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Description

[0001] The invention relates to a seal for sealing a longitudinal object, such as a wire, said seal having an axial cavity for receiving said longitudinal object in a fully mounted position, said axial cavity being open on both axial ends for at least partially receiving said longitudinal object through said axial cavity, the seal comprising a first partial body, a second partial body and a third partial body, the second partial body and the third partial body both being made of a similar material, the first partial body being made of a different material, wherein the first partial body forms a base onto which the second partial body is affixed in a non-removable manner such that the second partial body is at least partially positioned outside the first partial body in a radial direction, wherein the third partial body is at least partially configured to be positioned inside the first partial body along at least a part of the axial cavity and wherein the first partial body is made of a material which is relatively more rigid as compared to the material making up the second partial body and the third partial body.

[0002] The provision of sealing is often a requirement in electrical connector assemblies. The prevention of passage of air, water, gases, oils or other material from one side of an electrical connector to another is often undesirable, and seals are used in such situations. In single wire applications that have a terminal mounted at one end of an electrical conductor wire, it may be desirable to also prevent the movement of the wire too much, in addition to providing a sealing function. An extreme movement of such wires could potentially damage the conductor, the insulation of such an electrical conductor wire, the terminal or even the crimp that fixes the terminal onto the electrical conductor wire. When used in high-vibration environments or where miniaturized wire sized and/or electrical conductor wire is required, the transmission of these mechanical forces to the terminal are often preferably avoided.

[0003] Seals that provide the dual functionality of providing a holding or dampening function on wires in addition to their sealing functionality are known. Typically, the requirement of rigidly holding the electrical conductor wire requires different mechanical properties of the seal as contrasted with the requirement of providing soft and supple features that contact and seal against a cavity in an electrical connector to properly seal against the insides of such a cavity. This contrast in the mechanical requirements at different locations within a seal lead to different materials being selected for different parts of the seal.

[0004] DE 195 46 963 discloses a cylindrical sealing unit for use with an electric wire or cable that is inserted through a center bore. The center bore is located in a bushing made using a relatively hard material. Sealing lips are molded on to the outer surface of the bushing, and are made of a flexible material that is secured around a flange on the bushing. The assembly has a main sealing

section and a separate section that is crimped to provide a secure seal on the cable. Here, the relatively harder material is configured to be in contact with the electrical conductor wire or its insulation on the inside, while a softer material is used to manufacture the sealing lips to the outside.

[0005] WO 2013/178727 discloses an electrical connector comprising at least one electric cable surrounded by an insulating sheath and a housing arranged on at least a portion of the electric cable. The housing is made of a first material. The electrical connector further comprises a sealing arranged on the electric cable and surrounding the insulating sheath in a sealing manner. The sealing is made of a second material. The housing is molded over the sealing and over at least a portion of the cable to encompass the sealing. Here, the relatively softer material is configured to seal against the insulating sheath and is mechanically supported and held in place by the comparatively mechanically rigid housing.

[0006] Another typical wire seal is disclosed in JP 2007 134123 A: The wire seal comprises a solid member and an elastic member, wherein the elastic member is partly arranged inside and outside a cavity which is formed by the solid member.

[0007] A seal that is assembled from two parts, a solid part and an elastic part is known from JP H01 112575 U. The elastic part is provided with sealing lips which are arranged circumferentially inside a cavity for receiving a cable. Also from JP 2009 301890 A, a seal is known that consists of a rigid body and a second partial body made from softer material for receiving a longitudinal object.

[0008] There are a number of documents that disclose such use of a softer material to provide the sealing function as against either the connector housing by abutting the inner surfaces of the cavity it is placed in; or as against the electrical conductor wire or its insulation by abutting against the outer surface of the insulation it is placed into contact against. The comparatively rigid material may be used either to secure an electrical conductor wire in a comparatively fixed position against the seal; or to secure the seal in place with respect to the connector housing. However, when improved sealing is required not only between the seal and the connector housing but also between the seal and the electrical conductor wire, the known solutions fall short of providing a viable solution. This is particularly true for applications in high-vibration environments or where the size of the components is quite small because of miniaturization.

[0009] The object of this invention is thus to provide a solution that provides better sealing properties both between the seal and the connector housing and also between the seal and the electrical conductor wire, simultaneously. This object is achieved by a seal as defined in claim 1, made of different materials where the comparatively softer material is configured to be in contact inwardly with the electrical conductor wire and outwardly with the connector housing. According to the invention, the first partial body has at least a first axial region and

a second axial region, wherein a collar for providing a dampening effect to the longitudinal object in the fully mounted position is formed contiguously with the second partial body and the third partial body, the collar being located adjacent to the second axial region of the first partial body, and wherein the collar is formed on the circumferential edge of the first partial body, on a surface facing away from a crimping region that corresponds with the first axial region, the first axial region being configured to be crimped onto the longitudinal object, wherein the first axial region is provided with cuts in the axial direction along at least a part of the first axial region to allow radial deformation of said first partial body in a compressive direction when crimped.

[0010] A seal according to this invention may also be configured to provide adequate contact between the rigid material forming the seal and the electrical conductor wire and/or contact between the rigid material forming the seal and the connector housing. The contact between the rigid material forming the seal and the electrical conductor wire may allow the rigidity of the seal material to impart mechanical fixation and/or stability to the electrical conductor wire. This contact may be where the seal is fixed onto the electrical conductor wire or at another location that would serve to limit movement of the electrical conductor wire. Contact between the rigid material forming the seal and the connector housing may allow the seal to be optimally positioned within a cavity of the connector housing into which it may be inserted.

[0011] The seal according to this invention may be suitable for sealing a longitudinal object, such as an electrical conductor wire that may be received in an axial cavity in the seal. The axial cavity is open on both axial ends and may receive the longitudinal object through the axial cavity either partially or completely. A partially inserted longitudinal object such as an electrical conductor wire may be provided with a cap and sealed by crimping the cap in place. A longitudinal object such as an electrical conductor cable or wire may be inserted through the axial cavity to emerge at the other end. The part of the longitudinal object that emerges at the side opposite to the insertion end may be assembled onto a terminal. Assembly may be achieved by crimping the conductor wire to the terminal in a conductor crimp zone while the insulation may be crimped along with the seal at an insulation crimp zone of the terminal.

[0012] The first partial body is provided with at least one set of cuts. Such cuts extend through the first partial body at least through a part of its length in the axial direction. The cuts in the first partial body allow radial deformation of the first partial body both in a compressive as well as an expansive direction.

[0013] When crimped, the cut allows portions of the first partial body to move closer and to better crimp against the insulation of the electrical conductor wire extending through the seal. When the electrical conductor wire needs to be pushed into and through the seal, the cuts allow the expansion of the effective inner diameter

of the first partial body. Such an expansion may be achieved by the abutment of the electrical conductor wire or when a metal sleeve is inserted through the seal during an automatic wire insertion process. The cuts may further allow the seal to accommodate a larger range of electrical conductor wire thicknesses as compared to a rigid, static first partial body without any cuts. A judicious selection of the frequency and positioning of the cuts on the first partial body may be made to ensure the optimal radial deformation properties in conjunction with the required strength and rigidity of the first partial body.

[0014] In accordance with the invention, the seal comprises two or more parts with different mechanical properties due to different materials being used to manufacture those two or more parts. The seal comprises a first partial body, a second partial body and a third partial body. The second partial body and the third partial body are both made of the same or a similar material that allows flexibility of movement of the sealing features.

[0015] The first partial body is made of a different material which is relatively more rigid as compared to the material making up the second and third partial bodies. The first partial body may form a base onto which the second partial body may be affixed in a non-removable manner. When observed in a radial direction from the central axis and moving outwards, the second partial body may be at least partially positioned outside the first partial body. The third partial body may be at least partially configured to be positioned inside the first partial body along at least a part of the axial cavity. When viewed from the central axis, the third partial body may come closest to the central axis at least at some locations along the length of the axial cavity. The first partial body may be 'sandwiched' between the third partial body and the second partial body. The first partial body may provide mechanical support to both the second partial body as well as the third partial body.

[0016] In another advantageous embodiment, the second partial body and the third partial body are contiguous. The second partial body and the third partial body therefore form a single continuous part and may hereinafter be addressed as the second partial body. The teachings of this invention allow for an advantageous selection of whether the second partial body and the third partial body are separate parts or formed as a unitary part. The selection may depend upon factors such as ease of manufacture, durability, effectiveness of sealing etc.

