

(19)



(11)

EP 3 859 895 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

04.08.2021 Bulletin 2021/31

(51) Int Cl.:

H01R 4/20 (2006.01)**H01R 9/05 (2006.01)**(21) Application number: **21154322.8**(22) Date of filing: **29.01.2021**

(84) Designated Contracting States:

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated Extension States:

BA ME

Designated Validation States:

KH MA MD TN

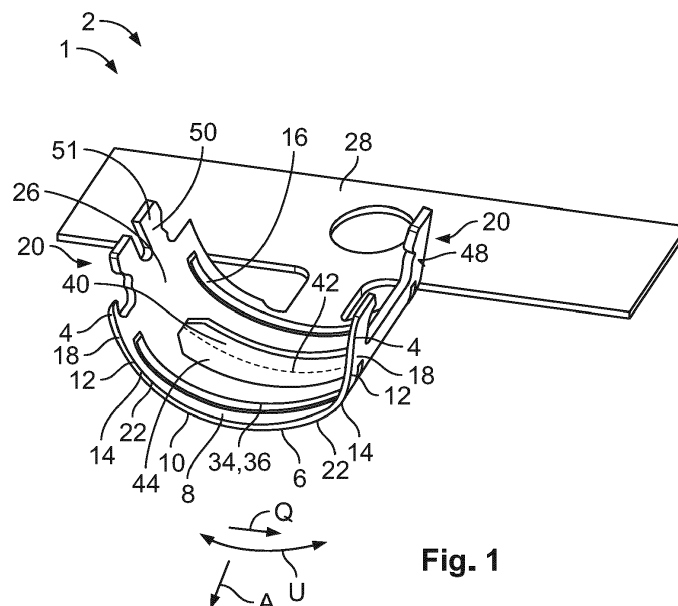
(72) Inventors:

- **DE CLOET, Olivier**
64625 Bensheim (DE)
- **WEIDNER, Matthias**
64625 Bensheim (DE)
- **SCHRETTLINGER, Christian**
64625 Bensheim (DE)
- **MUELLER, Wolfgang**
64625 Bensheim (DE)

(30) Priority: **30.01.2020 DE 102020201137**(71) Applicant: **TE Connectivity Germany GmbH**
64625 Bensheim (DE)(74) Representative: **Grünecker Patent- und**
Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)**(54) CRIMP BARREL PREPARED FOR CRIMPING**

(57) The invention relates to a crimp barrel (1) prepared for crimping. The crimp barrel (1) according to the invention comprises a crimp base (6) that is disposed between two crimp wings (4) and that is provided with a support region (8) for the electrical conductor (3), wherein the support region (8) has a first curvature (10). Furthermore, disposed on both sides of the support region (8) in a circumferential direction (U), in which at least support

region (8) is curved, is a respective region (12) having a second curvature (14), wherein a curvature diameter of the second curvature (14) is smaller than a curvature diameter of the first curvature (10). It is further provided that a rigidity, in particular a flexural rigidity, in the support region (8) or even in the entire crimp base (6), is less than a rigidity, in particular a flexural rigidity, in the respective crimp wings (4).

**Fig. 1**

Description

[0001] The invention relates to a crimp barrel prepared for crimping in order to crimp an electrical conductor of a predetermined diameter.

[0002] Crimp barrels of the aforementioned kind are crimped onto a wire braid of the electrical conductor, for example, as a support barrel. The size or geometry, respectively, of the crimp barrel is matched to the diameter of the electrical conductor. For an electrical conductor having a predetermined diameter, a crimp barrel provided for this diameter can therefore be used to crimp the electrical conductor. The crimp barrel can there serve as a support for an electrical contact that can be crimped around the crimp barrel to terminate the electrical conductor. It is important that individual strands or shielding wires of the electrical conductor do not protrude radially from the crimp barrel or get caught in a crimp seam. This problem leads to discard in the production of a crimped conductor. In order to prevent the strands or shielding wires from getting caught or protruding, a special crimping tool can be used which is provided, for example, with spring assemblies for pressing the electrical conductor onto a support region of the crimp barrel during the crimping process. However, such crimping tools are very specific and not always available at the place of use.

[0003] It is therefore the object of the invention to produce a crimp barrel prepared for crimping which reduces the risk of incorrect production during crimping.

