is configured such that a connector pin internal hollow can be securely mounted on each protrusion, and such that the connector pin is removable from the protrusion on insertion into an addressable hole.

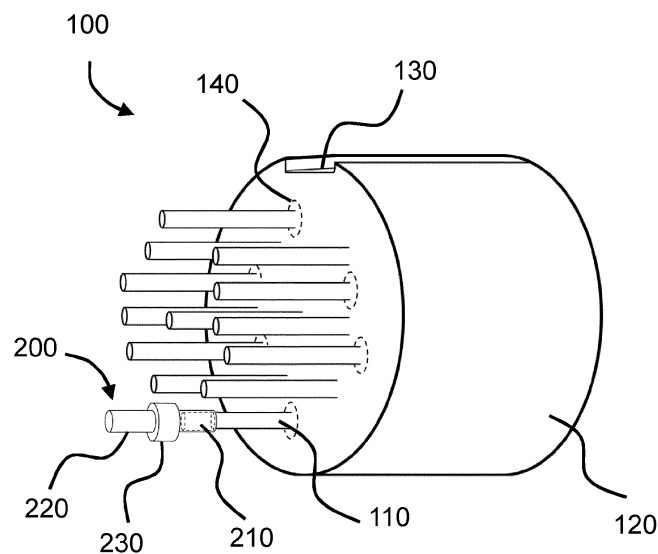


Fig. 1

Description

FIELD

[0001] The present invention relates to a pin population device, and more particularly to the population of a socket with customisable addressable holes arrangements, a method for populating pins of a socket and a calibration cap for calibrating a pin population device.

BACKGROUND

[0002] Connectors such as Amphenol® plug socket connectors are used for high ingress protection electrical connections. They comprise a multiple-pin contact socket and a corresponding plug.

[0003] During assembly of multiple-pin contact sockets with customisable layouts for electrical connections (such as Amphenol® connectors), pins are inserted into an internal gasket which can often comprise of a rubberised outer surface. The sockets can contain a large number of pins which often involve individual population. This can cause issues with consistency and precision as well as taking a significant amount of time to perform.

[0004] Additionally the individual pin insertion is often performed by hand using a contact pin gripping tool wherein incorrect insertion can damage the connector socket gasket, connector pin itself or any other part of the socket.

[0005] Additionally the tools used for population often compressively grip the exterior of the pins and the forces required for insertion can lead to damage of the exterior of the connector pins.

SUMMARY

[0006] According to a first aspect of the invention there is provided a pin population device for inserting connector pins, each connector pin comprising an internal mounting hollow at one end and a tip at the other, into a pin contact socket with an array of addressable holes, the pin population device comprising: a base; and one or more protrusions extending from the base, wherein the one or more protrusions are arranged such that each protrusion corresponds with an addressable hole in the pin contact socket, and the shape and size of each protrusion is configured such that a connector pin internal hollow can be securely mounted on each protrusion, and such that the connector pin is removable from the protrusion on insertion into an addressable hole.

[0007] The connector pin may be manufactured with an internal mounting hollow or a hollow may be excavated for use with the pin population device. The connector pin may be made from any conducting material and is manufactured such that the tip may be solid for increased conduction. The connector pin may comprise a lateral extension between the tip and internal mounting hollow to: demarcate the position the connector pin

should sit once populated in the socket, prevent over-insertion into the socket, and reduce the unwanted movement of connector pins after insertion into the socket. The tip of the connector pin may end in a flat face or may be rounded to aid insertion into a socket gasket, for example aiding insertion into the flexible outer surface of the gasket. When the socket is in use (after connector pin insertion) the socket will be matched with a corresponding plug such that the connector pins will create an electrical conducting connection between the plug and socket.

[0008] The secure mounting of each connector pin internal hollow to the one or more protrusions may be provided by a mechanical fit, whereby the shape and size is configured to be within a certain tolerance such that the connector pins once mounted on the protrusions are held in place by the frictional forces applied to the internal mounting hollow. It will be understood by the skilled person that the frictional forces and friction are interchangeable and are the effect of friction between the protrusion and connector pin such that any movement of the pin is resisted by a frictional force. The mechanical fit frictional forces may be substantial enough to prevent any connector pin movement until insertion into the socket gasket, for example this could be an interference fit. The frictional forces may be produced by a small tolerance in difference between cross sectional length of the protrusion and internal mounting hollow (e.g. 0.025mm). In another example, the secure mounting of each connector pin may be provided by an expandable and contractible lateral extension from the protrusion, such that the internal mounting hollow can be gripped and released. The secure mounting of the protrusions tends to distribute the force applied during pin insertion across the whole internal mounting surface area and as such prevents damage to the outside of the connector pin. Damage to the connector pin could compromise the functionality or safety of the electrical connection when the socket is in use.

[0009] The secure mounting of each connector pin internal hollow to the one or more protrusions may be provided by a frictional force relative to the addressable hole to which the connector pin is being inserted into. For example the friction between a protrusion and a pin internal mounting hollow may be lesser than the friction between the pin and an addressable hole after insertion, such that the protrusions (and as such the pin population device) are removable from the addressable holes leaving the pins in place - for example the addressable holes may be in a gasket within the connector socket. The mechanical fit can be achieved without electronics or expansion or barbed members as it relies on the interplay between frictional/compression forces during mounting.

[0010] The protrusions may extend from the base such that the pin population device is cast and/or printed in one process. In another example the protrusions may be manufactured separately and attached to the base using permanent methods such as welding.

[0011] The correspondence of each protrusion with an addressable hole may be configured such that every addressable hole is matched with a protrusion on the pin population device, such that during insertion of the device (in a particular an orientation) into the socket, every protrusion and hole is aligned and therefore any mounted pins can be successfully inserted into the corresponding addressable holes. In one example the number of protrusions may equal to the number of addressable holes. In another example the number of protrusions is greater than 28. In another example, there may be fewer protrusions than addressable holes, the fewer protrusions line up with one addressable hole each such that during insertion some addressable holes have no corresponding protrusion and as such no insertion of a connector pin. The corresponding of each protrusion with an addressable hole allows the connector pins mounted to the one or more protrusions to be inserted into the array of addressable holes simultaneously in a consistent method with all mounted pins receiving an equal "pushing" force into for example a socket gasket. Additionally the correspondence of the one or more protrusions and the layout of the addressable hole array reduces the risk of connector pin or socket damage by a misalignment of hole and pin during insertion.

[0012] The base and protrusion may be made from the same material, for example metal or plastic. In another example the base and protrusion are made of dissimilar materials such as plastic and rubber to give the protrusions extra friction for use in mounting the connector pins.

[0013] The shape of the pin population device base may be related to the socket the pin population device is populating with connector pins and the skilled person would understand the base can be customised to fit the required dimensions and shape of the socket. Additionally the skilled person would understand that the one or more protrusion layout of the pin population device could be customised to match the addressable hole layout. The secure fitting may require different shapes and materials depending on the materials and dimensions of the connector pins used by the socket and the internal mounting hollow. The base may be shaped to fit within the shape of the socket such that with shorter protrusions the base does not prevent a full insertion of the pins.

[0014] The cross-sectional shape of the one or more protrusions may correspond to the cross-sectional shape of the internal mounting hollow of the connector pins. The cross-sectional shape of both protrusion and internal mounting hollow may correspond such that each protrusion and internal mounting hollow are the same shape, for example both protrusion and internal mounting hollow may be cylindrical in nature. The corresponding cross-sectional shape reduces the chance of movement of the connector pin when mounted and as such greater accuracy of placement of each pin during insertion into the addressable hole array.

[0015] The cross-sectional shape of both protrusion and internal mounting hollow may correspond such that

the cross-sectional shape of the protrusion has a number of outlying edges that engage with the internal mounting hollow, for example the protrusion may be a hexagon in cross-sectional shape and the outer edges of the hexagon may be of a similar diameter to the diameter of a cylindrical internal mounting hollow. The protrusion and internal mounting hollow may have corresponding channel and protrusions such that the protrusion only fits into the internal mounting hollow in one orientation.

[0016] The dimensions of the cross-section of the shape of the one or more protrusions may be configured to allow the one or more protrusions to fit securely into the internal mounting hollow of the connector pins such that, at an axis defined along the length from the internal mounting hollow to the distal end of the connector pin, there is negligible translation or rotation of each pin relative to the corresponding protrusion.

[0017] The dimensions of the cross-section of the shape of the protrusions may for example be the diameter of a cylindrical protrusion cross-section.