[0017] In another advantageous embodiment, the second partial body may be radially positioned inside the first partial body along at least a part of the axial cavity. This radial positioning may be independent of the axial position where the second partial body is radially positioned outside the first partial body, relative to at least a part of the axial cavity. The sealing features provided by the second partial body may therefore be located at different distances along the axis of the cavity from any given end of the axial cavity.

[0018] In another advantageous embodiment, the sec-

ond partial body forms at least one of a first sealing lip protruding inwards into the axial cavity and a second sealing lip protruding in the radially outward direction. The inside-facing first sealing lips may be positioned independently of where the outside facing second sealing lips are being positioned. The first sealing lips or the second sealing lips may be annular following a circular or ring shape at a given static axial location with respect to any given end of the axial cavity. The circular or ring shape may be configured both in the inwards as well as the outwards direction and may form the first sealing lips of the second sealing lips.

[0019] Further, the first sealing lips or the second sealing lips may also be oval shaped and located along an axially varying circumferential position. The oval shape may result from the second partial body being configured along a non-cross sectional location. The oval shape may also result from the second partial body being configured to form an intertwined helical path. The oval shape may be configured both in the inwards as well as the outwards direction and may form the first sealing lips of the second sealing lips.

[0020] The first sealing lip and the second sealing lip may be configured to be non-concentric or located at different locations inside the first partial body and outside the first partial body with respect to each other. The first sealing lip and the second sealing lip may be formed at relatively different axial locations along the second partial body.

[0021] The first partial body is manufactured using a material with a relatively higher rigidity than the material used to manufacture the second partial body. The first partial body may be made of a rigid plastic material of higher mechanical stability as compared to the material used to manufacture the second partial body. The material used to manufacture the first partial body can be selected to have temperature stability up to a temperature that is higher than the vulcanization temperature of the material used to manufacture the second partial body. Any material that is suitable for over-molding or co-molding applications may be used to manufacture the first partial body. Examples of such materials may include Polybutylene terephthalates, Polyamides, ABS resins, or any other similar material with the requisite mechanical rigidity in combination with temperature stability.

[0022] The second partial body may be made of a silicone based material or a material with similarly flexible mechanical properties as a silicone based material. Examples of such materials may include liquid silicone material, Neoprene, thermoplastic elastomer materials, natural or artificial rubber or any other material that provides the requisite mechanical flexibility in combination with the ability to manufacture parts using injection molding.

[0023] The second partial body may be integrally molded onto the first partial body utilizing an over-molding process or a co-injection molding process. It is possible to take a fully molded rigid part and subject it to an over-molding process to manufacture parts according to this

invention. It is also possible to manufacture parts according to this invention using a co-injection molding process or a 2K (two component) molding process.

[0024] The first partial body has at least a first axial region and a second axial region. The first and second axial regions on the first partial body may either be positioned to be in contact with the longitudinal object such as an electrical conductor wire in the fully mounted position, or may be positioned to be adjacent to the longitudinal object such as an electrical conductor wire in the fully mounted position. The first axial region may be configured to be crimped onto the longitudinal object. The first axial region may be in direct contact with the insulation of the electrical conductor wire, and may be crimped along with the insulation by the insulation crimp of a terminal. The second axial region may be configured to abut at least one of the longitudinal object and a cavity in an electrical connector that would receive the seal.

[0025] Contacting or abutting the longitudinal object would secure the longitudinal object to a greater length behind the insulation crimp by the rigid first partial body. This may further limit undesirable whipping movement of the longitudinal object in the fully mounted position being transmitted through the longitudinal object such as an electrical conductor wire to the terminal. When the fully mounted seal is inserted into a cavity in an electrical connector housing, the second axial region may abut the inside surface of the cavity to avoid excessive bending of the longitudinal object at the exit of the cavity. The second axial region may thus additionally help in dampening the terminal from the movement and vibrations being experienced by the longitudinal object. In addition to the second axial region of the first partial body, the second partial body may also be configured to provide a dampening effect. The second partial body may be configured with a collar located adjacent to the second axial region for providing a dampening effect to the longitudinal object in the fully mounted position.

[0026] In another advantageous embodiment, this invention may be utilized to satisfy the requirements of industry in general. The requirements in the industry are increasingly moving towards miniaturization of electrical contacts and connectors. This is being done for a variety of reasons including the saving of space and weight in applications, and is also driven by the requirement of saving materials to reduce manufacturing costs. The increased efficiency in terms of space, material and weight often requires the use of highly miniaturized electrical conductors in conjunction with smaller electrical terminals. Numerous applications of such miniaturized arrangements require sealing, and this present invention is well suited to provide sealing functionality also in such miniaturized applications.

[0027] The invention will now be described in greater detail using advantageous embodiments in an exemplary manner and with reference to the drawings. The described embodiments are merely possible configurations and it must be borne in mind that the individual features

as described above can be provided independently of one another or can be omitted altogether while implementing this invention.

[0028] The drawings show:

Fig. 1 shows an exemplary embodiment of a seal according to this invention;

Fig. 2 shows a cross section of the exemplary embodiment of Fig. 1;

Fig. 3 shows a first partial body of the embodiment of Fig. 1;

Fig. 4 shows an exemplary embodiment of the seal of Fig. 1 mounted inside a cavity;

Fig. 5 shows another exemplary embodiment of a seal according to this invention;

Fig. 6 shows a first partial body of the embodiment of Fig. 5;

Fig. 7 shows a cross section of the embodiment of Fig. 5 mounted inside a cavity;

Fig. 8 shows yet another exemplary embodiment of a seal according to this invention;

Fig. 9 shows a first partial body of the embodiment of Fig. 8;

Fig. 10 shows a cross section of the first partial body of the embodiment of Fig. 8; and

Fig. 11 shows a cross section of the embodiment of Fig. 8 mounted inside a cavity.

[0029] Fig. 1 shows an exemplary embodiment of a seal 100 according to this invention is depicted. The seal 100 comprises a first partial body 110 and a second partial body 120 mounted onto the first partial body 110. The first partial body 110 is made of a comparatively more rigid material as compared to the material used to manufacture the second partial body 120. A third partial body (not shown) is positioned inside the first partial body 110 and is not visible in this view. The third partial body extends along at least a part of an axial cavity 130 formed within the first partial body 110 and the second partial body 120.

[0030] Fig. 2 shows a cross section of the exemplary embodiment of the seal 100 shown in Fig. 1. In this view, the third partial body 210 is shown to be contiguous with the second partial body 120. The first partial body 110 forms a rigid base upon which the second partial body 120 and the third partial body 210 are formed. The contiguous second partial body 120 with the third partial body 210 has surfaces for sealing against both an external

cavity of an electrical connector housing (not shown) into which it may be mounted, as well as for sealing against the outer surface of a longitudinal object such as the insulation of an electrical conductor wire that may be inserted into the axial cavity.

[0031] Seal 100 may have a first collar 220 formed contiguously with the first partial body 110. Being made of the same rigid material as the first partial body 110, the first collar 220 may help optimize the alignment of the seal 100 when placed into a cavity of a conductor housing. The first collar 220 may prevent the over elongation of the seal 100 in any direction and may ensure the functioning of the seal in the compressive direction instead of in a deflective direction. In the final fully mounted position, the first collar 220 may abut the inner surfaces of the cavity of the connector housing in which it may be mounted to provide further stability to the longitudinal object such as an electrical conductor wire.

[0032] A second collar 250 is formed contiguously with the second partial body 120 and the third partial body 210. The second collar 250 may be formed on the circumferential edge of the first partial body 110, on a surface facing away from the crimping region that corresponds with a first axial region. The second collar 250 can be made of varying thicknesses using different quantities of material. This thickness may be determined by the expected dynamic stresses that this location may be expected to experience when a longitudinal object such as an electrical conductor wire leaves the structure of the seal 100. The optimal thickness may be calculated depending upon the mechanical properties of the material used to manufacture the second collar 250 and possibly also the thickness of the longitudinal object itself, in addition to other factors.

[0033] Fig 3 shows a first partial body 110 of the embodiment of Fig. 1. This depiction has removed the second partial body 120 and third partial body 210 to allow observation of the features of the first partial body 110 in greater detail. The first partial body 110 is provided with a first axial region 310 and a second axial region 320. The first axial region 310 is configured to be crimped onto the longitudinal object. Significant compressive forces that would act on this first axial region 310 when the first partial body 110 is crimped. In order to allow flexibility of movement and the avoidance of breakage, the first axial region 310 is provided with cuts 330 in the axial direction along at least a part of the first axial region 310. The cuts 330 allow radial deformation of the first partial body 110 in a compressive direction when crimped. The effective diameter of the axial cavity 130 in the first axial region 310 is reduced at the time of crimping of the first partial body 110 onto the longitudinal object such as an electrical conductor wire. This allows the first partial body 110 to have a good frictional hold on the longitudinal object once crimped.