[0004] The object is satisfied according to the invention by a crimp barrel prepared for crimping in order to crimp an electrical conductor of a predetermined diameter, wherein the crimp barrel comprises a crimp base that is disposed between two crimp wings and that is provided with a support region having a first curvature for the electrical conductor. It is provided according to the invention that a region with a second curvature is disposed on both sides of the support region, wherein a curvature diameter of the second curvature is smaller than a curvature diameter of the first curvature. It is further provided that the crimp base exhibits less rigidity than the crimp wings, in particular less flexural rigidity.

[0005] In this context, the crimp barrel prepared for crimping describes an initial state of the crimp barrel in which the crimp barrel has not yet been deformed for crimping onto the electrical conductor.

[0006] The solution according to the invention optimizes the geometry of the crimp barrel prior to deformation in such a way that the crimp base is first deformed during crimping so that the curvature diameter of the first curvature adapts to the curvature diameter of the second curvature. The electrical conductor is pressed against the support region by the crimp wings before the crimp wings are bent over in a final step. It can be ensured in this manner regardless of the crimping tool that the electrical conductor is pressed against the support region during the crimping process, in particular before the crimp wings are bent over, thus preventing individual strands

or shielding wires from getting caught in a crimp seam between the two crimp wings. Since the crimp barrel for crimping is adapted to the predetermined diameter or a predetermined diameter range, specially optimized crimp barrels can be provided for different electrical conductors.

[0007] In the following, further developments are specified which can be combined with one another as desired independently of one another and which are advantageous in themselves.

[0008] For example, the support region may be spaced on both sides from the respective regions with the second curvature. The crimp base may extend beyond the support region in a circumferential direction along which the support region is curved having the first curvature. The crimp base may preferably have an end-to-end curvature in the circumferential direction so that the crimp base forms a depression. As a result, the electrical conductor may automatically align itself in the circumferential direction by sliding along an inner wall of the crimp base in the support region, even if it is initially positioned incorrectly.

[0009] The crimp barrel may preferably be curved in the circumferential direction and receive the electrical conductor in an axial direction. For this purpose, at least the support region may have a convexly curved support area. The crimp wings may be arranged on both sides in the circumferential direction on the crimp base, wherein the region with the second curvature may preferably be a section of the respective crimp wing adjoining the crimp base.

[0010] In order to ensure the best possible fit of the electrical conductor in the crimp barrel, the curvature diameter of the first curvature may be greater than the predetermined diameter of the electrical conductor. A secant between two ends of the crimped base disposed opposite each other in the circumferential direction may preferably be greater than the predetermined diameter. This can ensure that the electrical conductor can be pressed flat against the support region without resistance from the crimp base.

[0011] The support region may extend in the axial direction to a separating web. The separating web may be intended, for example, for better handling of the crimp barrel and for resting on the crimping tool. During the crimping process, the separating web may be removed from the remainder of the crimp barrel, for example, by cutting it off or punching it out.

[0012] For further optimization of the geometry of the crimp barrel, the curvature diameter of the second curvature may correspond substantially to the predetermined diameter. As a result, the respective region may nestle against an outer surface of the electrical conductor during the crimping process without having to be deformed.

[0013] According to a further advantageous embodiment, the regions having the second curvature may exhibit a greater rigidity as compared to the support region,

in particular the crimp base, and the crimp wings. If the regions form a section of the crimp wings, then the respective regions may exhibit a greater rigidity than the remainder of the respective crimp wings. This ensures that the regions are not significantly deformed during the crimping process. First, the crimp base is bent over until the regions nestle against the outer surface of the electrical conductor and the curvature diameter of the crimp base corresponds approximately to the predetermined diameter. In a final step, the wings are bent over so that the crimp barrel engages around the electrical conductor.

[0014] Greater rigidity may be generated, for example, in that at least the regions have at least one corrugation, that is to say, depressions or elevations introduced that are introduced perpendicular to a surface. The at least one corrugation may be shaped, for example, as a reinforcing rib protruding radially on a convexly curved inner surface of the regions. Preferably, two reinforcing ribs may be provided spaced from one another in the axial direction.

[0015] Since these reinforcing ribs in the crimped state press against the electrical conductor, the electrical conductor may be additionally axially affixed by the reinforcing ribs. The axial fixation may be further improved if the corrugation is as sharp as possible.

[0016] The corrugation may be realized with various methods, the corrugation may in particular be embossed.

