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Patent Application

Cable clamp

The invention relates to a cable clamp as is described in the preamble of claim 1. One such means is already known from cable glands, for example so-called PG cable glands, such as for example the "UNI-Dicht [UNI-Tight] system from Pflitsch and is shown in Figure 4.

Here the two pressure disks 1, the clamp lock washer 2 and the gasket 3 are separate parts which must be placed in the cable penetration part 4 with a sleeve 5 in the installation of the cable clamp in an complex and expensive manner. Moreover the warehousing and mainly the keeping of these separate parts are expensive on site and not always reliably ensured especially for cable connections.

The object of the invention is to develop a cable clamp of the initially mentioned type as simply and economically as possible such that simple and prompt installation and economical storage are enabled and the probability is minimized that parts of the cable clamp would be lacking at the installation site.

This object is achieved by the characterizing features of claim 1. The ^①thrust piece which consists of the two thrust collars and the clamp lock washer and which is installed beforehand at the manufacturer simplifies both storage and installation and makes cable connection very fast. To do this simply the thrust piece can be inserted into the cable

penetration part which is generally made as a socket piece of a housing, the cable can be guided through the sleeve and the relieved thrust piece and finally the sleeve can be attached to the cable penetration part, all in succession.

In the latter installation step moreover the two thrust collars within the framework of the possible axial travel are pressed against one another, by which the clamp lock washer on the oblique inner end faces of the thrust collars is pressed along the entire periphery towards the axis and thus against the cable so strongly that it is fixed to the desired degree.

In the dependent claims advantageous embodiments of the cable clamp as claimed in the invention are given.

Thus, making the thrust collars as claimed in claim 2 without additional costs results in that the clamp lock washer cannot be laterally deflected, but is held centrally between the two thrust collars and thus also uniformly adjoins the cable periphery and is pressed against it with a pressure which is the same over the entire contact surface. This is not only advantageous when the clamp lock washer is pressed into the plastic jacket of the cable and in doing so damage of the jacket is prevented, but also, when to make electrical contact under pressure it adjoins the shield of the stripped shielded cable because then the maximum contact surface is ensured.

Claims 3 describes a thrust piece which can be produced easily and economically, in which the two thrust collars which are provided for example in an injection molding process without additional cost with a groove or a series of catch arms after

insertion of the clamp lock washer must only be pushed together. Here the width of the groove is such that after subtracting the thickness of the catch arms the desired size of the axial stroke necessary to compress the clamp lock washer results.

The aforementioned insertion-withdrawal process is greatly facilitated by the catch projections being made as claimed in claim 4. The second thrust collar then need only be clipped with its catch projections only with minimum expenditure of force into the groove of the other thrust collar. This installation process if necessary can be carried out without tools by hand, for mechanical production very simple tools can be used for this purpose.

One advantageous embodiment of the groove wall behind which the catch projections fit is listed in claim 5. With it an especially small diameter of the thrust piece is enabled. In addition, over its entire length it has a constant diameter and thus optimum guidance in the cable penetration part.

For the case of a cable gland which is common in practice for shielded cables the cable shield can be conductively connected to the ground potential, for example a metal housing. In the cable clamp as claimed in the invention this is done in an advantageously simple manner by at least one of the two thrust collars consisting of electrically conductive material as claimed in claim 6. If the housing-side inner thrust collar is made of metal, conductive connection of the cable shield takes place via the clamp lock washer and this inner thrust collar which for its part lies on the stop collar of the metal cable penetration part.

The alternative possibility of making the outer thrust collar of metal for conductive connection of the cable shield to the housing presupposes that the sleeve likewise consists of metal and is conductively connected to the outer thrust collar.

In most applications the cable clamp in a cable penetration part must moreover ensure the tightness of the cable penetration. This is achieved in the known manner by the arrangement of a gasket between the outer thrust collar and the sleeve which when the sleeve is attached to the cable penetration part is squeezed together such that it moreover adjoins the cable and the inner surface of the sleeve under pressure.

This known gasket is a separate part which must be purchased in addition and stored at the warehouse is often not ready at the installation site nonetheless and requires another installation step.

Conversely, in the embodiment as claimed in claim 7 especially favorable storage and very simple installation of the thrust piece are achieved by the gasket being mechanically connected to the thrust collar which faces it. In this compact initial version of the thrust piece the connection, for example by screwing or locking, can be detachable. But the connection can also be nondetachable and thus made captive, for example as claimed in claim 8 by cementing the gasket to the outer thrust collar or as claimed in claim 9 by injecting it thereto. This second alternative has the advantage of better adhesion of the gasket to the thrust piece and more economical production because

the thrust collar and the gasket which had been injected on can be produced in a single step by means of a double injection mold.