[0034] The second axial region 320 is provided with through holes 340 that allow the material forming the second partial body 120 (not shown) and the third partial

body 210 (not shown) to be contiguous. The through holes 340 in conjunction with the cuts 330 in the second axial region 320 allow the comparatively softer material forming the second partial body 120 (not shown) and the third partial body 210 (not shown) to be affixed onto the first partial body 110 both on the inside as well as the outside. Cuts 330 in the second axial region 320 allow the radial deformation of the second axial region in an expansive direction. Such an expansive radial deformation may be caused by the abutment of the longitudinal object such as an electrical conductor wire against the inside surfaces of the axial cavity 130 in the second axial region 320. The expansive radial deformation may also be caused by a metal sleeve that may be inserted through the seal 100 during an automatic wire insertion process towards manufacture of the fully mounted seal 100.

[0035] Fig. 4 shows an exemplary embodiment of the seal of Fig. 1 mounted inside a cavity 410 of an electrical connector housing 420. Once the seal 100 is mounted and fixed onto a longitudinal object 430 such as an electrical conductor wire, the first sealing lips 440 protruding inwards towards the longitudinal object 430 in the axial cavity 130 seal against the outer surface of the longitudinal object 430. When the fully mounted and fixed arrangement of the longitudinal object 430, the seal 100 and a terminal 450 is inserted into the cavity 410, the second sealing lips 460 protruding in the radially outwards direction from the seal 100 seal the arrangement against the inner surface of the cavity 410. This effectively seals off the end of the longitudinal object 430 with the terminal 450 from the end of the longitudinal object 430 protruding out of the cavity 410 behind (above, in Fig. 4) the seal 100.

[0036] Fig. 5 shows another exemplary embodiment of a seal 500 according to this invention. The seal 500 comprises of a first partial body 510 with a second partial body 520, and can further comprise a third partial body (not shown) that protrudes into the axial cavity 530 or the second partial body 520 itself may be configured to protrude into the axial cavity 530 in a contiguous construction.

[0037] Fig. 6 shows the first partial body 510 of the embodiment of Fig. 5 without the second partial body 520 or a third partial body formed on it. Here, the first axial region 610 is configured to be crimped onto the longitudinal object (not shown) such as an electrical conductor wire. As significant compressive forces would act on this first axial region 610 when the first partial body 510 is crimped onto the longitudinal object, the design has to provide for flexibility of movement to avoid breakage. The first axial region 610 is provided with cuts 630 in the axial direction along at least a part of the first axial region 610. The cuts 630 allow radial deformation of the first partial body 510 in an inward direction when it is compressed during crimping. The effective diameter of the axial cavity 530 in the first axial region 610 is reduced from its rest state when the first partial body 510 is crimped onto the longitudinal object such as an electrical conductor wire.

This allows the first partial body 510 to achieve an interference hold that keeps the seal 500 fixed onto the longitudinal object by increasing frictional forces between the seal and the outer surface of the longitudinal object such as the insulation of an electrical conductor wire, once crimped.

[0038] The second axial region 620 is provided with through holes 640 that form the path through which material that forms the second partial body 520 (not shown) and either a contiguous or separate third partial body (not shown) may move during the manufacturing process. The through holes 640 allow the comparatively softer material forming the second partial body 520 (not shown) and a separate or contiguous third partial body (not shown, contiguous with the second partial body) to be affixed onto the first partial body 510 both on the inner surface of the first partial body 510 as well as its outer surface. The part of the second partial body 520 that is affixed onto the inner surface of the first partial body 510 may be contiguous with or independent of the part of the second partial body 520 that is affixed onto the outer surface of the first partial body 510. The part of the second partial body 520 on the inner surface of the first partial body 510 protrudes into the cavity 530. The part of the second partial body 520 on the outer surface of the first partial body 510 extends outwards and may be configured to be suitable to seal against a cavity into which the seal may be mounted. Through holes 640 in the second axial region 620 may further contribute to the flexibility of this part of the first partial body 510. Through holes 640 may allow a more controlled radial deformation of the second axial region 620 in an expansive or outward direction. The seal 500 may be expected to experience such an expansive radial deformation when the longitudinal object is mounted through it. Often, a metal sleeve is used for accomplishing the insertion of longitudinal objects such as electrical conductor wires, especially in automated manufacturing processes. In such automated processes, the metal sleeve 'caps' the longitudinal object and this is then inserted through the seal 500 to bring the longitudinal object through the seal 500.

[0039] Fig. 7 shows a cross section of the embodiment of Fig. 5 mounted inside a cavity 710. Once the seal 500 is crimped onto a longitudinal object 730 such as an electrical conductor wire along with a terminal (not shown), the first sealing lips 740 that face into the axial cavity 530 about the longitudinal object 730. This results in a sealed status being achieved against the outer surface of the longitudinal object 730. When the fully mounted and fixed arrangement of the longitudinal object 730, the seal 500 and a terminal (not shown) is inserted into the cavity 710, the second sealing lips 760 that extend radially outwards from the central axis result in a sealed status being achieved against the inner surface of the cavity 710. This bi-directional sealing effect directed both inwards as well as outwards by the seal 500 effectively seals off one side of the longitudinal object 730, say, the side mounted with a terminal, from its other side in which the longitudinal

object 730 is protruding out of the cavity 710 behind the seal 500.

[0040] Fig. 8 shows yet another exemplary embodiment of a seal according to this invention. Seal 800 is formed by the first partial body 810 having a second partial body 820 formed on the outer surface of the first partial body 810. In an exemplary embodiment, it is possible for the first partial body 810 to not have any through holes in its design as shown in Fig. 8. The outer surface of the first partial body 810 is therefore not connected to or contiguous with the inner surface of the first partial body 810 inside the axial cavity 830 along its curved side surfaces as was seen for the other exemplary embodiments.

[0041] Fig. 9 shows a first partial body 810 of the embodiment of Fig. 8, showing outer grooves 910 formed on its curved side surface. The outer grooves 910 may provide improved anchoring of the second partial body 820 once this is formed on the first partial body 810. The outer grooves 910 may further provide an improved pathway for guiding the flow of material during the manufacture of the second partial body 820 on the first partial body 810. The invention however does not require the presence of the outer grooves 910 and the second partial body 820 may be formed on the first partial body 810 also without requiring any anchoring or guiding features such as these outer grooves 910, and this too would be a fully functional implementation of this invention.

[0042] Fig. 10 shows a cross section of the first partial body 810 of the embodiment of Fig. 8, showing inner grooves 920 formed on the inner surface of the first partial body 810, facing into the axial cavity 830. The inner grooves 920 may provide guidance for the manufacture of; or anchoring for; a third partial body 940 (not shown) formed on the inner surface of the first partial body 810 and extending into the axial cavity 830. This third partial body 940 (not shown) may be formed either independent of; or contiguous with; the second partial body 820 (not shown) on the outer surface of the first partial body 810.

[0043] Fig. 11 shows a cross section of the embodiment of Fig. 8 mounted inside a cavity 1110. In this figure, the second partial body 820 formed on the outer surface of the first partial body 810 is not connected to the third partial body 940 formed on the inside surface of the first partial body 810 along its curved side surfaces. However, in this exemplary depiction of an embodiment of this invention, a second collar 1150 is formed contiguously with the second partial body 820 and the third partial body 940. Second collar 1150 is formed on the circumferential edge of the first partial body 810, opposite to the crimping region that corresponds with the first axial region (310, 610) that has been described above. The amount of material utilized to form the second collar 1150 may be determined by the expected dynamic stresses that would be experienced at this location where the longitudinal object 730 leaves the structure of the seal 800.