[0017] If the foothold of the electrical conductor is to be further strengthened in the axial direction, then at least one corrugation may extend, preferably end-to-end, in the circumferential direction away from one region to the other region over the crimp base and/or the support region. While this may increase the rigidity of the crimp base, this, however, may be compensated for by different measures. For example, the material thickness of the crimp wings may be adapted such that the crimp base is still less rigid than the crimp wings and/or the regions.

[0018] According to a further advantageous embodiment, the rigidity of the crimp base may be reduced by a recess in the crimp base. The recess may extend preferably from one end of the crimped base in the circumferential direction toward the opposite end.

[0019] The recess may be configured to be elongate in the circumferential direction and have a uniform depth in the radial direction transverse to the circumferential direction. The recess may penetrate the crimp barrel in the radial direction, thereby forming a window framed by the remainder of the crimp base. Due to the recess, the rigidity of the crimp base may be greatly reduced without great effort, whereby an increase in rigidity caused by the corrugation may be balanced.

[0020] The recess may be arranged in the axial direction between two corrugations. The recess may preferably have a central axis extending in the circumferential direction and at the same time forming an axis of symmetry for the crimp barrel. It may then be ensured that the crimp barrel is uniformly deformed in the axial direction during the crimping process.

[0021] According to a further advantageous embodiment, the crimp wings or the remaining portion of the crimp wings may extend substantially in a rectilinear manner away from the respective region to a free end.

5 The crimp wings or the remaining portion of the respective crimp wings in an initial state prior to crimping may preferably extend at angles inclined away from one another, so that a clear width between the oppositely disposed crimp wings widens towards the free end. This may prevent individual strands or shielding wires from getting caught on the crimp wings when the electrical conductor is inserted into the crimp barrel. This may be realized, for example, in that the region with the second curvature extends at an angle of up to a maximum of approximately 90°.

10 **[0022]** To be able to secure the crimp barrel in the crimped state, the crimp wings may have positive-fit elements that are complementary to one another. The positive-fit elements may preferably be arranged at the respective free end and by way of a positive fit prevent the crimp barrel from opening in that the crimp wings move in opposite circumferential directions.

15 **[0023]** The complementary positive-fit elements may be formed, for example, by mutually engaging tabs. At one free end, for example, two tabs may be arranged spaced from one another in the axial direction with shoulders projecting toward one another in the axial direction. Two complementary tabs which may be inserted between the tabs at the first free end and which are each provided with shoulders projecting away from one another in the axial direction may be integrally formed at the other free end. The shoulders of the tabs and the complementary tabs may then create a positive fit in the circumferential direction.

20 **[0024]** A crimp assembly may comprise an electrical conductor with a predetermined diameter and a crimp barrel according to one of the preceding configurations. At least prior to crimping, the crimp base may comprise a support region having a curvature, the curvature diameter of which is greater than the predetermined diameter. The regions with the second curvature may preferably have a curvature diameter which corresponds substantially to the predetermined diameter. As a result, the regions may nestle against the outer surface of the electrical conductor during crimping, while the crimp base, in particular the support region, is bent around the electrical conductor.

25 **[0025]** The crimp wings or the remaining portion of the respective crimp wings, respectively, may press the electrical conductor against the support region during the crimping process before the crimp wings are bent over in a final step of the crimping process and likewise nestle against the outer surface of the electrical conductor.

30 **[0026]** The electrical conductor may preferably have a cross-sectional geometry in a sectional plane transverse to the axial direction, which is almost identical before and after crimping. The crimp may be, for example, an O-crimp, an overlap crimp or a surrounding crimp. Conse-

quently, the crimp barrel may serve as a support barrel and be configured in such a manner that it does not penetrate into the conductor or its insulation.

[0027] In the following, the invention shall be described in more detail using embodiments with reference to the appended figures. Elements in the figures that correspond to one another in terms of structure and/or function are provided with the same reference symbols.

[0028] The combinations of features shown and described in the individual embodiments are for explanatory purposes only. In accordance with the above explanations, a feature of an embodiment may be dispensed with if its technical effect is of no significance in a particular application. Conversely, in accordance with the above explanations, a further feature may be added in an embodiment should its technical effect be advantageous or necessary for a particular application.

Fig. 1 shows a schematic perspective view of an exemplary embodiment of a crimp barrel according to the invention;

Fig. 2 shows a schematic front view of the crimp barrel prior to crimping;

Fig. 3 shows a schematic front view of the crimp barrel from Fig. 2 during the crimping process; and

Fig. 4 shows a schematic perspective view of the crimp barrel from Fig. 1 in a closed state.