If the elasticity of the material of this thrust collar which faces the cable insertion area of the sleeve is large enough for sealing purposes, but still small enough to be able to accommodate the required pressure of the clamp lock washer when the sleeve is attached to the cable penetration part, it is especially advantageous to use the thrust collar moreover as a gasket (claim 10). Thus a special gasket - whether as a separate part or one connected to the external thrust collar - is no longer necessary, so that the cable clamp can be produced and used especially easily and economically.

The greatest possible compactness of the cable clamp as claimed in the invention is achieved by the version (Figure 1) described in claim 11, in which a single premounted part is made available to the user by simply clipping the sleeve onto the gasket, which part can be produced not only with minimum cost, but enables extremely uncomplicated handling in practical use. This is because only the (optionally stripped) cable can be inserted through the gasket and the thrust piece as far as the desired position and then the sleeve can be attached to the contact penetration part. Here moreover the cable is clamped securely and the cable penetration area is sealed by compressing the gasket liquid-tight.

One especially feasible attachment of the sleeve to the contact penetration part, for example a socket piece of a housing (claim 13), consists as claimed in claim 12 in providing a screw

sleeve which can be screwed onto the cable penetration part which is made as a threaded socket. Not only the desired clamping pressure of the clamp lock washer and thus the necessary tension relief of the cable, but also the required sealing action according to the requirements of the individual case are achieved by the intensity of tightening of the screw sleeve in conjunction with the material selection of the gasket and the axial dimensions of the interacting parts of the cable clamp.

Claim 14 gives a simple and economical possibility for electrically insulating the metallic housing together with the socket piece and at the same time protecting it mechanically.

The invention is explained below using one embodiment in the figures.

Figure 1 shows an axial section through the installed cable clamp which has not yet been completely attached to the cable insertion connecting piece;

Figure 2 shows an axial section through the individual parts of the cable clamp,

Figure 3 shows an overhead view of the end faces of the two thrust collars facing one another and the clamp lock washer and

Figure 4 shows a halved view of a cable gland known from the prior art.

The cable clamp 10 for clamping ~~of~~ a shielded cable 11 in a tubular cable insertion connecting piece 12 of a metal housing which is (not shown) ^{The clamp 10} and which is integral with it for holding the electrical circuit means consists of a housing-side inner metal thrust collar 13, a cable-side outer thrust collar 14 of plastic,

a clamp lock washer 15 which is located between them and which is bent from a helical metal spring, a gasket 17 which is injection-molded to the cable-side end face 16 of the outer thrust collar 14, and a screw sleeve 18 which encompasses the gasket and which can be screwed onto a matched external thread 19 of the cable insertion connecting piece 12.

The latter consists of a metallic inner socket piece 20 which is made in one piece with the metal housing, and a tubular plastic jacket 21 which is produced by extrusion coating and which has an external thread 19 on its free end. The screw sleeve 18 has a knurled grip 22 by which the required torque can also be applied when screwing on by hand.

The gasket 17 has a collar 23 with a peripheral recess 24 into which a terminal shoulder 25 of the screw sleeve 18 fits such that it can be turned on the one hand relative to the gasket 17 and on the other hand when screwed onto the external thread 10 compresses the gasket 17. In doing so the screw sleeve 18 and gasket 17 adjoin one another over a large surface by corresponding shaping of their surfaces facing one another such that high pressure is transferred both in the axial and also in the radial direction. The contours 26, 27 of the surfaces of the screw sleeve 18 and the gasket 17 which are pressed against one another for this purposes are arched concavely or correspondingly convexly, by which on the one hand the indicated force transfer is produced as in the interacting conical surfaces and on the other hand the gasket 17 is prevented from sliding through the inlet opening 28 of the screw sleeve 18.

Due to pressure in the radial direction the gasket 17 is moreover pressed against the inner surface 26 of the screw sleeve 18 and over a large area against the cable surface so that the cable insertion area of the cable insertion connecting piece 12 is reliably sealed. In addition, the gasket 17 is also pressed against the inner wall 29 of the free end part of the plastic sleeve 21, by which the cable clamp 10 is also secured against penetration of liquid via the threaded gland.

