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(73) Patenthaver: **Schneider Electric Industries SAS, 89, Boulevard Franklin Roosevelt, 92500 Rueil-Malmaison, Frankrig**

(72) Opfinder: **Kullolli, Dharmveer M, Madar Maddi, Near 6 No School, Jaibheem Nagar Dharwad, 580001 Karnataka, Indien**
Wängstre, Håkan, Stenbrovägen 18, 611 37 Nyköping, Sverige

(74) Fuldmægtig i Danmark: **NORDIC PATENT SERVICE A/S, Bredgade 30, 1260 København K, Danmark**

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DESCRIPTION

Technical Field

[0001] The present invention relates to an end seal that is intended to seal between a number of conductors pulled in a wiring tube and the wiring tube wherein the seal is connected to the end of the wiring tube. The wiring tube is of a flexible type having equidistant grooves with intermediate ridges.

Background of the Invention

[0002] Previously known seals for flexible wiring tubes, for the elimination of air migrations in the wiring tubes and in the buildings, consist of an essentially cylindrical elastic plug, which is provided with a penetratable diaphragm. The application of such a seal is made by each conductor, which has been pulled through the wiring tube, being allowed to penetrate the diaphragm of the elastic plug, the plug being displaced on the conductors to the end of the wiring tube where the plug is pressed in, wherein sealing is provided between the conductors and the wiring tube.

[0003] A disadvantage of these known types of seals is that the thickness of the elastic plug intrudes on the already narrow space in the wiring tube.

[0004] Further disadvantages of these prior art seals are that each conductor has to be brought through the diaphragm of the plug, after which the conductors with a certain inertia can be adjusted in relation to the plug.

[0005] A further disadvantage is that the plug may come loose from the wiring tube if an additional length adjustment of the conductors is required, since the plug is frictionally connected to the inside of the wiring tube. In addition, the plug cannot be indestructibly removed from the conductors without all the conductors having to be pulled through the plug.

[0006] Because of these disadvantages that are time-consuming, installation engineers or electricians tend to fail to apply these types of seals, wherein the wiring tube will become entirely unsealed.

[0007] The prior art document US patent 6211465 discloses a sealed connecting box for fitting a tube to an aperture of a wall. The connecting box includes two shells which are connected by a hinge at their common longitudinal jointing face. In the closed state the connecting box is provided for holding a tube in an aperture of a wall.

The Object of the Invention

[0008] The object of the invention is to provide an end seal for a flexible wiring tube that solves the problems indicated.

[0009] One object is to provide an end seal for a flexible wiring tube that allows an application after the conductors have been connected to the respective electrical device.

[0010] A further object is to provide an end seal for a flexible wiring tube that can be readily mounted and dismounted at the end of the wiring tube even if conductors already are pulled in the wiring tube.

[0011] In addition, the object is to provide an end seal for a flexible wiring tube that is sufficiently fixedly connected to the end of the wiring tube to allow readjustment of the conductors by pulling without risk of the end seal coming loose.

Summary of the Invention

[0012] By the present invention, as the same appears in the independent claims, the above-mentioned objects are met, said disadvantages having been eliminated. Suitable embodiments of the invention are defined in the dependent claims.

[0013] The invention concerns an end seal according to the features of claim 1. In one embodiment of the invention, at least one support ring part of the seal is provided with an internally placed friction means. The friction means serves the purpose of grasping around the external surfaces of the wiring tube in order to eliminate axial movement of the end seal and to lock the end seal in the axial direction to the wiring tube when the cables are adjusted by being pulled through the seal.

[0014] In one embodiment of the invention, the friction means consists of one or more radially inwardly directed protuberances shaped to engage the notches of the wiring tube. This or these protuberances may be evenly distributed along the inner periphery of the support ring parts in order to distribute the axial forces that may arise on the end seal.

[0015] In one embodiment of the invention, the friction means consists of a protuberance that extends along the inner periphery of the entire support ring part. In this embodiment, the axial forces are evenly distributed along the entire periphery of the wiring tube.

[0016] In one embodiment of the invention, the two support ring parts are provided with similar friction means. This embodiment further increases the loading symmetry of the support ring.