Reference Numbers

[0044]

5	100, 500, 800	seal
	110, 510, 810	first partial body
	120, 520, 820	second partial body
	130, 530, 830	axial cavity
	210, 840, 940	third partial body
10	310, 610	first axial region
	320, 620	second axial region
	330, 630	cuts
	340, 640	through holes
	410, 710, 1110	cavity
15	420, 720	electrical connector housing
	430, 730	longitudinal object
	440, 740	first sealing lips
	450	terminal
	460, 760	second sealing lips
20	910	outer grooves
	920	inner grooves
	220	first collar
	250, 1150	second collar

Claims

1. Seal (100, 500, 800) for sealing a longitudinal object (430, 730), such as a wire, said seal (100, 500, 800) having an axial cavity (130, 530, 830) for receiving said longitudinal object (430, 730) in a fully mounted position, said axial cavity (130, 530, 830) being open on both axial ends for at least partially receiving said longitudinal object (430, 730) through said axial cavity (130, 530, 830), the seal (100, 500, 800) comprising a first partial body (110, 510, 810), a second partial body (120, 520, 820) and a third partial body (210, 840, 940), the second partial body (120, 520, 820) and the third partial body (210, 840, 940) both being made of a similar material, the first partial body (110, 510, 810) being made of a different material, wherein the first partial body (110, 510, 810) forms a base onto which the second partial body (120, 520, 820) is affixed in a non-removable manner such that the second partial body (120, 520, 820) is at least partially positioned outside the first partial body (110, 510, 810) in a radial direction, wherein the third partial body (210, 840, 940) is at least partially configured to be positioned inside the first partial body (110, 510, 810) along at least a part of the axial cavity (130, 530, 830), and wherein the first partial body (110, 510, 810) is made of a material which is relatively more rigid as compared to the material making up the second partial body (120, 520, 820) and the third partial body (210, 840, 940), **characterized in that** the first partial body (110, 510, 810) has at least a first axial region (310, 610) and a second axial region (320, 620), and **in that** a collar (250, 1150) for pro-

- viding a dampening effect to the longitudinal object (430, 730) in the fully mounted position is formed contiguously with the second partial body (120, 820) and the third partial body (210, 940), the collar (250, 1150) being located adjacent to the second axial region (320, 620) of the first partial body (110, 510, 810), wherein the collar (250, 1150) is formed on the circumferential edge of the first partial body (110, 810), on a surface facing away from a crimping region that corresponds with the first axial region (310, 610), the first axial region (310, 610) being configured to be crimped onto the longitudinal object (430, 730), wherein the first axial region (310, 610) is provided with cuts (330, 630) in the axial direction along at least a part of the first axial region (310, 610) to allow radial deformation of said first partial body (110, 510, 810) in a compressive direction when crimped.
2. Seal (100, 500, 800) of claim 1, wherein the second partial body (120, 520, 820) and the third partial body (210, 840, 940) are contiguous.
 3. Seal (100, 500, 800) of claims 1 or 2, wherein the second partial body (120, 520, 820) is radially positioned before the first partial body (110, 510, 810) along at least a part of the axial cavity (130, 530, 830) and independent of the axial position where the second partial body (120, 520, 820) is radially positioned after the first partial body (110, 510, 810), relative to at least a part of the axial cavity (130, 530, 830).
 4. Seal (100, 500, 800) of any of claims 1 to 3, wherein the second partial body (120, 520, 820) forms at least one of a first sealing lip protruding inwards into the axial cavity (130, 530, 830) and a second sealing lip protruding in the radially outward direction.
 5. Seal (100, 500, 800) of claim 4, wherein the first sealing lip or the second sealing lip are annular, in a circumferential shape at a fixed axial location.
 6. Seal (100, 500, 800) of claim 4, wherein the first sealing lip or the second sealing lip are oval shaped and located along an axially varying circumferential position.
 7. Seal (100, 500, 800) of any of claims 4 to 6, wherein the first sealing lip and the second sealing lip are at relatively different axial locations along the second partial body (120, 520, 820).
 8. Seal (100, 500, 800) any of the preceding claims, wherein the second partial body (120, 520, 820) is made of a silicone based material or a material with similarly flexible mechanical properties as a silicone based material.
 9. Seal (100, 500, 800) of any of claims 1 to 7, wherein the first partial body (110, 510, 810) is made of a rigid plastic material with temperature stability up to the vulcanization temperature of the material used to manufacture the second partial body (120, 520, 820).
 10. Seal (100, 500, 800) of any of the preceding claims, wherein the second partial body (120, 520, 820) is integrally molded onto the first partial body (110, 510, 810) utilizing an over-molding process or a co-injection molding process.
 11. Seal (100, 500, 800) of any of the preceding claims, wherein the second axial region (320, 620) is configured to abut at least one of the longitudinal object (430, 730) and a cavity (410, 710, 1110) receiving said seal (100, 500, 800), to limit movement of said longitudinal object (430, 730) in the fully mounted position.

Patentansprüche

1. Dichtung (100, 500, 800) zum Abdichten eines länglichen Objektes (430, 730), wie eines Drahtes, wobei die Dichtung (100, 500, 800) einen axialen Hohlraum (130, 530, 830) zum Aufnehmen des länglichen Objektes (430, 730) in einer vollständig montierten Position aufweist, der axiale Hohlraum (130, 530, 830) an beiden axialen Enden offen ist, um das längliche Objekt (430, 730) über den axialen Hohlraum (130, 530, 830) wenigstens teilweise aufzunehmen, die Dichtung (100, 500, 800) einen ersten Teilkörper (110, 510, 810), einen zweiten Teilkörper (120, 520, 820) und einen dritten Teilkörper (210, 840, 940) umfasst, der zweite Teilkörper (120, 520, 820) und der dritte Teilkörper (210, 840, 940) beide aus einem ähnlichen Material bestehen, der erste Teilkörper (110, 510, 810) aus einem anderen Material besteht, der erste Teilkörper (110, 510, 810) eine Basis bildet, auf der der zweite Teilkörper (120, 520, 820) nicht abnehmbar so befestigt ist, dass der zweite Teilkörper (120, 520, 820) wenigstens teilweise in einer radialen Richtung außerhalb des ersten Teilkörpers (110, 510, 810) positioniert ist, der dritte Teilkörper (210, 840, 940) wenigstens teilweise so ausgeführt ist, dass er entlang wenigstens eines Teils des axialen Hohlraums (130, 530, 830) im Inneren des ersten Teilkörpers (110, 510, 810) positioniert ist, und der erste Teilkörper (110, 510, 810) aus einem Material besteht, das vergleichsweise steifer ist als das Material, das den zweiten Teilkörper (120, 520, 820) und den dritten Teilkörper (210, 840, 940) bildet, **dadurch gekennzeichnet, dass** der erste Teilkörper (110, 510, 810) wenigstens einen ersten axialen Bereich (310, 610) sowie einen zweiten axialen Bereich (320, 620) aufweist, und dadurch, dass ein Kragen