The end faces 30, 31 of the two thrust collars 13, 14 facing one another are tapered conically towards the axis A of the cable clamp 10. The end face 30 of the inner thrust collar 13 has on the outer edge an axially projecting end flange 32 which prevents lateral divergence of the clamp lock washer 15 which in the relieved state adjoins its inner surface and thus the installation of the thrust piece 33 which consists of the thrust collars 13, 14, and the clamp lock washer 15 is greatly facilitated in a simple manner.

The inner thrust collar 13 has a peripheral groove 34 with a first groove wall 35 facing the clamp lock washer 15 and a second groove wall 36.

The outer thrust collar 14 bears six catch arms 37 which are integral therewith, which are distributed uniformly on the periphery and which are provided with catch projections 38 which project towards the axis A, which are located on the free end, and which each have an insertion bevel 39. The first groove wall 35 is equipped with an leading bevel 40 which corresponds to the insertion bevel 39.

With the thrust piece 33 installed the catch projections 38 fit behind the first groove wall 35 and can be moved axially by a correspondingly chosen width of the peripheral groove 34 in it by a stroke which is sufficient to compress the clamp lock washer 15, with the screw sleeve 18 screwed on, so strongly that the required clamping force is achieved for tension relief of the cable 11.

The height of the first groove wall 35 is less by the material thickness of the catch arm 37 than that of the second groove wall 36 so that the thrust piece 33 over its entire length has a constant outside diameter and thus can be inserted unhindered into the cable insertion connecting piece.

In the production of the cable clamp 10, first of all the thrust piece 33 is produced. To do this only the clamp lock washer 15 need be inserted into the inner thrust collar 13, and the outer thrust collar 14 with the gasket 17 molded on its outer end face 16 can be clipped onto the inner thrust collar 13; this can therefore also be done hand by the corresponding oblique surfaces 39, 40 with low expenditure of force. Afterwards only the screw sleeve 18 need be guided over the gasket 17 and with its terminal shoulder 25 need be engaged in the peripheral recess 24 of the gasket 17.

In this state the tension of clamp lock washer 15 is relieved and it adjoins on the outside the end flange 32 of the inner thrust collar 13. The catch projections 38 adjoin the first groove wall and the inside diameter of the clamp lock

washer 15 is slightly larger than the outside diameter of the cable shield 41 which is to be clamped.

For the user this preinstalled cable clamp 10 can be easily stored and installed at the installation site, the uncertainty of a missing individual part being eliminated.

For installation, the cable clamp 10 can be pushed simply into the cable insertion connecting piece 12 as far as a stop of the housing-side external end face 42 of the inner thrust collar 13 on the face edge 43 of the inner socket piece 20, then the correspondingly stripped cable 11 can be inserted through the gasket 17 and the clamp lock washer 15 so far that the cable shield 41 is positioned at the height of the clamp lock washer 15 and then the screw sleeve 18 can be screwed securely on the external thread 19 of the plastic sleeve 21 of the cable insertion connecting piece 12. In this final installation step the gasket 17 is pressed over a large area under pressure against the cable jacket 44, the inner surface 26 of the screw sleeve 18 and the inner surface of the plastic sleeve 20 and moreover the outer thrust collar 14 is pressed against the inner thrust collar 13, the clamp lock washer 15 on its conical surfaces 30, 31 radially sliding centrally towards the axis A and in doing so being pressed into the cable shield 41 until the catch arm 37 adjoins the second groove wall 36 of the peripheral groove 34 of the inner thrust collar 13. This stroke is such that a sufficiently high clamping force is achieved and thus the required tension relief of the cable 11 is ensured and that on

the other hand there is no undue deformation of the cable shield 41.

The described cable clamp 10 is therefore extremely simple and economical in production and handling, thus ensures effective tension relief of the cable 11, high liquid-tightness and permanently secure contact-making between the cable shield 41 and the metal housing, which takes place via the clamp lock washer 15, the metall inner thrust collar 13 and the conductive inner socket piece 20.