[0017] In one embodiment of the invention, the two friction means consist of or both friction

means are covered with a softer material, for instance a styrene-ethylene-butadiene thermoplastic elastomer, than the material of the support ring parts. This embodiment helps to further limit air migrations in the wiring tube by sealingly abutting against the outer surface of the wiring tube and the bottom and sides of the notches.

[0018] In one embodiment of the invention, each diaphragm part has a thickness T_{min} at the centre of the diaphragm part that is smaller than the thickness T_{max} at the connection of the diaphragm part to its respective support ring part. This embodiment contributes to the connection of the diaphragm parts to the insulated conductors being improved wherein also the sealing effect is improved.

[0019] In one embodiment of the invention, each support ring part consists of half a support ring foldable along a diameter of the sealing ring, the diaphragm parts connecting to each other along the same diameter when the support ring is folded.

[0020] The invention also concerns a method for the manufacture of an end seal as defined above with the features of claim 10. Preferably, the support ring is injection-moulded with polypropylene in a moulding tool after which the diaphragm is connected to the support ring by the injection of a styrene-ethylene-butadiene thermoplastic elastomer against the connection position in the support ring. Both these manufacturing steps are carried out in one and the same moulding tool without the detail having to be moved from its position.

[0021] Preferably, the injection against the connection position in the support ring is made against radially directed front folds in the support ring. The front folds increase the strength of the attachments of the diaphragm parts.

[0022] Preferably, the material polypropylene (PP) is used in the encompassing support ring of the end seal part, and preferably styrene-ethylene-butadiene thermoplastic elastomer (SEBS), which is a thermoplastic rubber, is used in the diaphragm. These two materials are joined by a two-material injection moulding. Accordingly, there is no mounting of the two material types but the materials connect to each other by chemical bond. The relatively hard support ring is produced in a first manufacturing step of the injection moulding. Next, the support ring detail is moved to a second manufacturing step situated in the same moulding tool for injecting the soft material against the support ring detail, the two materials being joined to each other into a complete end seal.

Brief Description of the Drawings

[0023] Now, the invention will be described in more detail with references in connection with the accompanying drawing figures.

Figure 1

shows a perspective view of an end seal according to the invention mounted on a

flexible wiring tube.

Figure 2

shows Figure 1 in a side view.

Figure 3

shows a perspective view of a closed end seal according to the invention.

Figure 4

shows a front view of the closed end seal according to the invention.

Figure 5

shows a perspective view of an open end seal according to the invention.

Figure 6

shows a side view of the open end seal according to the invention.

Figure 7

shows an inner planar view of the open end seal according to the invention.

Description of the Invention

[0024] Figure 1 shows an end seal 10 mounted on a flexible wiring tube 11. The end seal 10 comprises a support means in the form of a support ring 12 consisting of a first support ring part 121 and a second support ring part 122. These two support ring parts are interconnected via a hinge joint 13. Furthermore, the first support ring part 121 is provided with a first diaphragm part 141 and the second support ring part 122 provided with a second diaphragm part 142. Furthermore, the first support ring part 121 is provided with a first fixed locking part 151 in the form of a male part and the second support ring part 122 is provided with a second resilient locking part 152 in the form of a female part that can encompass said male part, wherein said locking parts can be snapped together into the position shown in Figure 1. Other forms of the locking parts than those shown in the figures are feasible within the scope of the invention. For instance, the male part may be resilient and be attached by snap action into a female part. Neither the female part has to be a loop or a hole but may be an edge or a hook.

[0025] The figure also shows how the two diaphragm parts 141, 142 of the end seal 10 abut against three insulated conductors L1, L2, L3 that have been pulled through the wiring tube 11.

[0026] Figure 2 shows the mounted end seal 10 that has been folded around the three insulated conductors L1, L2, L3 and snapped together over the wiring tube 11 by the second locking part 152 having been snapped over the first locking part 151. The figure shows that the flexible wiring tube 11 is formed with equidistant ridges 21 between which equidistant notches 22 are formed. Here, a pitch D is defined as the distance between two adjacent ridges according to the figure. For the folding around of the end seal and snap locking of the same to the wiring tube, the inside of at least one support ring part 122 is provided with a friction means that makes the end seal to be retained on the wiring tube when the conductors are readjusted. Said friction means will be described in more detail under Figure 5.