[0018] The dimensions of the cross-section of the shape of the protrusions may be configured to be within a tolerance (e.g. 0.025mm) in comparison to the cross-sectional dimensions of the internal mounting hollow to create a mechanical fit such that the frictional force acting at the boundary between protrusion and internal mounting hollow holds the connector pin in place during insertion into the socket. The negligible translation or rotation of each connector pin reduces the chance of misalignment between mounted connector pin and addressable hole and as such allows a consistent insertion of the connector pins into the addressable holes and prevents damage to the connector pin or socket due to misalignment.

[0019] The length of the one or more protrusions may be equal to or greater than the length of the internal mounting hollow of the connector pins.

[0020] The protrusion length being at least equal to the internal mounting hollow allows the minimisation of any unwanted movement of the pin in respect to the protrusion to prevent misalignment during insertion and additionally may increase the frictional force present between internal mounting hollow and protrusion boundary. The one or more protrusions may comprise an array of protrusions which terminate in a common plane corresponding to a plane defined by the array of addressable holes in the pin contact socket.

[0021] The base and the common plane of termination may be parallel, or alternatively if the base and common plane of termination are dissimilar, the length of each protrusion may be configured to be dissimilar to end in a common plane corresponding to the plane of addressable holes. The corresponding termination and addressable hole plane allows each protrusion and mounted pin to be pushed simultaneously into the array of addressable holes the same distance. The array of protrusions terminating in a common plane allows multiple pins to be mounted and hence inserted into the addressable holes

simultaneously, hence significantly increasing pin population through-put in a period of time or actions for example in comparison to a single connector pin population method. Additionally a uniform pin population tool corresponding with the pin contact socket improves insertion consistency, repeatability and precision.

[0022] The base may comprise at least one visual feature for calibrating the orientation of the pin population device.

[0023] The visual feature may be additive or negative manufactured symbol such that the required orientation for insertion of the pin population device to the socket is visible to the user of the device, to allow alignment of mounted connector pins and the corresponding addressable holes via a correct orientation indicator and to prevent misalignment issues such as damage to pins and parts of the socket such as the gasket.

[0024] The at least one visual feature for calibrating the orientation of the pin population device may comprise a guide structure configured to fit around the exterior of the pin contact socket.

[0025] The guide structure prevents incorrect orientation insertion of the pin population device into the pin contact socket as the shape of the guide is similar to the contact socket, for example if the socket is cylindrical the guide will likewise be cylindrical and of the same length as required for pin contact insertion.

[0026] The at least one visual feature for calibrating the orientation of the pin population device may comprise a channel.

[0027] The channel allows the alignment of mounted connector pin and corresponding addressable holes by interlocking with an orientation ridge at the socket. Thus the pin population device will tend only to push into the socket when the orientation ridge fits into and guides motion along the channel.

[0028] The channel prevents misalignment where a purely visible feature could be missed or ignored as it prevents incorrect orientation insertion of relevant device or socket.

[0029] The base may comprise more than one calibration channel and at least two of the channels may be dissimilar in shape.

[0030] The at least two channels may be two shapes that cannot fit inside the other such that the base can only be inserted into the socket when corresponding extensions align with the respective calibration channels. Having at least two channels that are dissimilar in shape prevents incorrect orientation insertion, especially when rotational symmetry would allow an accidental wrong insertion. Additionally more than one calibration channel further reduces any unwanted movement during insertion.

[0031] The pin population device may contain at least a first and second portion of the one or more protrusions, and wherein the base may further comprise a visual indication identifying the first portion of one or more protrusions.

[0032] The visual indication may be an additive feature such as a small extension, bump or added symbol. The visual indication may be a subtractive feature such as a hole or countersink. The visual feature allows the user of the pin population device to distinguish between the first and other portions of the one or more protrusions without the need to consult external diagrams or work out from the addressable holes which protrusions require mounting and so constitute a portion. The first portion of protrusions may be half the number of protrusions. The portioning of protrusions to be mounted allows the separation of which protrusions to be mounted at a certain stage - for example the same pin population device could be used for a variety of different connector pin requirements as long as the addressable holes are in the same configuration - i.e. the same socket, but different pin requirements for different situations. The first portion of protrusions may be the maximum number of connector pin mounted protrusions in a specific layout that can be inserted into a socket gasket without causing problems such as the gasket expanding and preventing insertion to some addressable holes.

[0033] The one or more protrusions may further comprise a lateral extension, configured such that a connector pin when mounted on a protrusion sits on the lateral extension.

[0034] In an embodiment the lateral extension may extend to a width at least as far from the protrusion surface as the outside surface of the connector pin, as this would maximise the area to which force is applied to the extension from the connector pin during mounting and during insertion of the pins into the addressable holes.

[0035] The one or more protrusions may further comprise a lateral extension, the lateral extension is extended from an axis defined along the length of the connector pin from the internal mounting hollow to the tip end, the lateral extensions is located along the protrusion from the tip at a distance equal to or less than the length of the internal mounting hollow, such that a connector pin when mounted on a protrusion sits on the lateral extension.

[0036] The lateral extension prevents the over pushing of connector pins onto the protrusions and as such reduces damage to the internal of the pin, additionally provides a second surface to spread the stress forces that occur during insertion into the addressable holes such that all force isn't applied via the internal mounting hollow especially at the most inward section of the internal mounting hollow. Additionally the lateral extension aids in ensuring consistency of the positioning of pins during mounting and insertion by providing a uniform seating position.

[0037] The pin population device may further comprise at least one protrusion configured such that it is selectively deployable.

[0038] The at least one selectively deployable protrusion may be telescopic such that it can be pulled and locked out during use and then pushed away when not in

use. The selectively deployable protrusion may be slider mounted to a hole of similar size to the protrusion such that it can be pulled out of the base or completely pushed back inside the base when not in use. The selectively deployable protrusion may contain a twist catch such that the protrusion sits within a hole in the base when not in use and can be pulled out to a full extension and locked when in use.

[0039] The at least one selectively deployable protrusion allows the same pin population device to be used for different connector pin arrangements and/or for different addressable hole arrangements (i.e. different sockets) by for example retracting unwanted protrusion during the population of the different arrangements.

[0040] The pin population device may further comprise at least one protrusion configured such that it is removably attached to the base.

[0041] The at least one removably attached protrusion may for example be attached via an interference fit, magnetic joints, or a catch system such that the protrusion can be attached when needed for a specific socket pin requirement and easily removed when not.

[0042] The at least one removably attached protrusion may comprise a threaded root, and wherein the base further comprises at least one threaded hole such that the at least one removably attached protrusion is screwed to the base.

[0043] The at least one removably attached protrusion allows the same pin population device to be used for different connector pin arrangements and/or for different addressable hole arrangements (i.e. different sockets) by removing unwanted protrusion during the population of the different arrangements. This method is simpler and less likely to fail than more complicated methods wherein the pins remain attached to the base and prevent confusion during mounting of pins that result in the wrong protrusions being mounted by connector pins.

[0044] According to a further aspect of the invention there is provided, a calibration cap for calibrating a pin population device for inserting connector pins, comprising an internal mounting hollow at one end and a tip at the other end, into a pin contact socket with addressable holes, the calibration cap comprising:

a body, wherein; the face comprises holes configured to correspond with the pin population protrusions, wherein; the cross-sectional shape of the calibration cap holes is similar to the cross-sectional shape of the pin population device protrusions, and the cross-sectional dimensions of the calibration cap holes is similar to the cross-sectional dimensions of the protrusions such that the cap may be fitted onto the pin population device such that the holes maintain the alignment of the protrusions.

[0045] The cross-sectional dimensions of the calibration cap holes may be within a certain tolerance of the protrusion cross-sectional dimensions (e.g. 0.2mm) such that any bending or translation that has occurred during use can be demonstrated by the calibration cap no longer fitting over the protrusions of the pin population device

and as such prevents further use of the tool which could for example damage the internal mounting hollow of a connector pin or damage a socket hole gasket.

[0046] The length of the calibration cap from the pin population device entrance side to the protrusion holes at the other, may be equal to or longer than the length of the pin population device base such that the whole length of the pin population protrusions are checked for misalignment when inserted into the calibration cap. The calibration cap may also prevent pin population device from damage while not in use.

[0047] The depth of the face of the calibration cap comprising the calibration cap holes (and as such the depth of the holes), may be any depth such that the whole alignment of the pin population device protrusions can be checked for misalignment, for example if the protrusions are uniform in width then the depth of the holes can be from minimum structural depth tolerance (and extend fully through the calibration cap face) to the entire length of the protrusion. In another example where the protrusions are non-uniform along the length, a depth equal to the length of the protrusion may be required to match the non-uniformity.

[0048] In an embodiment the cross-sectional shape of the calibration cap holes is the same as the cross-sectional shape of the pin population device protrusions and both are cylindrical, such that any dents or damage from use can be demonstrated by the calibration cap no longer fitting over the protrusions.