1.5

Reference number list

- 10 cable clamp
- 11 cable
- 12 cable insertion connecting piece
- 13 inner (first) thrust collar
- 14 outer (second) thrust collar
- 15 clamp lock washer
- 16 cable-side end face of the inner thrust collar 13
- 17 gasket
- 18 screw sleeve
- 19 external thread of the plastic sleeve 21
- 20 inner socket piece of the cable insertion connecting piece
12
- 21 plastic sleeve on the inner socket piece 20
- 22 knurled grip
- 23 collar of the gasket 17
- 24 peripheral recess of the gasket 17
- 25 terminal shoulder of the screw sleeve 18
- 26 inner contour of the screw sleeve 18
- 27 outer contour of the gasket 17
- 28 inlet opening of the screw sleeve 18
- 29 inside wall of the plastic sleeve 21
- 30 inner end face of the inner thrust collar 13
- 31 inner end face of the outer thrust collar 13
- 32 end flange of the inner end face 30
- 33 thrust piece consisting of 13, 14, and 15

- 34 peripheral groove of the inner thrust collar 13
- 35 first groove wall of the peripheral groove 34
- 36 second groove wall of the peripheral groove 34
- 37 catch arm of the outer thrust collar 34
- 38 catch projections of the catch arm 37
- 39 insertion bevel of the catch projections 38
- 40 leading bevel of the first groove wall 35

Claims

1. Cable clamp (10) for clamping a cable (11) in a tubular cable penetration part (12) which has a stop shoulder (42) on the inside wall, with an clamp lock washer (15) which encompasses the cable (11) and which is located between the inner end faces (30, 31) of the two thrust collars (13, 14), i.e. the end faces which face one another and which diverge towards the axis (1), and with a sleeve (18) which surrounds the thrust collars (13, 14) and the clamp lock washer (15) and which is attached to the cable penetration part (12) such that the outer end face (42) of one thrust collar (13) is pressed against the stop shoulder (42) and the inner end faces (30, 31) of the thrust collars (13, 14), i.e. the end faces which face one another, and these inner end faces press the clamp lock washer radially against the cable (12), characterized in that the thrust collars (13, 14) in the axial direction against one another are movably connected to one another by a stroke and the possible axial travel is such that the inside diameter of the clamp lock washer (15) in the relieved state is roughly greater than or equal to the outside diameter of the part of the cable (11) to be clamped and with the sleeve (18) attached is smaller than the aforementioned outside diameter.

2. Cable clamp as claimed in claim 1, wherein the inner end face (30) of at least one of the thrust collars (13) has an annular flange (32) which projects from its outer edge area in the axial direction and which has an inside diameter which



corresponds to the outside diameter of the clamp lock washer (15) in the relieved state.

3. Cable clamp as claimed in claim 1 or 2, wherein one thrust collar (13) has a peripheral groove (34) and the second thrust collar (14) on the side facing the first thrust collar (13) has at least somewhat elastic catch arms (37) which are distributed around the periphery and which with the catch projections (38) which project radially to the inside fit behind the first wall (35) of the peripheral groove (34) of the second thrust collar (14), i.e. the wall facing the projections.

4. Cable clamp as claimed in claim 3, wherein the catch projections (38) are made tapered conically towards the axis (A) of the cable clamp (10).

5. Cable clamp as claimed in claim 3 or 4, wherein the height of the first wall (35) of the peripheral groove (34) is less by the thickness of the catch arms (37) than that of the second wall (36) of the peripheral groove (34).

6. Cable clamp as claimed in one of claims 1 to 5, wherein at least one of the two thrust collars (13) consists of conductive material.

7. Cable clamp as claimed in one of claims 1 to 6 with a gasket (17) which is located between the sleeve (18) and the cable-side end surface (16) of the outer thrust collar (14), wherein the gasket (17) is connected to the thrust collar (14) facing it.



8. Cable clamp as claimed in claim 7, wherein the gasket (17) is cemented on the outer end face (16) of the thrust collar (14) facing it.

9. Cable clamp as claimed in claim 7, wherein the gasket (17) is injection molded to the outer end face (16) of the thrust collar (14) facing it.

10. Cable clamp as claimed in claim 7, wherein the gasket (17) is integral with the thrust collar (14) facing it.

11. Cable clamp as claimed in one of claims 7 to 9, wherein the gasket (17) in the end area on the cable insertion side has a recess (24) which is attached on the periphery and into which a collar-shaped end area (25) of the sleeve (18) fits.

12. Cable clamp as claimed in one of claims 1 to 10, wherein the sleeve (18) is a screw sleeve which can be screwed with an internal thread onto a matched external thread (19) of the tubular cable penetration part (12).

13. Cable clamp as claimed in one of claims 1 to 11, wherein the cable penetration part (12) is made as a tubular socket (20) of a housing in which the cable (11) can be connected to the electrical circuit parts.

14. Cable clamp as claimed in claim 12, wherein the socket (20) together with the housing has peripheral plastic molded sleeve (21).