[0029] An exemplary embodiment of a crimp barrel 1 according to the invention prepared for crimping is explained in more detail below with reference to Figs. 1 to 4.

[0030] Crimp barrel 1 may be configured as a shield crimp and be used as a support barrel 2. Consequently, crimp barrel 1 may be crimped to an electrical conductor 3, for example, as a surrounding crimp, an overlap crimp or as an O-crimp. Support barrel 2 may be used in the crimped region as a support for a further crimp connection, for example, for terminating electrical conductor 3. A crimp assembly 52 may comprise electrical conductor 3 and a crimp barrel 1 according to the invention.

[0031] Crimp barrel 1 according to the invention comprises a crimp base 6 that is disposed between two crimp wings 4 and that is provided with a support region 8 for electrical conductor 3, wherein support region 8 has a first curvature 10. Furthermore, disposed on both sides of support region 8 in a circumferential direction U, in which at least support region 8 is curved, is a region 12 having a second curvature 14, wherein a curvature diameter of second curvature 14 is smaller than a curvature diameter of first curvature 10. It is further provided that a rigidity, in particular a flexural rigidity, in support region 8 or even in entire crimp base 6 is less than a rigidity, in particular a flexural rigidity, in respective crimp wings 4.

[0032] Due to the optimized geometry of crimp barrel 1 according to the invention, the first deformation may

take place at the support region, in particular at crimp base 6. In the process, crimp base 6 is bent around electrical conductor 3 while crimp wings 4 press the electrical conductor against support region 8. It is then possible to prevent individual strands or shielding wires of the electrical conductor from getting caught in a crimp seam between two crimp wings 4 during crimping or even from protruding in the radial direction. Consequently, a risk of incorrect production during crimping may be reduced, even without a special crimping tool.

[0033] Crimp barrel 1 may preferably be formed integrally as a monolithic component, for example, by way of a punching and bending process.

[0034] Regions 12 may each be spaced from support region 8 in circumferential direction U. Crimp base 6 may extend away over support region 8 on both sides in circumferential direction U and preferably adjoin respective regions 12 on both sides in circumferential direction U. Regions 12 may preferably represent a section 16 of respective crimp wings 4, wherein regions 12 adjoin crimp base 6 and a remaining portion 18 of respective crimp wings 4 extend away from respective regions 12 to a free end 20, in particular in a rectilinear manner.

[0035] Crimp base 6 may be curved continuously in circumferential direction U having first curvature 10 from an end 22 adjoining a region 12 to an end 22 adjoining oppositely disposed region 12. As a result, a depression 24 is formed with a convexly curved inner surface through which electrical conductor 3 automatically slides to support region 8 located at the extremum.

[0036] If crimp base 6 has an end-to-end curvature in circumferential direction U, then crimp base 6 may be precisely distinguished from regions 12 by the change in curvature.

[0037] Crimp barrel 1 may in particular be convexly curved in a transverse direction Q and extend in a rectilinear manner in an axial direction A perpendicular to transverse direction Q. As a result, crimp barrel 1 forms a trough 26 into which the electrical conductor may be inserted in axial direction A.

[0038] A secant 31 extending from one end 22 of the crimp base to other end 22 of the crimp base may preferably be longer than predetermined diameter 30 of electrical conductor 3, as shown in Fig. 2. It may thereby be ensured that electrical conductor 3 may be inserted into crimp barrel 1 without any problems prior to crimping and may be pressed against support region 8. The curvature diameter of first curvature 10 may preferably be greater than predetermined diameter 30.

[0039] As may be seen in Fig. 1, crimp base 6, in particular support region 8, may extend to a separating web 28 in an axial direction A, transverse to circumferential direction U. Separating web 26 may be used, for example, for better handling of crimp barrel 1 and may be removed during the crimping process by, for example, punching or severing, so that at most a stub is still arranged on crimped crimp barrel 1 after the crimping process.

[0040] Second curvature 14 may have a curvature diameter which substantially corresponds to a predetermined diameter 30 of electrical conductor 3. As a result, region 12 may nestle against an outer surface 32 of electrical conductor 3 during the crimping process without deformation.

[0041] In order to avoid deformation of regions 12 during the crimping process, regions 12 may exhibit greater rigidity, in particular flexural rigidity, as compared to crimp base 6 and crimp wings 4. In the embodiment shown in Fig. 1, regions 12 are part of respective crimp wings 4. In this embodiment, regions 12 may exhibit greater rigidity, in particular flexural rigidity, as compared to respective remaining portion 18, i.e. respective free end 20 of respective crimp wing 4.