[0027] Figure 3 shows the end seal 10 with its two support ring parts 121, 122 joined to each other by the hinge joint 13 as well as snapped together by the locking parts 151, 152 so as to form said support ring. The figure shows that the two diaphragm parts 141, 142 abut edge to edge with each other along a straight edge line 31.

[0028] Figure 4 shows in a front view that the edge line 31, which is defined by the diaphragm parts 141, 142, extends parallel to a diameter of the support ring 12, which diameter when extended extends through the hinge joint 13. Furthermore, the extension of the edge line 31 is selected so that it does not coincide with an inner dividing line 41 between the two support ring parts 121, 122 on the side of the support ring where the locking parts are arranged.

[0029] Figure 5 shows the complete end seal 10 from within and unfolded via the hinge joint 13. On the inside of each support ring part 121, 122 a friction means 51, 52 as well as the diaphragm parts 141, 142 are placed, the friction means and the diaphragm parts being situated at an axial distance from each other. Said axial distance is a slightly exceeding the total width of a ridge and a notch on the wiring tube but smaller than the total width of two ridges and two notches. The friction means 51, 52 extend around the inner periphery of the entire end seal 10, the end surfaces 53, 54 and 55, 56, respectively, of the friction means abutting against each other when the end seal is snapped together.

[0030] Also other forms of friction means than what has been shown in Figure 5 are covered by the invention, for instance in the form of a number of separate and similar protuberances having the same pitch around the inner periphery of the end seal.

[0031] Figure 6 shows the end seal 10 in an unfolded position in a front view, the support ring parts 121, 122 being provided with each a front fold 61, 62 against which the diaphragm parts are injected and accordingly abut. These front folds 61, 62 are plane and have a radial extension and increase the strength of the diaphragm parts 141, 142 and contribute to prevent them from being pulled loose from the support ring parts 121, 122 when the end seal is mounted and the cables are adjusted in the wiring tube.

[0032] Figure 7 shows the end seal 10 in an unfolded position internally where the friction means 51, 52 are placed at an axial distance A from the diaphragm parts 141, 142 in relation to the previously defined pitch D between each ridge, see Figure 2, in a wiring tube, wherein said relationship preferably is $D < A < 2D$. A common value of D is 4 mm and a common value of A is 5 mm in wiring tubes having an outer diameter of 20 mm. The dimensions of A and D, respectively, are adapted to the current outer diameter of the wiring tube, which, for instance, may have the outer diameters 16 mm, 20 mm, 25 mm, 32 mm and 40 mm.

[0033] The diaphragm parts 141, 142 are formed so that their thickness T_{max} is greatest at their respective connection to the support ring parts 121, 122, while their thickness T_{min} occurs in the middle of the diaphragm parts. The relationship between said thicknesses is from 0,5 $T_{max} = T_{min}$ to 0,8 $T_{max} = T_{min}$. This reduction of the thickness of the diaphragms implies a

better connection of the diaphragm edges to the insulated conductors when the end seal is mounted around the conductors. Furthermore, there are seen the two front folds 61, 62 against which the diaphragm parts 141, 142 abut so that the connection position of the diaphragm parts in the support ring 12 is limited axially outward.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US6211465B [0007]

Patentkrav

1. Pakdåse (10), der kan forbindes for enden af en rillet ledningsslange (11), hvilken pakdåse (10) er indrettet til at forsegle et rum mellem kablerne (L1, L2, L3), som trækkes i ledningsslangen (11), og selve ledningsslangen (11), og hvilken pakdåse (10) omfatter et støttemiddel, til hvilket en forseglingsmembran (141, 142) er forbundet, og som, når pakdåsen (10) er monteret, støder op imod kablerne, idet pakdåsens (10) støttemiddel omfatter en støttering (12), til hvilken forseglingsmembranen (141, 142) er forbundet, hvilken støttering (12) består af to støtteringsdele (121, 122), som er indbyrdes forbundet ved hjælp af et hængselled (13), og idet hver støtteringsdel (121, 122) er forsynet med en membrandel (141, 142), så vel som hver støtteringsdel (121, 122) er forsynet med en låsedel (151, 152), som på en første støtteringsdel (121) består af en han-del (151), og som på en anden støtteringsdel (122) består af en hun-del (152), hvor støtteringsdelene (121, 122) med deres membrandele (141, 142) kan blive låst sammen af låsedelene (151, 152) for at danne en ringformet pakdåse (10), **kendetegnet ved, at** membrandelene (141, 142) støder op imod hinanden kant mod kant langs en lige kantlinje (31), der strækker sig parallelt med en diameter af støtteringen (12) og langs samme diameter, når støtteringen (12) er foldet, og imod kablerne (L1, L2, L3) for at virke forseglende i retning af kablerne, når støtteringsdelene (121, 122) er låst sammen.