- (250, 1150) zum Ausüben einer dämpfenden Wirkung auf das längliche Objekt (430, 730) in der vollständig montierten Position an den zweiten Teilkörper (120, 820) und den dritten Teilkörper (210, 940) angrenzend ausgebildet ist, wobei der Kragen (250, 1150) benachbart zu dem zweiten axialen Bereich (320, 620) des ersten Teilkörpers (110, 510, 810) angeordnet ist, der Kragen (250, 1150) an dem Umfangsrand des ersten Teilkörpers (110, 810) an einer Fläche ausgebildet ist, die von einem Crimp-Bereich weg gewandt ist, der dem ersten axialen Bereich (310, 610) entspricht, der erste axiale Bereich (310, 610) so ausgeführt ist, dass er auf das längliche Objekt (430, 730) gecrimpt wird, der erste axiale Bereich (310, 610) mit Einschnitten (330, 630) in der axialen Richtung entlang wenigstens eines Teils des ersten axialen Bereiches (310, 610) versehen ist, um radiale Verformung des ersten Teilkörpers (110, 510, 810) in einer Kompressionsrichtung beim Crimpen zu ermöglichen.
2. Dichtung (100, 500, 800) nach Anspruch 1, wobei der zweite Teilkörper (120, 520, 820) und der dritte Teilkörper (210, 840, 940) aneinander angrenzen.
3. Dichtung (100, 500, 800) nach Anspruch 1 oder 2, wobei der zweite Teilkörper (120, 520, 820) entlang wenigstens eines Teils des axialen Hohlraums (130, 530, 830) und unabhängig von der axialen Position, die der zweite Teilkörper (120, 520, 820) radial nach dem ersten Teilkörper (110, 510, 810) einnimmt, relativ zu wenigstens einem Teil des axialen Hohlraums (130, 530, 830) radial vor dem ersten Teilkörper (110, 510, 810) positioniert ist.
4. Dichtung (100, 500, 800) nach einem der Ansprüche 1 bis 3, wobei der zweite Teilkörper (120, 520, 820) eine nach innen in den axialen Hohlraum (130, 530, 830) hinein vorstehende erste Dichtlippe oder/und eine radial nach außen vorstehende zweite Dichtlippe bildet.
5. Dichtung (100, 500, 800) nach Anspruch 4, wobei die erste Dichtlippe oder die zweite Dichtlippe in einer Umformsform an einer festen axialen Position ringförmig ist.
6. Dichtung (100, 500, 800) nach Anspruch 4, wobei die erste Dichtlippe oder die zweite Dichtlippe oval geformt ist und sich an einer axial variierenden Umfangsposition befindet.
7. Dichtung (100, 500, 800) nach einem der Ansprüche 4 bis 6, wobei die erste Dichtlippe und die zweite Dichtlippe an voneinander verschiedenen axialen Positionen entlang des zweiten Teilkörpers (120, 520, 820) angeordnet sind.
8. Dichtung (100, 500, 800) nach einem der vorangehenden Ansprüche, wobei der zweite Teilkörper (120, 520, 820) aus einem Material auf Silikonbasis oder einem Material mit ähnlich flexiblen mechanischen Eigenschaften wie ein Material auf Silikonbasis besteht.
9. Dichtung (100, 500, 800) nach einem der Ansprüche 1 bis 7, wobei der erste Teilkörper (110, 510, 810) aus einem starren Kunststoffmaterial mit Temperaturstabilität bis zur Vulkanisations-Temperatur des zum Herstellen des zweiten Teilkörpers (120, 520, 820) eingesetzten Materials besteht.
10. Dichtung (100, 500, 800) nach einem der vorangehenden Ansprüche, wobei der zweite Teilkörper (120, 520, 820) unter Einsatz eines Umspritz-Prozesses oder eines Co-Injection-Prozesses integral auf den ersten Teilkörper (110, 510, 810) aufgeformt wird.
11. Dichtung (100, 500, 800) nach einem der vorangehenden Ansprüche, wobei der zweite axiale Bereich (320, 620) so ausgeführt ist, dass er an dem länglichen Objekt (430, 730) oder/und einem Hohlraum (410, 710, 1110) anliegt, der die Dichtung (100, 500, 800) aufnimmt, um Bewegung des länglichen Objektes (430, 730) in der vollständig montierten Position zu begrenzen.

Revendications

1. Joint (100, 500, 800) pour rendre étanche un objet longitudinal (430, 730), tel qu'un fil, ledit joint (100, 500, 800) ayant une cavité axiale (130, 530, 830) pour recevoir ledit objet longitudinal (430, 730) dans une position entièrement montée, ladite cavité axiale (130, 530, 830) étant ouverte sur les deux extrémités axiales pour recevoir au moins partiellement ledit objet longitudinal (430, 730) à travers ladite cavité axiale (130, 530, 830), le joint (100, 500, 800) comprenant un premier corps partiel (110, 510, 810), un deuxième corps partiel (120, 520, 820) et un troisième corps partiel (210, 840, 940), le deuxième corps partiel (120, 520, 820) et le troisième corps partiel (210, 840, 940) étant tous deux réalisés en un matériau similaire, le premier corps partiel (110, 510, 810) étant réalisé en un matériau différent, dans lequel le premier corps partiel (110, 510, 810) forme une base sur laquelle le deuxième corps partiel (120, 520, 820) est fixé de manière non amovible de sorte que le deuxième corps partiel (120, 520, 820) soit au moins partiellement positionné à l'extérieur du premier corps partiel (110, 510, 810) dans une direction radiale, dans lequel le troisième corps partiel (210, 840, 940) est au moins partiellement configuré pour être positionné à l'intérieur du premier corps

- partiel (110, 510, 810) le long d'au moins une partie de la cavité axiale (130, 530, 830), et dans lequel le premier corps partiel (110, 510, 810) est réalisé en un matériau qui est relativement plus rigide que le matériau constituant le deuxième corps partiel (120, 520, 820) et le troisième corps partiel (210, 840, 940), **caractérisé en ce que** le premier corps partiel (110, 510, 810) a au moins une première région axiale (310, 610) et une deuxième région axiale (320, 620) et **en ce qu'**un collier (250, 1150) pour fournir un effet d'amortissement à l'objet longitudinal (430, 730) dans la position entièrement montée est formé de manière contiguë au deuxième corps partiel (120, 820) et au troisième corps partiel (210, 940), le collier (250, 1150) étant situé de manière adjacente à la deuxième région axiale (320, 620) du premier corps partiel (110, 510, 810), dans lequel le collier (250, 1150) est formé sur le bord circonférentiel du premier corps partiel (110, 810), sur une surface tournée à l'opposé d'une région de sertissage qui correspond à la première région axiale (310, 610), la première région axiale (310, 610) étant configurée pour être sertie sur l'objet longitudinal (430, 730), dans lequel la première région axiale (310, 610) est pourvue de découpes (330, 630) dans la direction axiale le long d'au moins une partie de la première région axiale (310, 610) pour permettre une déformation radiale dudit premier corps partiel (110, 510, 810) dans une direction de compression lorsqu'il est sertie.
2. Joint (100, 500, 800) de la revendication 1, dans lequel le deuxième corps partiel (120, 520, 820) et le troisième corps partiel (210, 840, 940) sont contigus.
 3. Joint (100, 500, 800) de la revendication 1 ou 2, dans lequel le deuxième corps partiel (120, 520, 820) est positionné radialement avant le premier corps partiel (110, 510, 810) le long d'au moins une partie de la cavité axiale (130, 530, 830) et indépendamment de la position axiale où le deuxième corps partiel (120, 520, 820) est positionné radialement après le premier corps partiel (110, 510, 810), par rapport à au moins une partie de la cavité axiale (130, 530, 830).
 4. Joint (100, 500, 800) de l'une des revendications 1 à 3, dans lequel le deuxième corps partiel (120, 520, 820) forme au moins l'une d'une première lèvre d'étanchéité faisant saillie vers l'intérieur dans la cavité axiale (130, 530, 830) et d'une deuxième lèvre d'étanchéité faisant saillie dans la direction radialement vers l'extérieur.
 5. Joint (100, 500, 800) de la revendication 4, dans lequel la première lèvre d'étanchéité ou la deuxième lèvre d'étanchéité sont annulaires, sous une forme circonférentielle à un emplacement axial fixe.
 6. Joint (100, 500, 800) de la revendication 4, dans lequel la première lèvre d'étanchéité ou la deuxième lèvre d'étanchéité est de forme ovale et située le long d'une position circonférentielle variant axialement.
 7. Joint (100, 500, 800) de l'une des revendications 4 à 6, dans lequel la première lèvre d'étanchéité et la deuxième lèvre d'étanchéité se situent à des emplacements axiaux relativement différents le long du deuxième corps partiel (120, 520, 820).
 8. Joint (100, 500, 800) de l'une des revendications précédentes, dans lequel le deuxième corps partiel (120, 520, 820) est réalisé en un matériau à base de silicone ou en un matériau ayant des propriétés mécaniques flexibles similaires à celles d'un matériau à base de silicone.
 9. Joint (100, 500, 800) de l'une des revendications 1 à 7, dans lequel le premier corps partiel (110, 510, 810) est réalisé en un matériau plastique rigide présentant une stabilité à la température allant jusqu'à la température de vulcanisation du matériau utilisé pour fabriquer le deuxième corps partiel (120, 520, 820).
 10. Joint (100, 500, 800) de l'une des revendications précédentes, dans lequel le deuxième corps partiel (120, 520, 820) est moulé d'un seul tenant sur le premier corps partiel (110, 510, 810) en utilisant un procédé de surmoulage ou un procédé de moulage par co-injection.
 11. Joint (100, 500, 800) de l'une des revendications précédentes, dans lequel la deuxième région axiale (320, 620) est configurée pour venir en butée contre au moins l'un(e) de l'objet longitudinal (430, 730) et d'une cavité (410, 710, 1110) recevant ledit joint (100, 500, 800), pour limiter le mouvement dudit objet longitudinal (430, 730) dans la position entièrement montée.