[0049] The calibration cap ensures the pin population device protrusions' calibration and hence connector pin population remains consistent after many uses by checking the intended orientation against the current orientation. The calibration cap is simpler and faster than for example laser inspection to check for misalignment of pins and more precise than for example manual visual inspection.

[0050] The pin population device may comprise at least one channel for calibrating the orientation of the pin population device, and wherein the calibration cap may further comprise at least one calibration guide member configured to be of a similar size and shape such that the calibration guide member lines up with at least one channel for calibrating the orientation of the pin population device.

[0051] In one embodiment the protrusion and channel may both be rectangular in shape such that both sets of dimensions are the same within a small tolerance (eg 0.75mm) such that when the calibration cap protrusion slides into the calibration channel of the pin population device, all of the pin population protrusions in a non-damaged pin population device will align with the respective calibration cap holes.

[0052] In an embodiment the number of calibration cap holes should equal the maximum number of addressable holes available in the socket, such that every protrusion calibration is checked and in the case of selectively deployable pins or multiple devices for the same socket

the calibration cap can be used for checking all protrusions.

[0053] The calibration guide member and channel prevents misalignment of the orientation of pin population device and calibration cap wherein a purely visible feature could be missed or ignored and only allows the correct orientation insertion hence reducing the chance of user error.

[0054] The calibration cap may further comprise more than one calibration guide member and the pin population device comprising more than one channel for calibrating the orientation of the pin population device, wherein; at least two of the calibration protrusions are dissimilar in shape.

[0055] The at least two dissimilar in shape calibration protrusions and hence two dissimilar in shape calibration channels may be two shapes that cannot fit inside of each other such that the pin population device can only be inserted into the calibration cap when corresponding calibration protrusions align with the calibration channels. The at least two calibration protrusions dissimilar in shape prevents incorrect orientation insertion, especially when rotational symmetry would allow an accidental wrong insertion. Additionally more than one calibration channel further reduces any unwanted movement during insertion.

[0056] According to a further aspect of the invention there is provided a method for inserting connector pins, each connector pin comprising an internal mounting hollow at one end and a tip at the other, into a pin contact socket with an array of addressable holes using a pin population device, the pin population device comprising an array of protrusions, the method comprising;

i) mounting a plurality of connector pins on the array of protrusions, ii) aligning the connector pins with the addressable holes, iii) pushing the pin population device into the rear of the pin contact socket.

[0057] The mounting, aligning and pushing of the pin population device is completed by hand, in another each of the steps may be completed by machinery.

[0058] The method of mounting, aligning and pushing the pin population device into the pin contact socket allows the simultaneous populating of an array of connector pins into the socket in a consistent, accurate and efficient manner as all pins are inserted by the same device all experiencing the same forces.

[0059] The method, may comprise a step (iv) remove pin population device from the pin contact socket, leaving the connector pins inserted in the pin contact socket.

[0060] It will be understood by the skilled person that once the pins are inserted into the pin contact socket it is ready for use as an electrical connection, for example with a corresponding plug socket.

[0061] The method, step (ii) may be completed using a press device as the pressure applied can be more directly applied to prevent damage to the protrusions and connector pins and allow a uniform insertion and repeatability of this uniformity on subsequent insertions.

[0062] The pin population device may contain at least a first and second portion of protrusions, and in steps (i) to (iii) of the method are performed for the first portion of protrusions, and then steps (i) to (iii) are performed for the second portion of protrusions.

[0063] In an embodiment the portioning of protrusions is configured such that the protrusions mounted and inserted in one portion are equally spaced out between others to be mounted and inserted in subsequent portions to prevent bunching (or other forms of encroachment) of the addressable hole gasket which can occur if too many pins are pushed simultaneously into addressable holes in a tight area and can cause unwanted blocking of an addressable hole.

[0064] Splitting the portion of protrusion mounted and inserted into the connector limits the stresses experienced by the socket addressable holes and especially in the case of a gasket covered socket, reduces the stress and strain occurring in one insertion to prevent any unwanted gasket deformation.

[0065] The first and second proportion number of protrusions may be decided dependent on the maximum number of pins able to be inserted into the pin contact socket at the same time without causing problems such as gasket bunching.

[0066] The pin population device may be provided with visual indications identifying the first portion, and differently-visual indications identifying the second portion such that steps (i) to (iii) of the method are performed for the first portion of similar visually indicated protrusions, and then steps (i) to (iii) are performed for the differently-visual or non-visually indicated protrusions second portion of protrusions.

[0067] The visual indications may be an additive feature such as a small extension, bump or added symbol. The visual indication may be a subtractive feature such as a hole or countersink. The visual feature allows the user of the pin population device to distinguish between the first and second portions of the array of protrusions without the need to consult external diagrams or work out from the addressable holes which protrusions require mounting and so constitute that portion. Additionally the differently-visual or non-visually indicated protrusions aids in identifying which pins are to be mounted at which point in the method to prevent user error.

[0068] Step (i) of the method may comprise using a jig suitable for holding the required number of pins in the same orientation to mount the plurality of connector pins on the array of protrusions.

[0069] The jig may be a vibratory bowl feeder, such that the jig orientates the pins and allows the insertions of all required connector pins onto the protrusion by a simple feeding method with perhaps a separate press to ensure full mounting of all connector pins to the protrusions.

[0070] The jig prevents user error during the mounting of connector pins to the protrusions and aids in faster mounting and allows the easier automation of the connector pin mounting stage.

[0071] Before step (i) of the method, the calibration of the pin population device array of protrusions may be checked using a calibration cap.

[0072] The pin population device may be provided with a channel for calibrating the orientation of the pin population and step (ii) of the method further comprises aligning the channel with the pin contact socket.

BRIEF DESCRIPTION OF THE FIGURES

[0073] Embodiments of the invention will now be described by way of example only with reference to the figures, in which:

Figure 1 shows a pin population device and a mounted connector pin;

Figure 2 shows a connector pin comprising an internal mounting hollow and a tip;

Figure 3 shows a pin population device comprising a lateral extension on a protrusion, and a connector pin mounted on one of the protrusions;

Figure 4 shows a pin population device a calibration channel and a visual feature for calibrating the orientation and a connector pin mounted on one of the protrusions;

Figure 5 shows a pin population device comprising an array of protrusions, a base comprising: two dissimilar calibration channels;

Figure 6 shows a cross-section of a pin contact socket with a connector pin inserted in the socket gasket;

Figure 7 shows a plan view of a pin population device;

Figure 8 shows a pin population device comprising a removable protrusion;

Figure 9a shows a calibration cap comprising holes and a calibration protrusion;

Figure 9b shows a calibration cap and an a pin population device

Figure 10 shows an example method according to the invention.

DETAILED DESCRIPTION

[0074] With reference to Figure 1, a pin population device 100 comprises an array of protrusions 110 and a base 120

[0075] The base 120 has a cylindrical drum form and the protrusions 110 extend from a first flat circular face thereof.

[0076] The protrusions 110 are elongate cylindrical members and extend perpendicularly from a root at the flat circular face to a distal tip. The distal tips of the protrusions 110 lie in a common plane.

[0077] The protrusions 110 are approximately as long as the base is deep.

[0078] The array is such that the protrusions 110 are evenly distributed over the first face, according to a

diamond spacing pattern.

[0079] The array of protrusions 110 comprises 13 protrusions.

[0080] The base 120 comprises: one calibration channel 130 and a visual indication identifying a first portion of one or more protrusions 140.

[0081] The calibration channel 130 has the form of a rectangular notch or groove running down the curved outer surface of the drum, and along a path parallel with the axis defined by the base 120.

[0082] The visual indication 140 has the form of a graphic circle around the root of each protrusion 110 of the portion.

[0083] Each protrusion 110 is for receiving a connector pin 200. A connector pin 200 is mounted onto a protrusion 110 in Figure 1.

[0084] Each connector pin 200 has the form of an elongate cylindrical member with a central wider lateral extension 230 for use during population. The end of the member nearest the pin population device comprises an internal mounting hollow 210 of the same cylindrical shape and similar cross-sectional dimensions to the protrusion 110 such that the protrusion 110 sits inside of the connector pin 200.

[0085] At the distal end of the connector pin 200 is a tip 220 with a flat circular face and between tip and internal mounting hollow 210 end is a cylindrical lateral extension 230 extending approximately half as far as the connector pin 200 diameter.

[0086] Accordingly the connector pin 200 in this example is mechanically fit mounted to the protrusion 110.

[0087] With reference to Figure 2 a connector pin 200 comprises an internal mounting hollow 210, a tip 220 and a lateral cylindrical expansion 230. The connector pin 200 is the equivalent to the connector pin 200 in Figure 1 and functions accordingly.