2. Pakdåse ifølge krav 1, **kendetegnet ved, at** mindst en støtteringsdel (121, 122) er forsynet med et internt placeret friktionsmiddel (51, 52) for at fastlåse pakdåsen (10) til ledningsslangen (11) i den aksiale retning.

3. Pakdåse ifølge krav 2, **kendetegnet ved, at** friktionsmidlet (51, 52) består af et eller flere indadrettede fremspring, der er formet til at gå i indgreb med ledningsslangens (11) riller (22).

4. Pakdåse ifølge krav 3, **kendetegnet ved, at** friktionsmidlet (51, 52) består af et fremspring, der strækker sig langs den indre omkreds af hele støtteringsdelen (121, 122).

5. Pakdåse ifølge et hvilket som helst af kravene 2-4, **kendetegnet ved, at** de to støtteringsdele (121, 122) er forsynet med tilsvarende friktionsmidler (51, 52).

6. Pakdåse ifølge krav 5, **kendetegnet ved, at** de to friktionsmidler (51, 52) enten består af eller er dækket af et blødere materiale end støtteringsdelenes (121, 122) materiale, for eksempel en termoplastisk styren-ethylen-butadien-polymer.

7. Pakdåse ifølge et hvilket som helst af kravene 1-6, **kendetegnet ved, at** hver membrandel (141, 142) har en kantlinje (31), således at kanterne af membrandelene støder op imod hinanden kant mod kant langs kantlinjen (31), når støtteringsdelene (121, 122) er låst sammen.

8. Pakdåse ifølge et hvilket som helst af kravene 1-7, **kendetegnet ved, at** hver membrandel (141, 142) har en tykkelse T_{min} i centrum af membrandelen (141, 142), som er mindre end tykkelsen T_{max} af membrandelen (141, 142) ved membrandelens (141, 142) forbindelse med dens respektive støtteringsdel (121, 122).

9. Pakdåse ifølge et hvilket som helst af kravene 1-8, **kendetegnet ved, at** hver støtteringsdel (121, 122) består af halvdelen af en støttering (12), der kan foldes til til separation langs en diameter af forseglingsringen, idet membrandelene er indbyrdes forbundet langs samme diameter, når støtteringen (12) er foldet.

10. Fremgangsmåde til fremstilling af en pakdåse ifølge et hvilket som helst af kravene 1-9, **kendetegnet ved, at** et forseglingsmembran (141) forbindes med en støttering (12), der omfatter to støtteringsdele (121, 122), som er indbyrdes forbundet ved hjælp af et hængselled (13) og forsynet med låsedele (151, 152), såvel som at hver støtteringsdel er forsynet med en membrandel (141, 142), som tilsammen danner forseglingsmembranen (141), idet materialet af den omgivende støttering (12) forenes med materialet af membranen ved en tokomponentsprøjestøbning, der bevirker en kemisk binding mellem materialerne.

11. Fremgangsmåde til fremstilling af en pakdåse ifølge krav 10, **kendetegnet ved, at** støtteringen (12) sprøjtestøbes med polypropylen i et formværktøj, hvorefter membranen (141, 142) forbindes med støtteringen (12) ved indsprøjtning af en termoplastisk styren-

ethylen-butadien-elastomer mod en forbindelsesposition for membranen (141, 142) i støtteringen (12).

12. Fremgangsmåde til fremstilling af en pakdåse ifølge krav 11, **kendetegnet ved, at** indsprøjtningen mod forbindelsespositionen i støtteringen (12) udføres mod radialt rettede frontfolder (61, 62) i støtteringen (12).