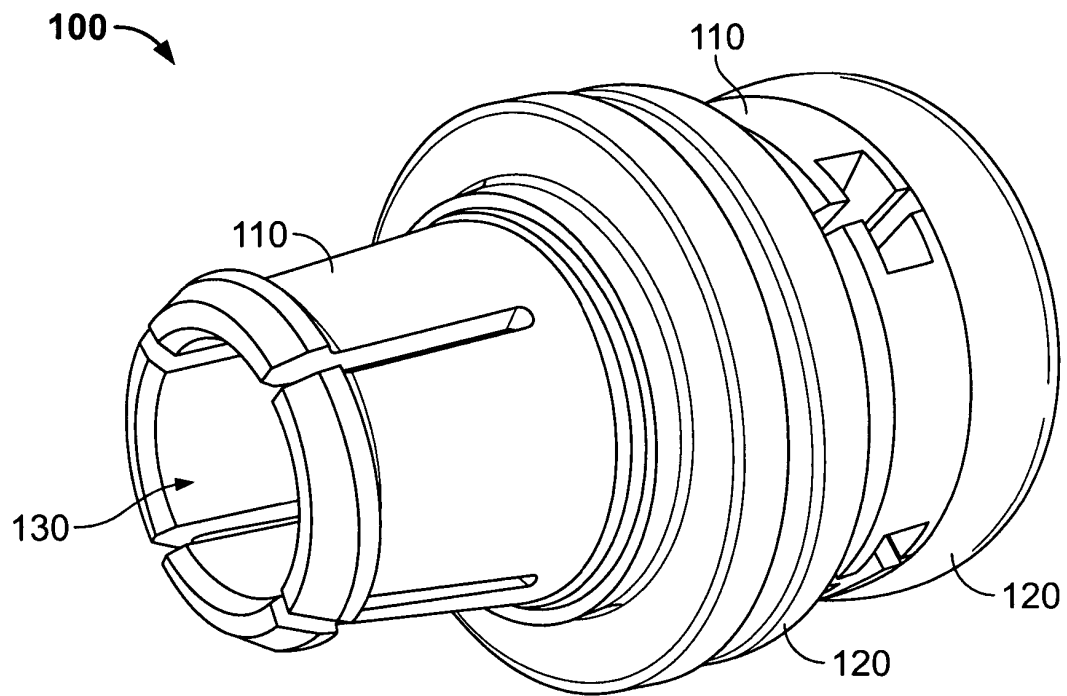


Fig. 1

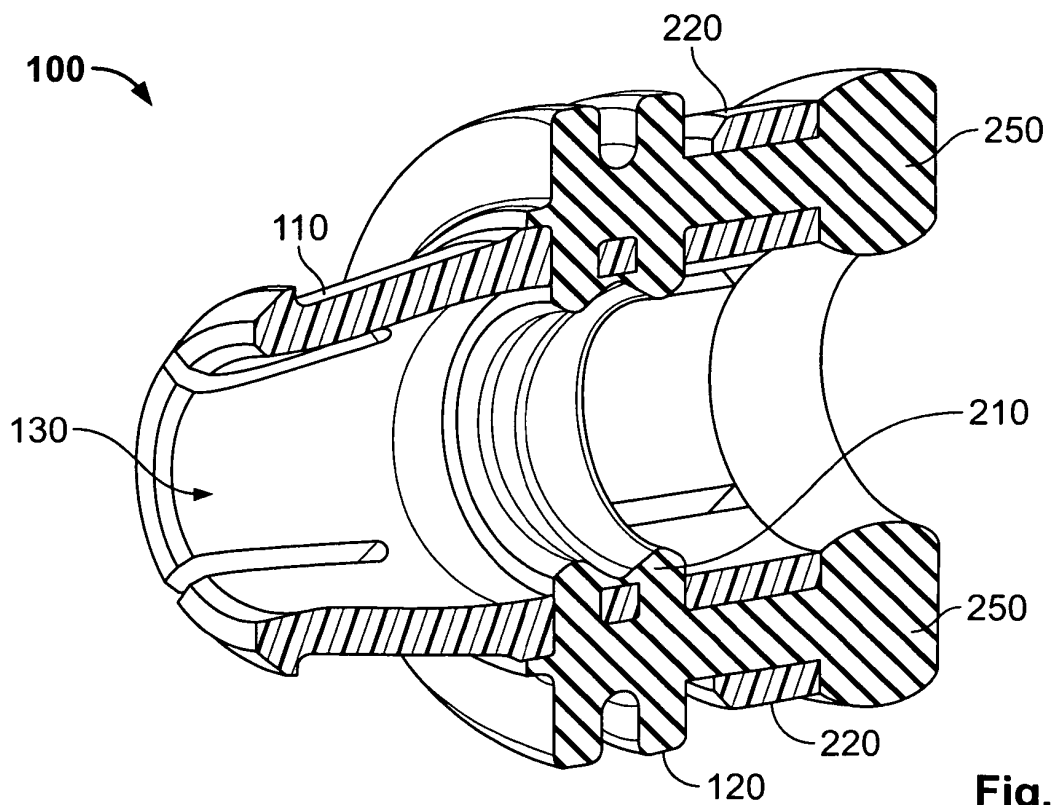
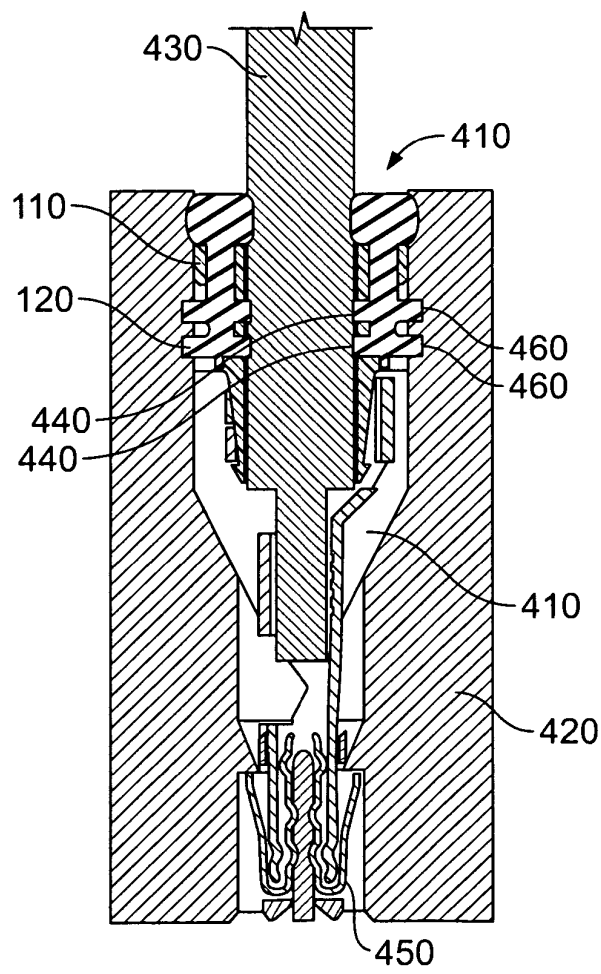
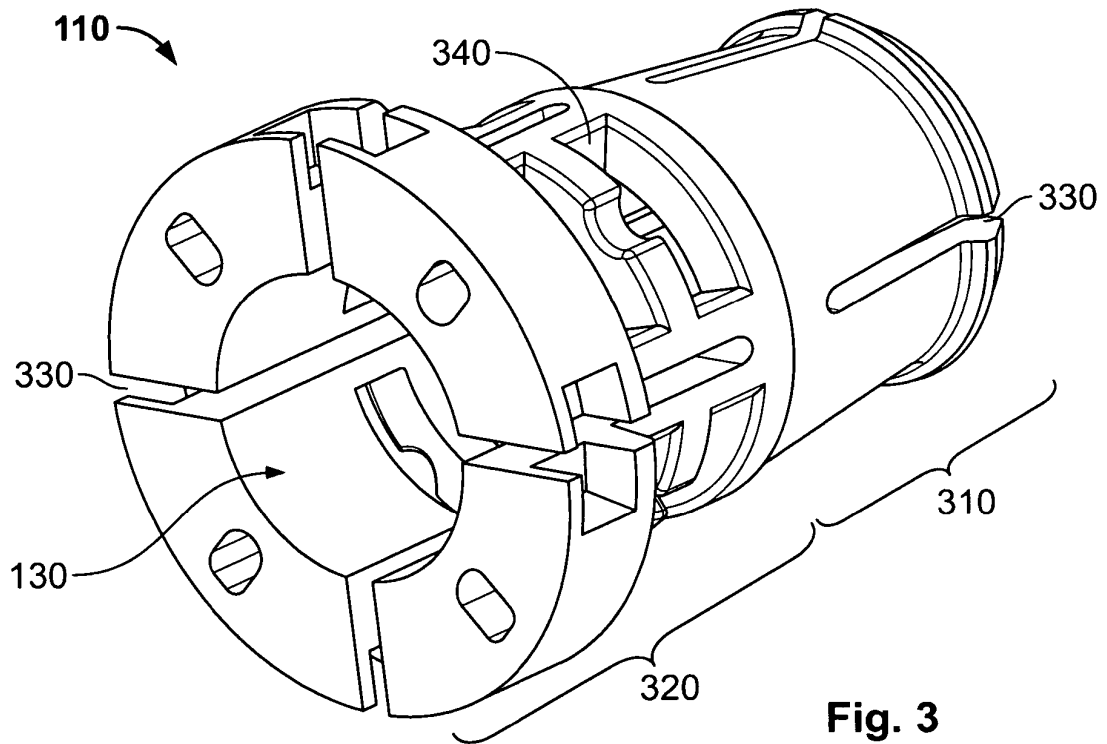