[0088] With reference to Figure 3 a pin population device 100 is equivalent to the pin population device of Figure 1 and functions accordingly. The pin population device 100 further comprises one protrusion comprising a cylindrical lateral extension 310. The cylindrical lateral extension 310 extends perpendicular to length of the protrusion and extends to approximately double the diameter of the internal mounting hollow 210. The cylindrical lateral extension 310 has a similar depth to the connector pin cylindrical extension 230 and is positioned at a length, from the tip of the protrusion 110, equal to the length of the internal mounting hollow 210.

[0089] With reference to Figure 4 a pin population device 100 is equivalent to the pin population device of Figure 1 and functions accordingly. The pin population device 100 further comprises one visual feature for calibrating the orientation of the device 410. The visual feature 410 takes the form of an arrow pointing in the opposite direction to the channel 130 situated touching the rim of the pin population device 110 on the same face from which the protrusions 110 extend.

[0090] With reference to Figure 5 a pin population

device 100 is equivalent to the pin population device of Figure 1 and functions accordingly. The pin population device 100 further comprises another calibration channel 510 that is dissimilar to the channel 130 shown in Figure 1. The calibration channel 510 has the form of a triangular notch or groove running down the curved outer surface of the drum, and along a path parallel with the axis defined by the base 120.

[0091] With reference to Figure 6 a pin contact socket 600 comprises socket walls 650 and a gasket 610. The socket walls 650 are longer than the length of the connector pin 200 and thicker at the front of the socket 640 where the gasket 610 is held and thinner at the rear of the socket 630.

[0092] The gasket 610 is, in the Figure 6 viewing plane, trapezoidal in shape and of a thickness from rear to front less than that of the tip end 220 of a connector pin 200. The gasket 610 is held in cut-outs in the socket walls 650, the cut-outs have the same form as that of the area of gasket 610 that extends into the socket wall 650. The cut-outs widen towards the rear of the thicker section socket to match the widening of the gasket 610 that extends into the socket wall 650. The gasket 610 comprises an addressable hole 620 extending completely through the gasket 610, a similar width and shape to the inserted connector pin 200, of a uniform width along the length.

[0093] The inserted connector pin 200, equivalent to the connector pin of Figure 1 and functions accordingly, is fully inserted up to the lateral extension 230 in one of the addressable holes 620 in the pin contact socket gasket 610, with the tip 220 end facing out the front of the socket 640 and the internal mounting hollow end 210 facing out the back of the socket 630.

[0094] With reference to Figure 7 a pin population device 100 is equivalent to the pin population device of Figure 1 and functions accordingly. The pin population device 100 is shown in a plan view without a mounted connector pin 200 looking at the face from which the protrusions 110 extend.

[0095] With reference to Figure 8 a pin population device 100 is equivalent to the pin population device of Figure 1 and functions accordingly. The pin population device 100 further comprises a threaded hole 820 of the same form and length as the threaded portion of a threaded protrusion 810. The threaded protrusion 810 non-threaded section is equal in length to the other protrusions 110 such that after screwed insertion the protrusions distal tips all lie in a common plane.

[0096] With reference to Figure 9a a calibration cap 900 comprises a calibration guide member 930 and a face 920 comprising holes 910.

[0097] The calibration cap 900 is of a cylindrical drum form, with a cylindrical hollow, closed at the face 920 and open at the other end 940. The calibration cap cross-sectional shape and cross-sectional dimensions and longest length are similar to a pin population device 100. The distal end of the face 920 comprises an array of circular holes 910 that are evenly distributed over the

face 920, according to a triangular spacing pattern and extend fully through the face 920.

[0098] The open end 940 of the calibration cap 900, comprises a mostly circular opening with a calibration guide member 930. The calibration guide member 930 is that of a rectangular ridge running down the curved inner surface of the drum, and along a path parallel with the axis defined by the calibration cap 900 length.

[0099] With reference to Figure 9b a calibration cap 900 is equivalent to the pin population device of Figure 9a and a pin population device 100 is equivalent to the pin population device of Figure 1 without a mounted connector pin 200. The pin population device 100 is shown to fit inside of the calibration cap with the arrow 950, the calibration guide member 930 aligns with the calibration channel 130 and the array of protrusions 110 align with the holes 910.

[0100] With reference to Figure 10 in operation, a pin population device 100 may be used to populate a socket 600 with connector pins 200 as follows:

At step 1010, mount a plurality of connector pins 200 on the array of protrusions 110;

At step 1020, align connector pins 200 with addressable holes 620; and

At step 1030, push pin population device 100 into the rear of the contact socket. Thereby pushing the pins 200 through the gasket 610 of the contact socket 600.

[0101] The operator is then able to remove the pin population device 100 from the contact socket 600. The grip strength of the contact socket 600 on the inserted pins 200 is greater than the grip strength of the protrusions 110 on the mounted pins 200. Thus removing the pin population device 100 tends to withdraw the protrusions 110 from their pins 200 leaving the connector pins 200 inserted in the pin contact socket 600.

[0102] The pin contact socket 600 with inserted connector pins 200 is ready for use and the skilled person can now insert the related plug socket to form a required electrical connection.

[0103] In a second scenario with a high number of connector pins requiring insertion, in operation a pin population device 100 may be used to populate a socket 600 with connector pins 200 as follows:

Mount a plurality of connector pins 200 on the array of protrusions for the first portion of similar visually indicated protrusions

1020 Align mounted connector pins 200 with addressable holes 620

1030 Push pin population device 100 into the rear of pin contact socket 630

Remove pin population device 100, leaving the connector pins inserted in the pin contact socket 600.

[0104] Mount a plurality of connector pins 200 on the

array of protrusions 110 for the differently-visual or non-visually indicated protrusions second portion of protrusions.

[0105] Align mounted connector pins 200 with addressable holes 620.

[0106] Push pin population device 100 into the rear of pin contact socket 600.

[0107] Remove pin population device 100, leaving the connector pins 200 inserted in the pin contact socket 600.

[0108] The pin contact socket 600 with inserted connector pins 200 is ready for use and the skilled person can now insert the related plug socket to form a required electrical connection with the socket.

Claims

1. A pin population device for inserting connector pins, each connector pin comprising an internal mounting hollow at one end and a tip at the other, into a pin contact socket with an array of addressable holes, the pin population device comprising:

a base; and
one or more protrusions extending from the base,

wherein

the one or more protrusions are arranged such that each protrusion corresponds with an addressable hole in the pin contact socket, and the shape and size of each protrusion is configured such that a connector pin internal hollow can be securely mounted on each protrusion, and such that the connector pin is removable from the protrusion on insertion into an addressable hole.

2. The pin population device according to claim 1, wherein the cross-sectional shape of the one or more protrusions corresponds to the cross-sectional shape of the internal mounting hollow of the connector pins.
3. The pin population device according to any one of claims 1 or 2, wherein the dimensions of the cross-section of the shape of the one or more protrusions is configured to allow the one or more protrusions to fit securely into the internal mounting hollow of the connector pins such that, at an axis defined along the length from the internal mounting hollow to the distal end of the connector pin, there is negligible translation or rotation of each pin relative to the corresponding protrusion.
4. The pin population device according to any preceding claim, wherein the one or more protrusions com-

prises an array of protrusions which terminate in a common plane corresponding to a plane defined by the array of addressable holes in the pin contact socket.

5. The pin population device according to any preceding claim, wherein the base comprises at least one visual feature for calibrating the orientation of the pin population device.
6. The pin population device according to claim 5, wherein the at least one visual feature for calibrating the orientation of the pin population device comprises a channel.
7. The pin population device according to claim 6, wherein the base comprises more than one calibration channel and at least two of the channels are dissimilar in shape.
8. The pin population device according to any preceding claim, wherein the pin population device contains at least a first and second portion of the one or more protrusions, and wherein the base further comprises a visual indication identifying the first portion of one or more protrusions.
9. The pin population device according to any preceding claim, wherein the one or more protrusions further comprise a lateral extension, configured such that a connector pin when mounted on a protrusion sits on the lateral extension.
10. The pin population device according to any preceding claim, wherein at least one protrusion is configured such that it is selectively deployable.
11. A calibration cap for calibrating a pin population device for inserting connector pins, comprising an internal mounting hollow at one end and a tip at the other end, into a pin contact socket with addressable holes, the calibration cap comprising:

a body, wherein;
the face comprises holes configured to correspond with the pin population protrusions, wherein;

the cross-sectional shape of the calibration cap holes is similar to the cross-sectional shape of the pin population device protrusions, and
the cross-sectional dimensions of the calibration cap holes are similar to the cross-sectional dimensions of the protrusions such that the cap may be fitted onto the pin population device such that the holes maintain the alignment of the protrusions.