[0042] As may be seen in Figs. 1 and 4, the rigidity, in particular the flexural rigidity, of regions 12 may be increased by a corrugation 34 in the form of an embossed reinforcing rib 36.

[0043] In the embodiment shown, reinforcing rib 36 may be embossed in a jacket surface 38 of crimp barrel 1 facing radially outwardly so that a depression is created on jacket surface 38, and reinforcing rib 36 protrudes on the inner surface of crimp barrel 1 facing radially inwardly, in particular of regions 12. Several reinforcing ribs 36 may also be provided. For example, there are two reinforcing ribs 36 present in the embodiment shown spaced parallel to one another in axial direction A and extending in circumferential direction U, wherein reinforcing ribs 36 extend end-to-end from one end of region 12 adjoining remaining portion 18 via crimp base 6 to the opposite end of other region 12.

[0044] Though this also increases the rigidity in crimp base 6, reinforcing ribs 36 may serve to axially affix electrical conductor 3, in particular if they are sharp-edged. In order to further reduce the rigidity in crimp base 6, a recess 40 extending between the two ends 22 of crimp base 6 in circumferential direction U is provided according to the exemplary embodiment. Of course, the recess may also be provided independently of reinforcing ribs 36 on crimp base 6.

[0045] Recess 40 may preferably be arranged axially centrally between the two reinforcing ribs 36 so that a central axis 42 of recess 40 running in circumferential direction U is arranged in a plane of symmetry transverse to axial direction A. This may prevent the bending behavior of crimp barrel 1 from being different in axial direction A, as a result of which non-uniform crimping in axial direction A occurs.

[0046] Recess 40 may be configured, for example, as a depression or, as may be seen in the figures, as a window 44 which penetrates crimp base 6 in the radial direction.

[0047] Crimp wings 4 or remaining portion 18 of respective crimp wings 4, respectively, may extend substantially in a rectilinear manner away from respective region 12. An angle by which region 12 extends has a preferably maximum of approximately 90° so that crimp

wings 4 are inclined away from one another. As a result, a clear width between crimp wings 4 may widen in the direction toward free end 20. This prevents individual strands and/or shielding wires of the conductor from getting tangled on crimp wings 4 or being deflected by crimp wings 4 when electrical conductor 3 is inserted prior to crimping.

[0048] Crimp wings 4 may be provided on their side facing away from oppositely disposed crimp wing 4 with an outwardly facing ramp surface 48, wherein the ramp surface 48 is configured to glide along a mating surface of a crimping tool. When gliding along, a force may be exerted on crimp wings 4 in a first step, wherein a bending moment generated by the force exceeds the flexural rigidity in crimp base 6. This results in a plastic deformation of crimp barrel 1 at crimp base 6, wherein crimp base 6 is bent around electrical conductor 3. Crimp wings 6 there press electrical conductor 3 against support region 8 without deforming, as shown in Fig. 3.

[0049] Crimp wings 4 may then be bent around electrical conductor 3 in a second step of the crimping process, so that crimp barrel 1 engages around electrical conductor 3. To lock crimp barrel 4, crimp wings 4 may comprise positive-fit elements 50 which are complementary to one another at their respective free ends 20.

[0050] Mutually complementary positive-fit elements 50 may be configured as tabs 51 engaging behind one another so that crimp wings 4 opening in circumferential direction U away from one another may be prevented by a positive fit.

Reference numerals

[0051]

1	crimp barrel
2	support barrel
3	electrical conductor
4	crimp wing
6	crimp base
8	support region
10	first curvature
14	second curvature
16	section
18	remaining portion
20	free end
22	end of the crimp base
24	depression
26	trough
28	separating web
30	predetermined diameter
32	outer surface
34	corrugation
36	reinforcing rib
38	jacket surface
40	recess
42	center axis
44	window

48 ramp surface
 50 positive-fit element
 51 tab
 52 crimp assembly

A axial direction
 Q transverse direction
 U circumferential direction

Claims

1. Crimp barrel (1) prepared for crimping in order to crimp an electrical conductor (2) of a predetermined diameter (30), wherein said crimp barrel (1) comprises a crimp base (6) that is disposed between two crimp wings (4) and that is provided with a support region (8) having a first curvature (10) for said electrical conductor (2), wherein a respective region (12) with a second curvature (14) is disposed on both sides of said support region (8), wherein a curvature diameter of said second curvature (14) is smaller than a curvature diameter of said first curvature (10), and wherein said crimp base (6) is less rigid than said crimp wings (4).