Fig. 2



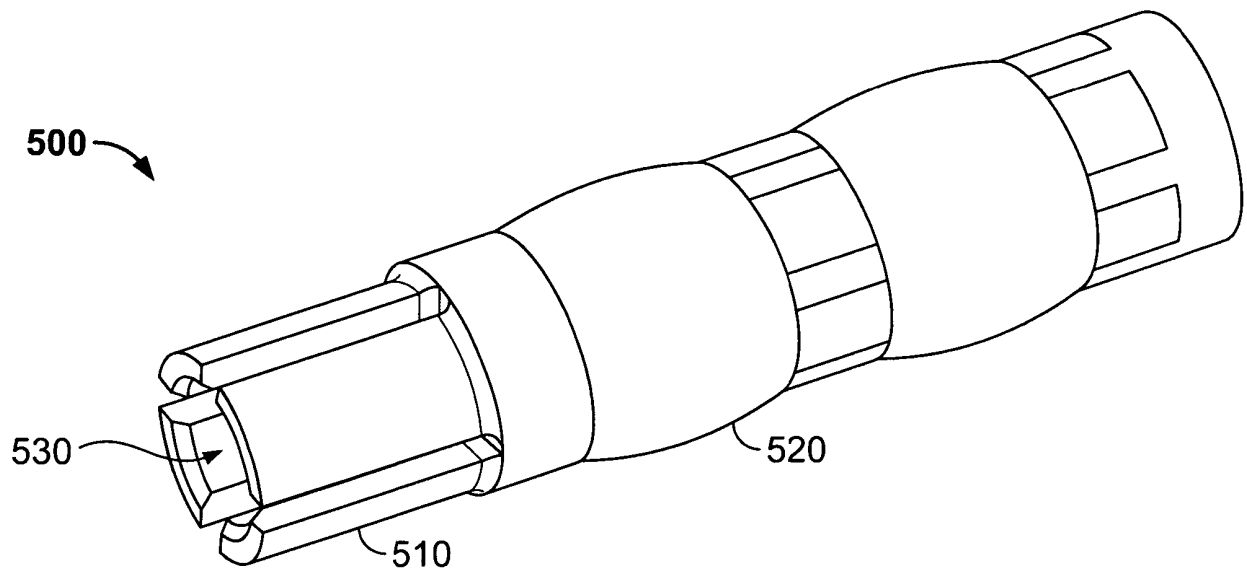


Fig. 5

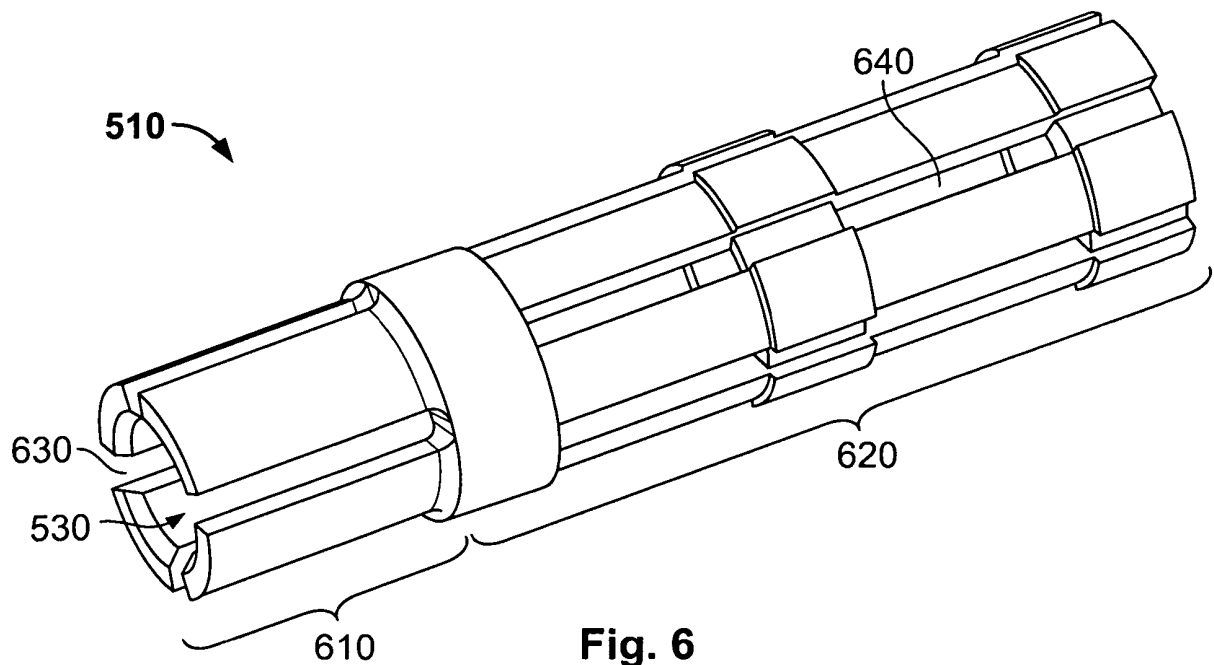


Fig. 6

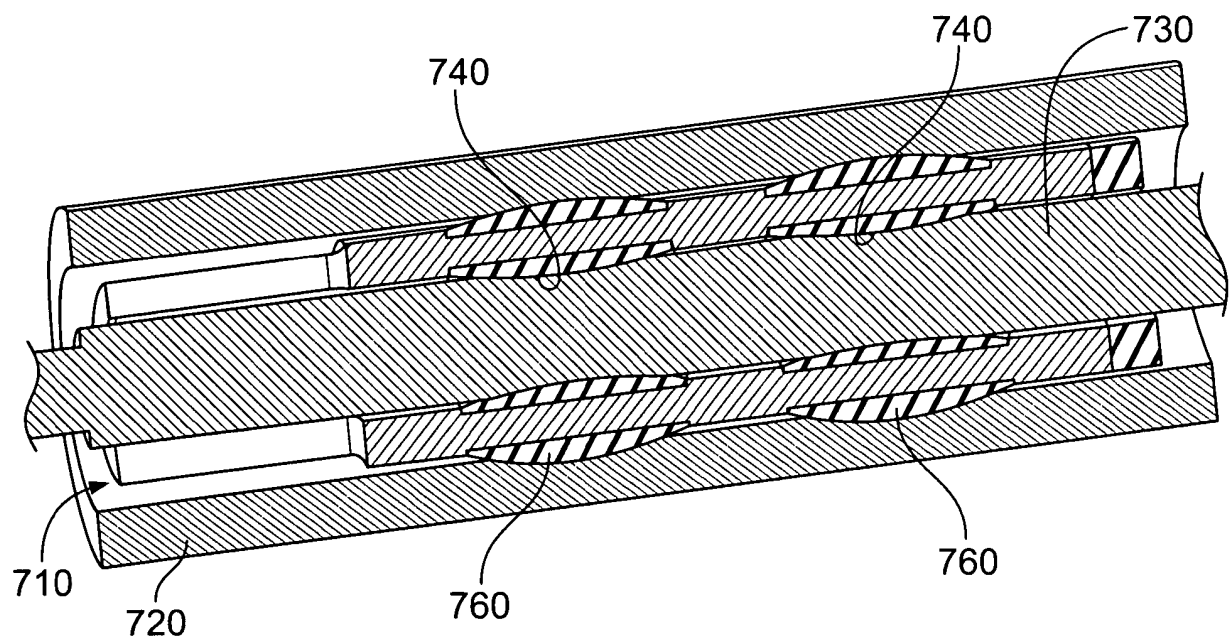


Fig. 7

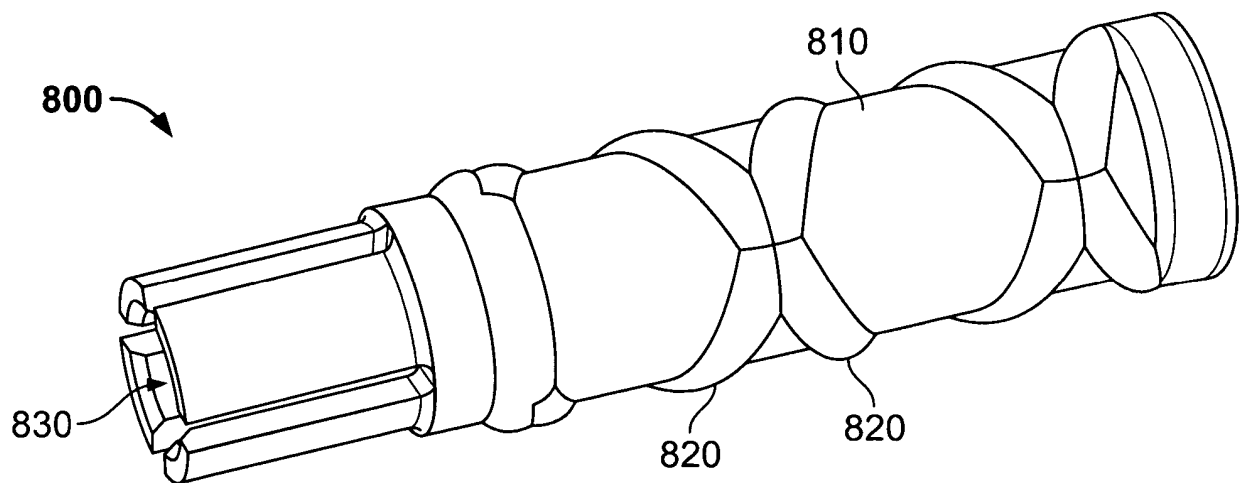


Fig. 8