12. The calibration cap according to claim 11, the pin population device comprising at least one channel for calibrating the orientation of the pin population device, and wherein the calibration cap further comprises at least one calibration guide member configured to be of a similar size and shape such that the calibration guide member lines up with at least one channel for calibrating the orientation of the pin population device. 5 10
13. A method for inserting connector pins, each connector pin comprising an internal mounting hollow at one end and a tip at the other, into a pin contact socket with an array of addressable holes using a pin population device, the pin population device comprising an array of protrusions, the method comprising; 15
- i) mounting a plurality of connector pins on the array of protrusions,
 - ii) aligning the connector pins with the addressable holes, 20
 - iii) pushing the pin population device into the rear of the pin contact socket.
14. The method for populating pins according to claim 13, wherein the pin population device comprises at least a first and second portion of protrusions and the pin population device further comprises visual indications identifying the first portion, and differently-visual indications identifying the second portion such that steps (i) to (iii) are performed for the first portion of similar visually indicated protrusions, and then steps (i) to (iii) are performed for the differently-visual or non-visually indicated second portion of protrusions. 25 30 35
15. The method for populating pins according to any one of claims 13 or 14, wherein before step (i) the calibration of the pin population device array of protrusions is checked using a calibration cap. 40

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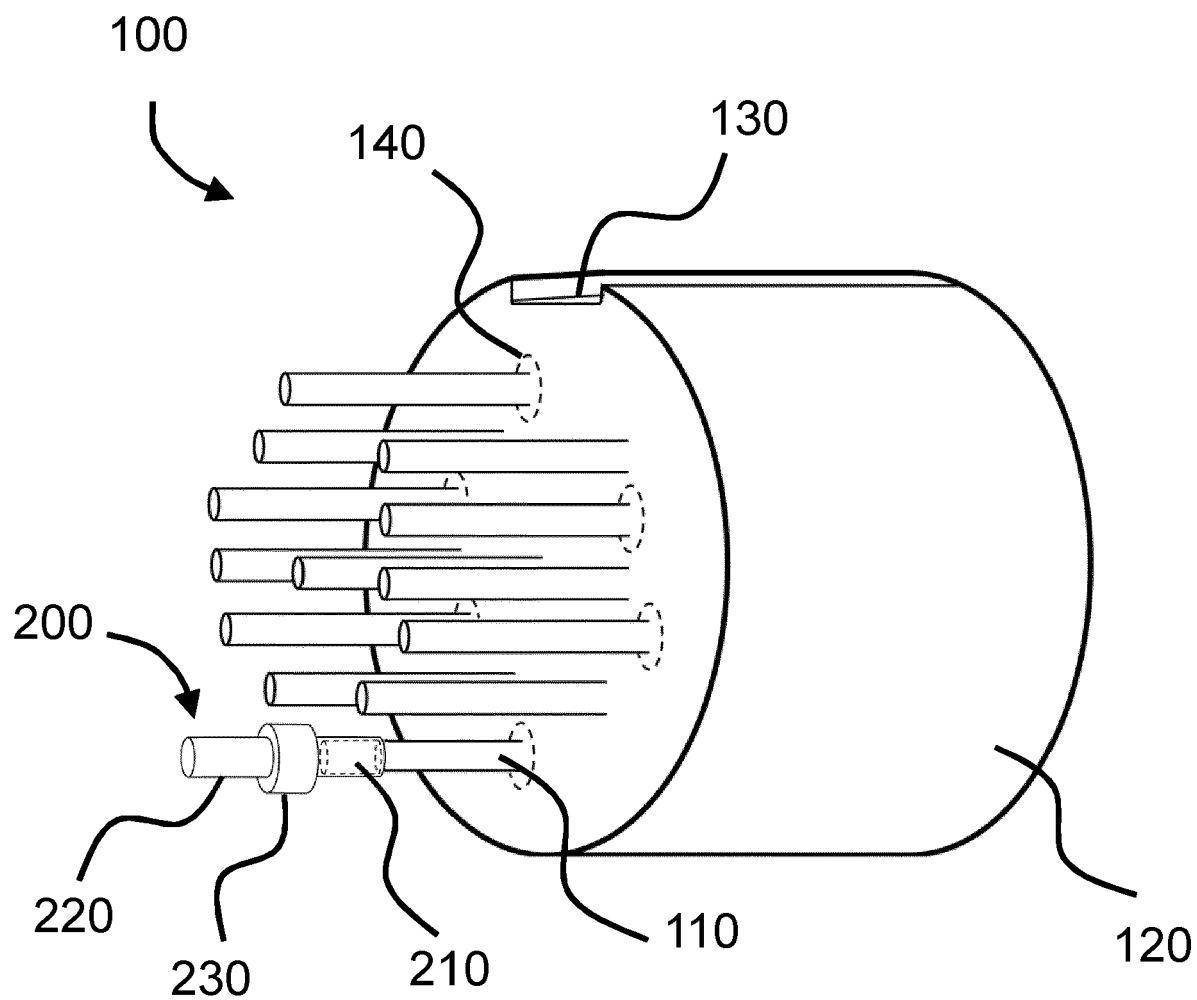