DRAWINGS

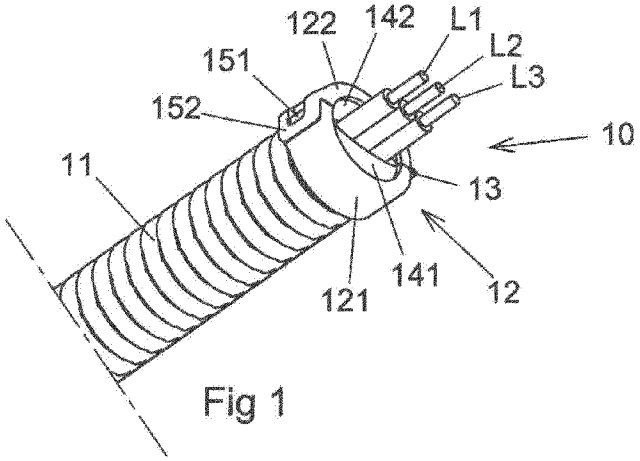

Fig 1

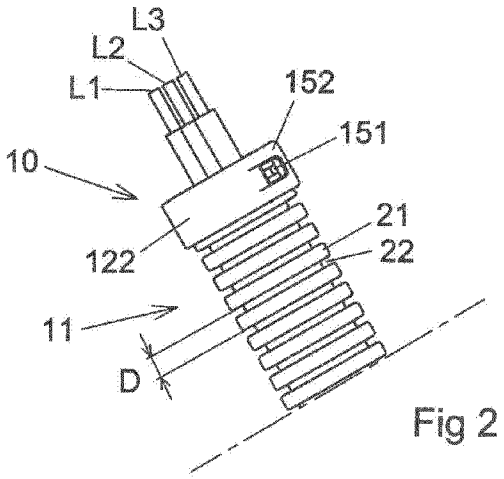

Fig 2

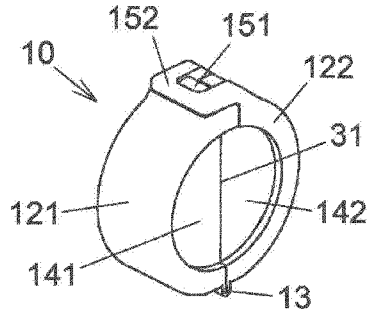

Fig 3

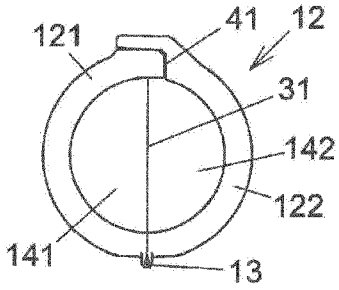

Fig 4

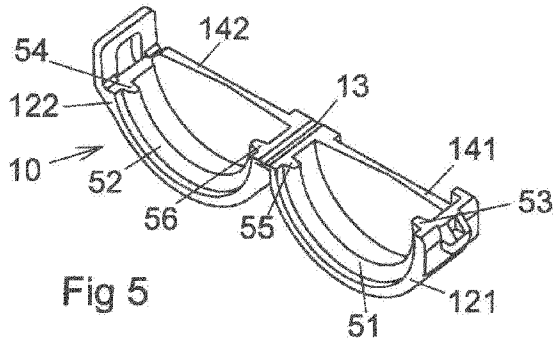

Fig 5

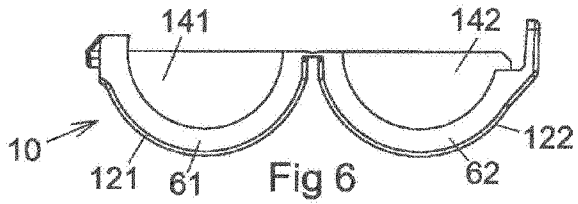

Fig 6

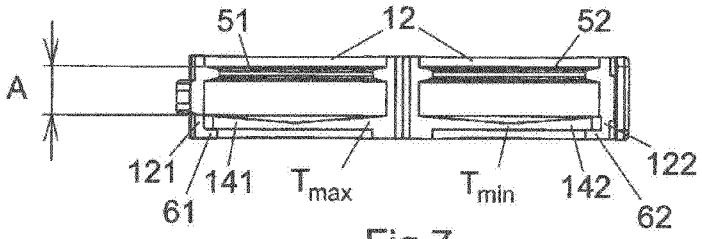

Fig 7