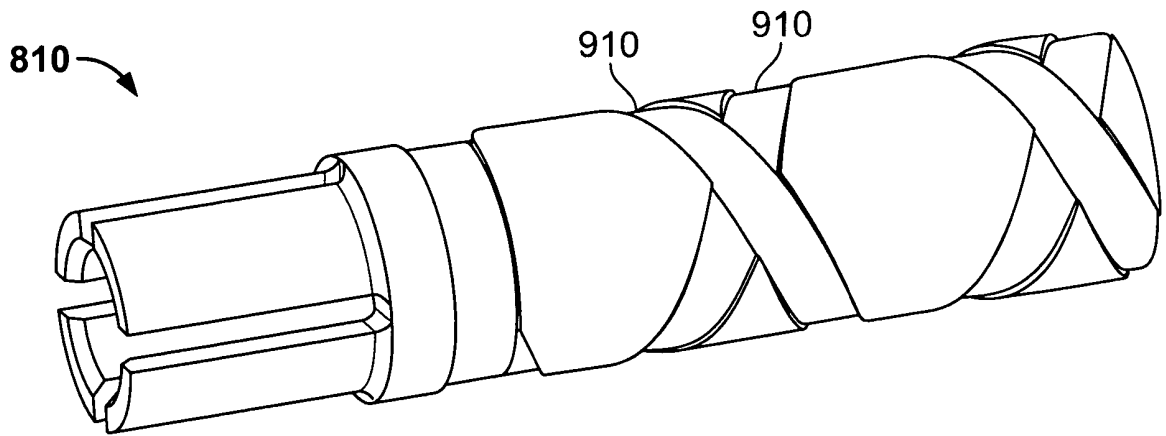


Fig. 9

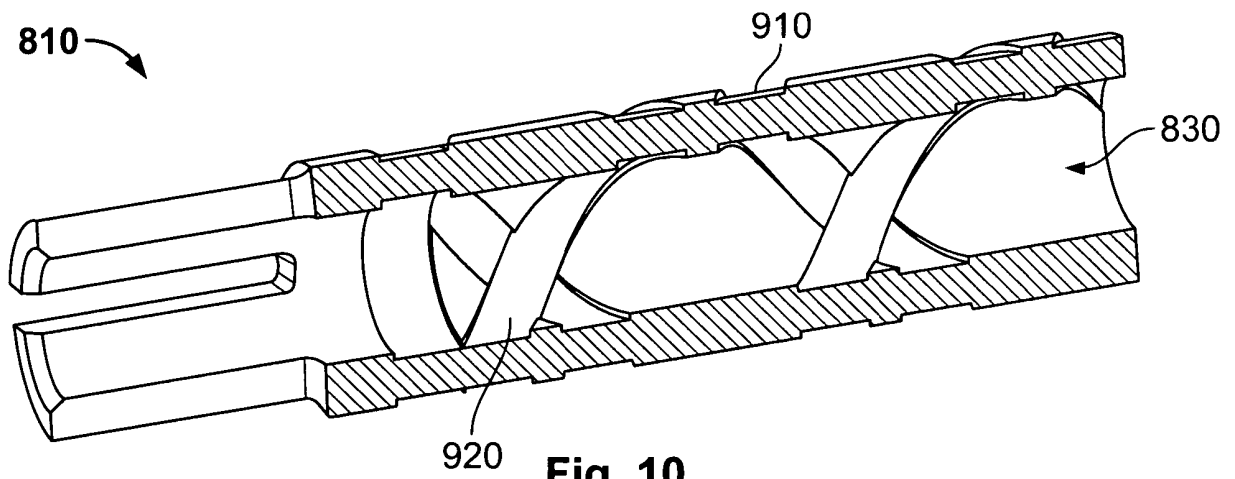


Fig. 10

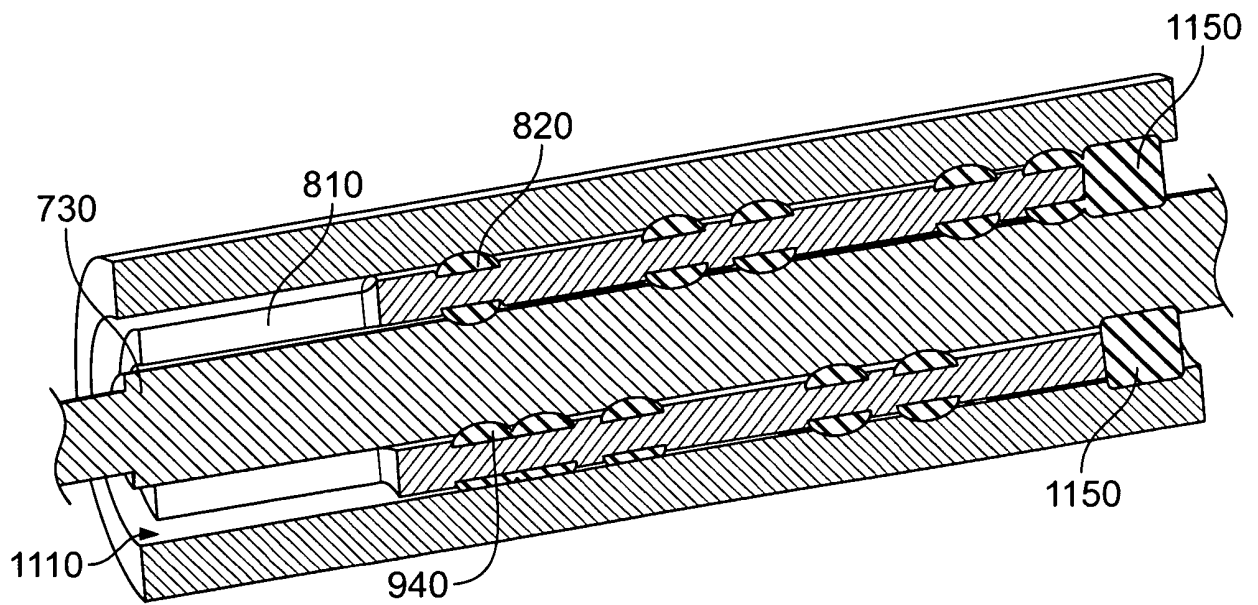


Fig. 11

REFERENCES CITED IN THE DESCRIPTION

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