Fig. 1

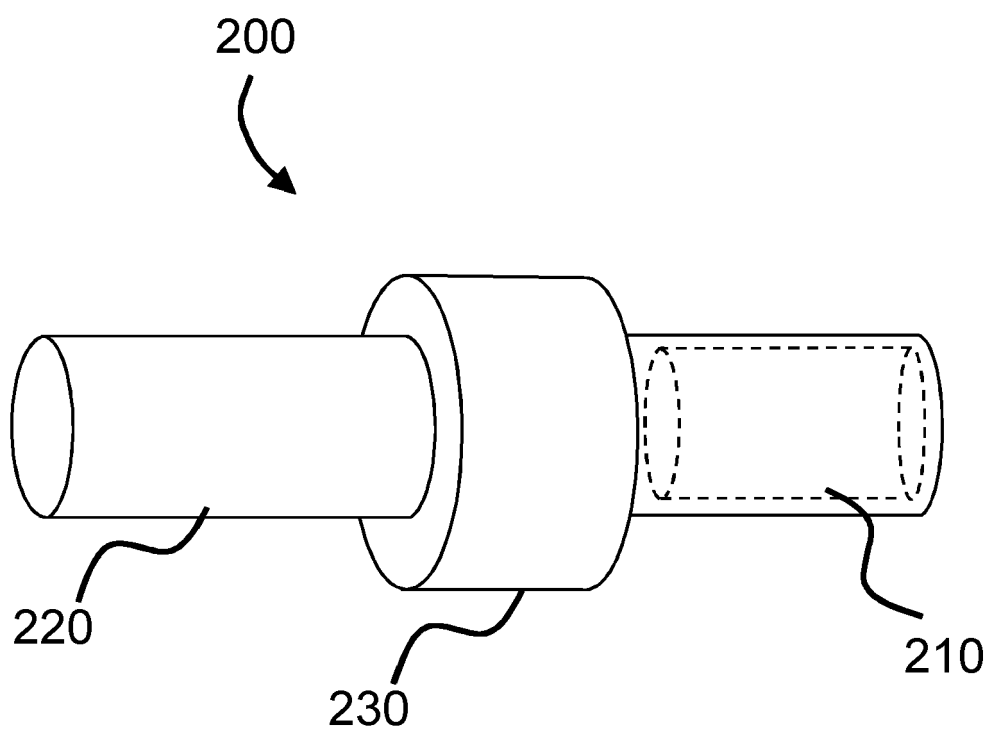


Fig. 2

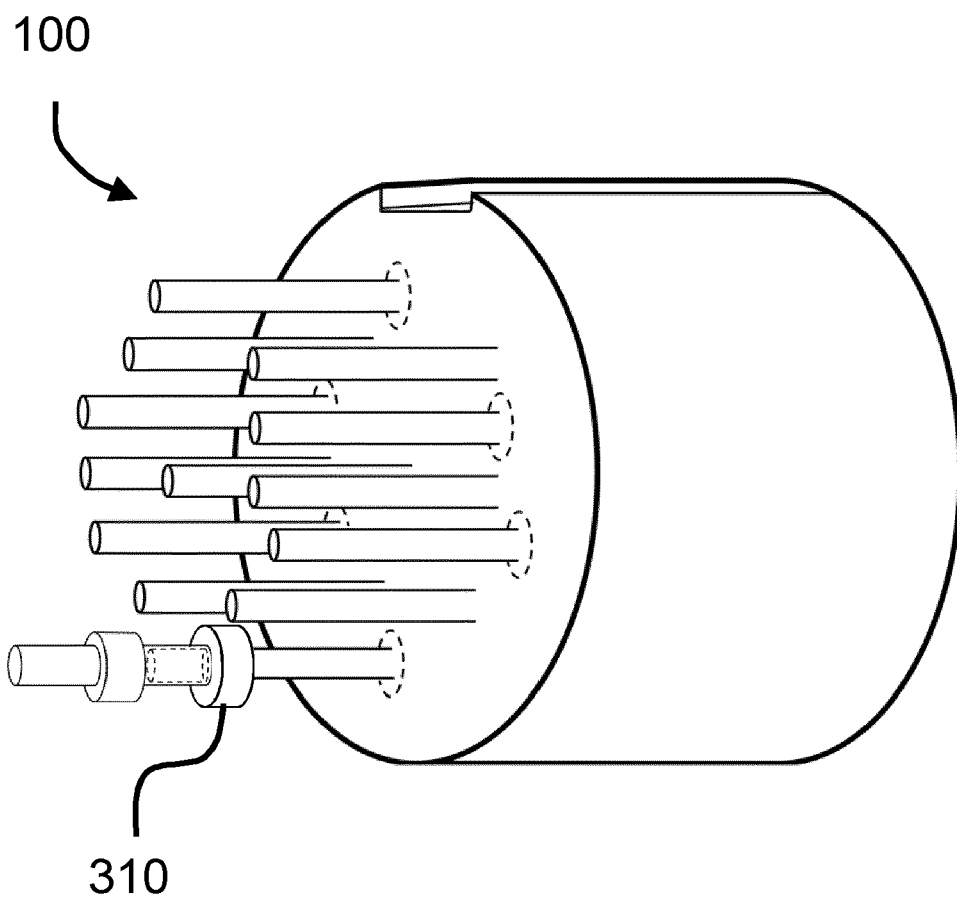


Fig. 3

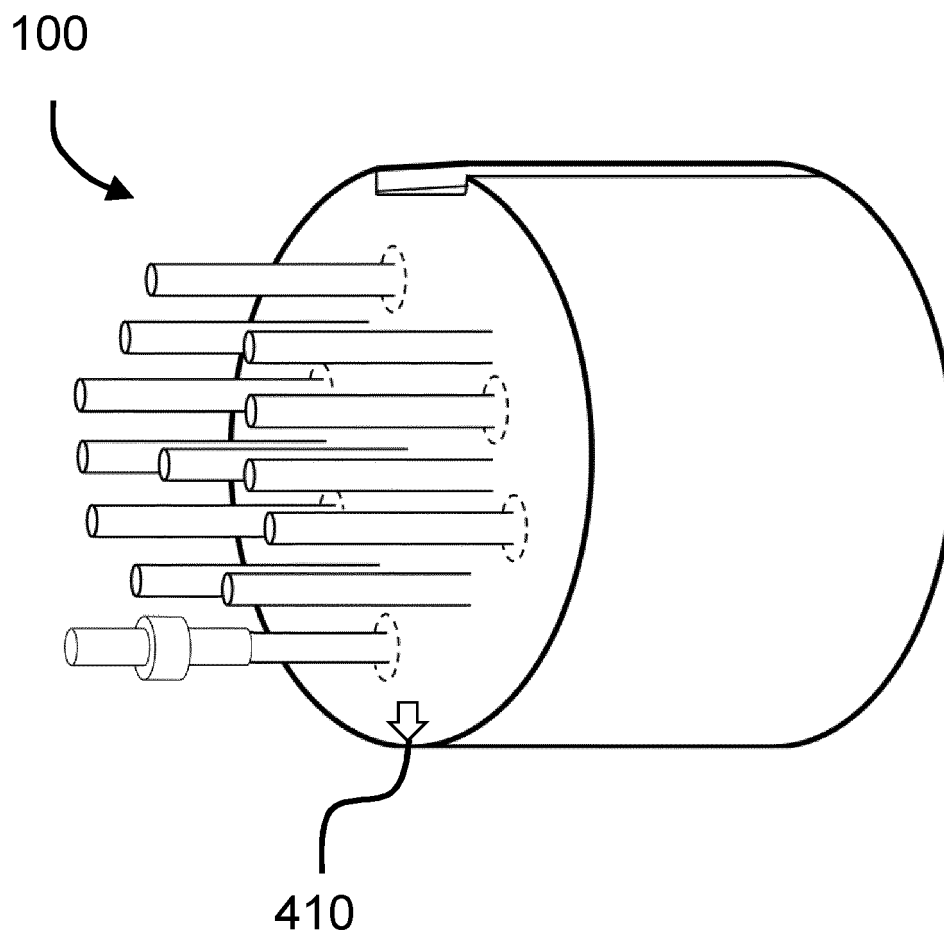


Fig. 4

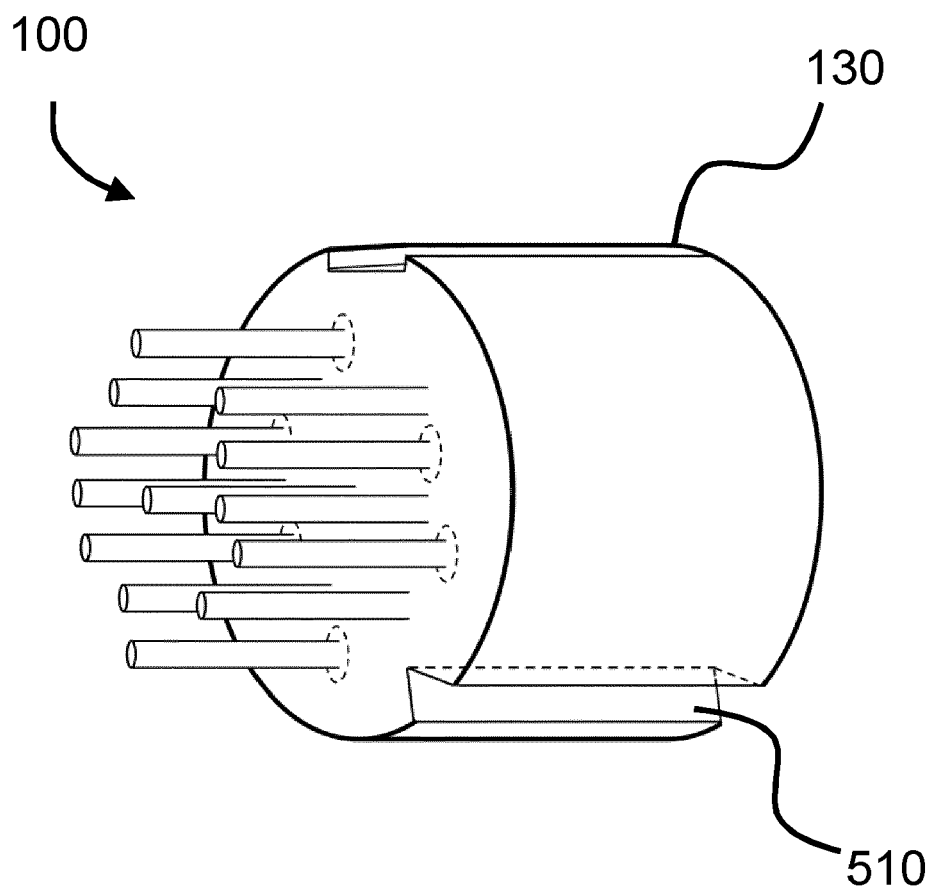


Fig. 5

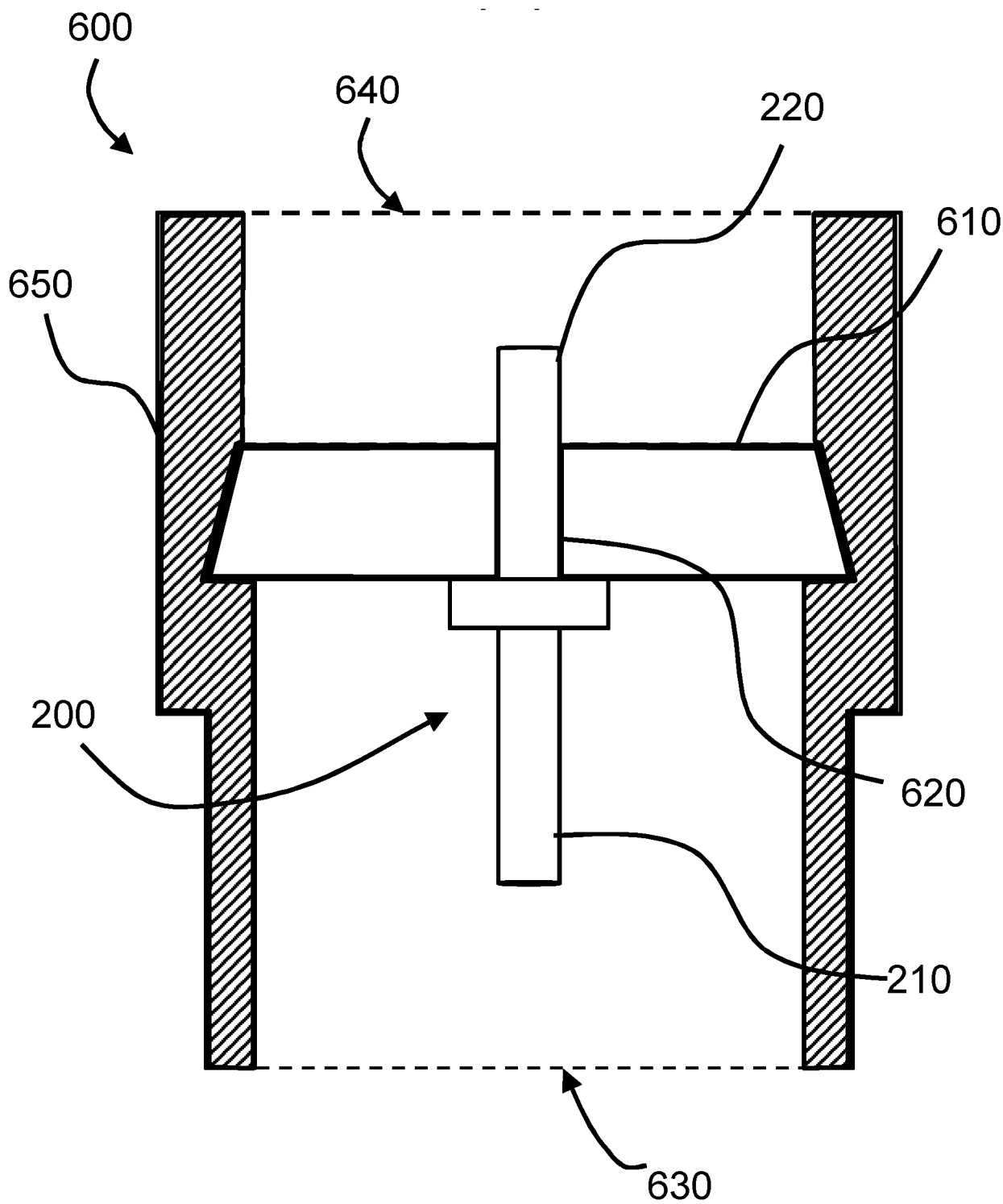


Fig. 6

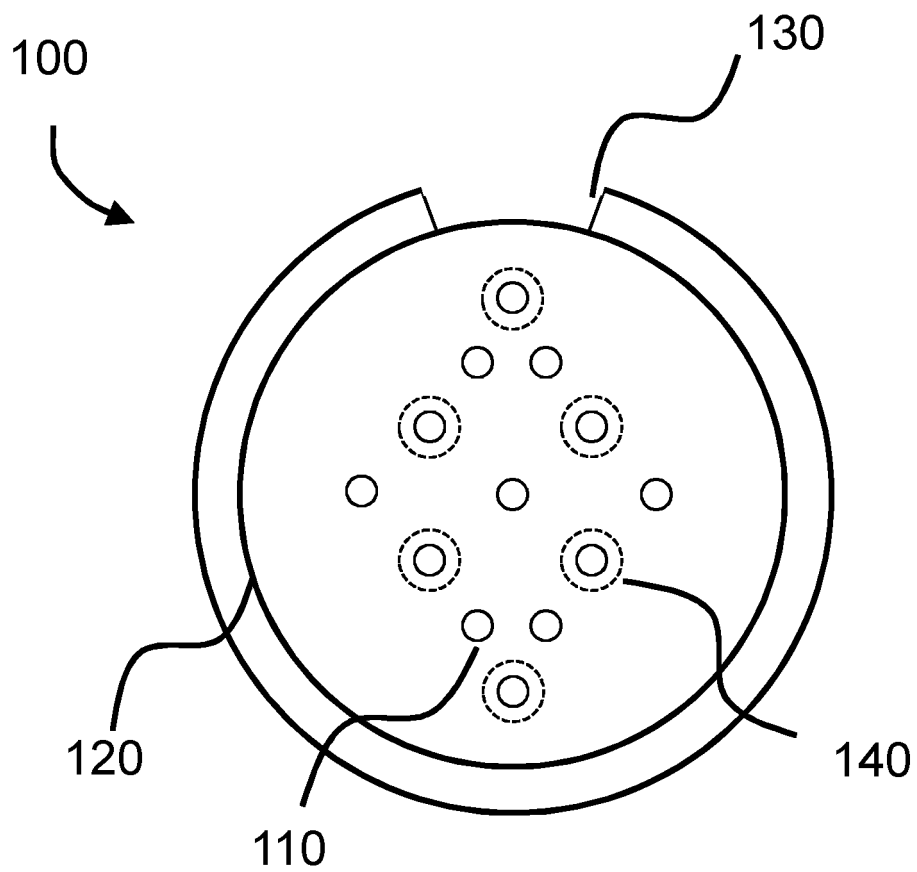


Fig. 7

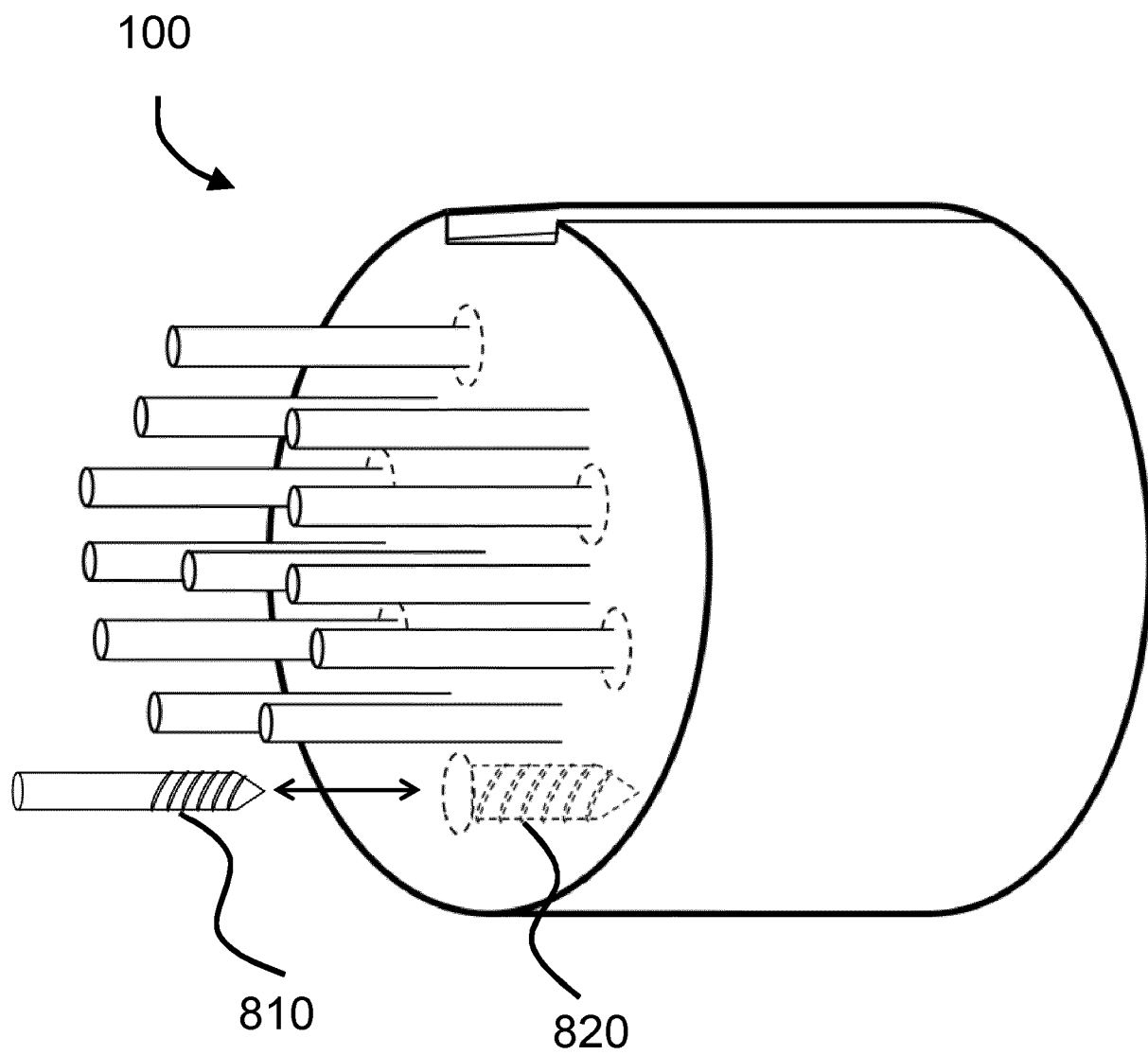


Fig. 8

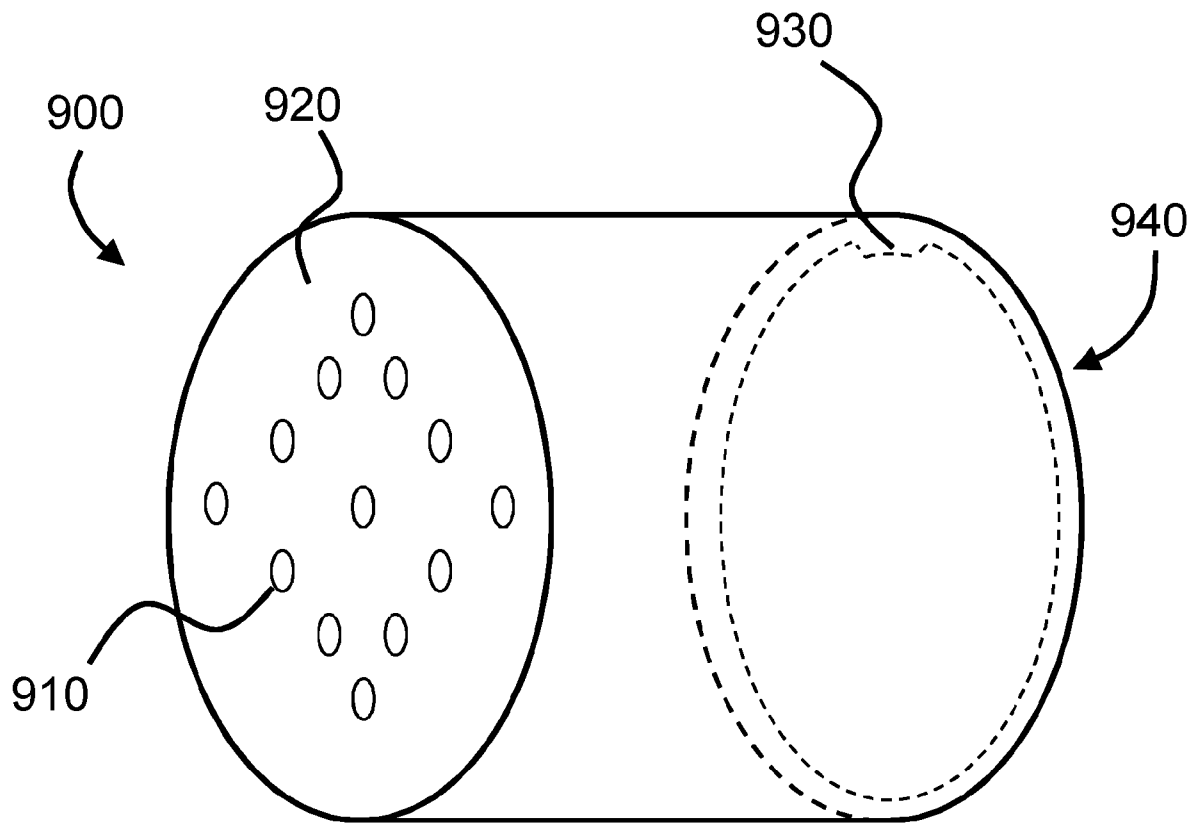


Fig. 9a

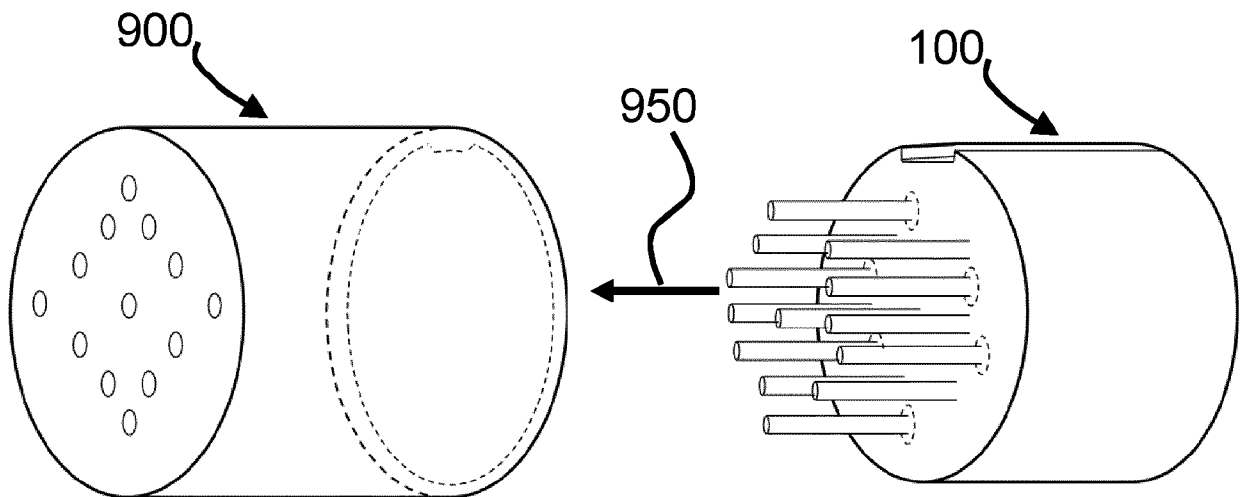


Fig. 9b

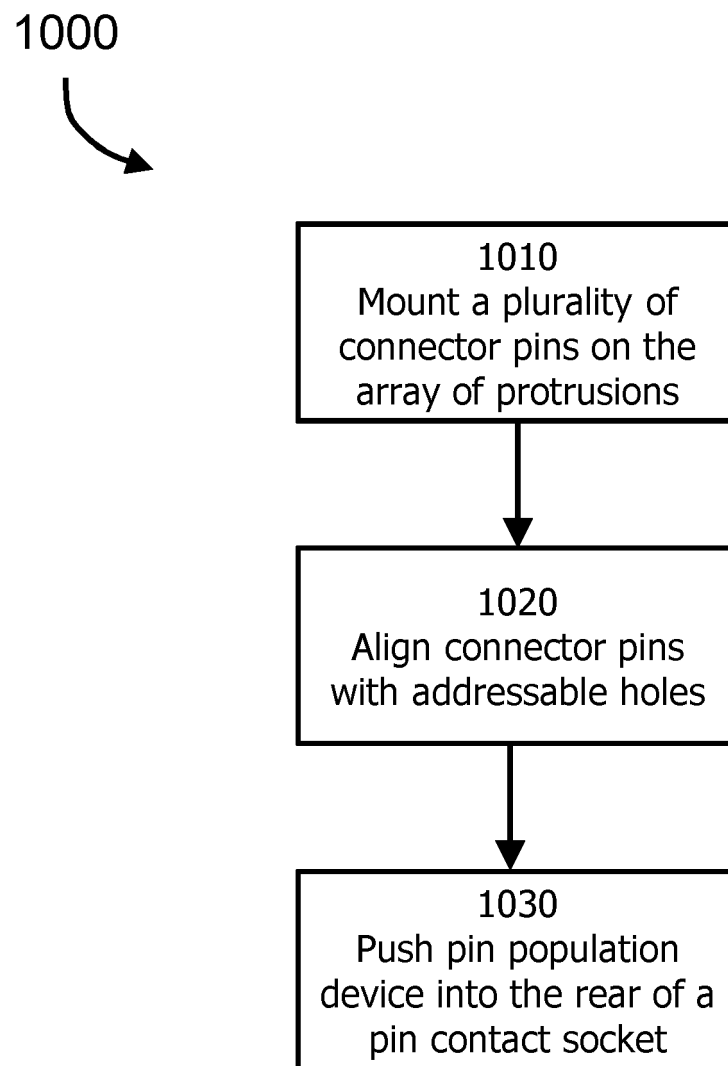


Fig. 10



EUROPEAN SEARCH REPORT

Application Number

EP 24 27 5088

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	* column 2, line 42 to column 4, line 20, figures 1-7 *	5-8,12, 14	
X	JP 3 455769 B2 (OKI ELECTRIC IND CO LTD) 14 October 2003 (2003-10-14)	1,13	
A	* the whole document *	2-12,14, 15	
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A	CN 114 540 798 A (JIANGXI HANKOU SEMICONDUCTOR TECH LIMITED COMPANY) 27 May 2022 (2022-05-27)	1-15	
	* the whole document *		TECHNICAL FIELDS SEARCHED (IPC)
			H01R H04Q B23P B25B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		6 December 2024	López García, Raquel
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& : member of the same patent family, corresponding document			

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ON EUROPEAN PATENT APPLICATION NO.

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06-12-2024

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