2. Crimp barrel (1) prepared for crimping according to claim 1, wherein said region (12) having said second curvature is a respective section (16) of said respective crimp wing (4) respectively adjoining said crimp base (6).

3. Crimp barrel (1) prepared for crimping according to claim 1 or 2, wherein said crimp base (6) is curved end-to-end having said first curvature (10).

4. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 3, wherein said regions (12) comprise a greater rigidity as compared to said crimp base (6) and a remaining portion (18) of said respective crimp wings (4).

5. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 4, wherein at least said regions (12) are provided with at least one corrugation (34).

6. Crimp barrel (1) prepared for crimping according to claim 5, wherein said at least one corrugation (34) is embossed.

7. Crimp barrel (1) prepared for crimping according to claim 5 or 6, wherein said at least one corrugation (34) extends end-to-end from one region (12) via said crimp base (6) to said other region (12).

8. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 7, wherein said crimp base (6) is provided with at least one recess (40).

9. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 8, wherein said at least one recess (40) penetrates said crimp base (6).

10. Crimp barrel (1) prepared for crimping according to claim 8 or 9, wherein said at least one recess (40) extends between ends (22) of said crimp base (6) adjoining said respective regions (12).

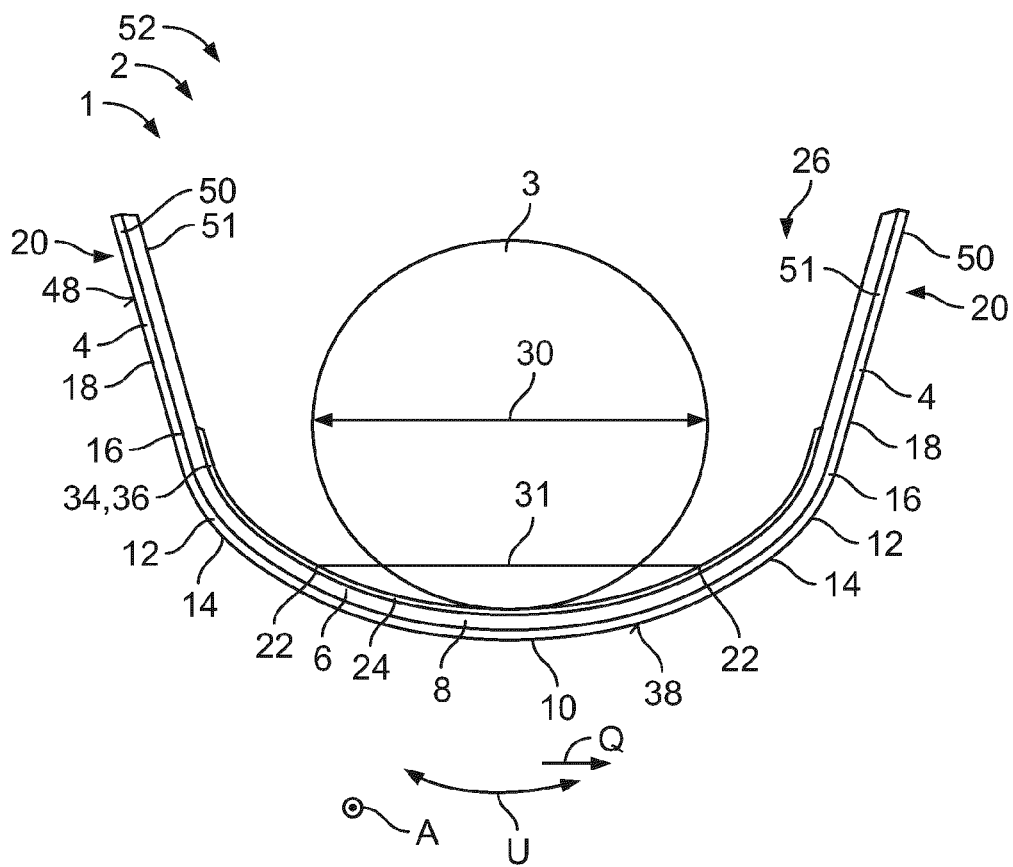
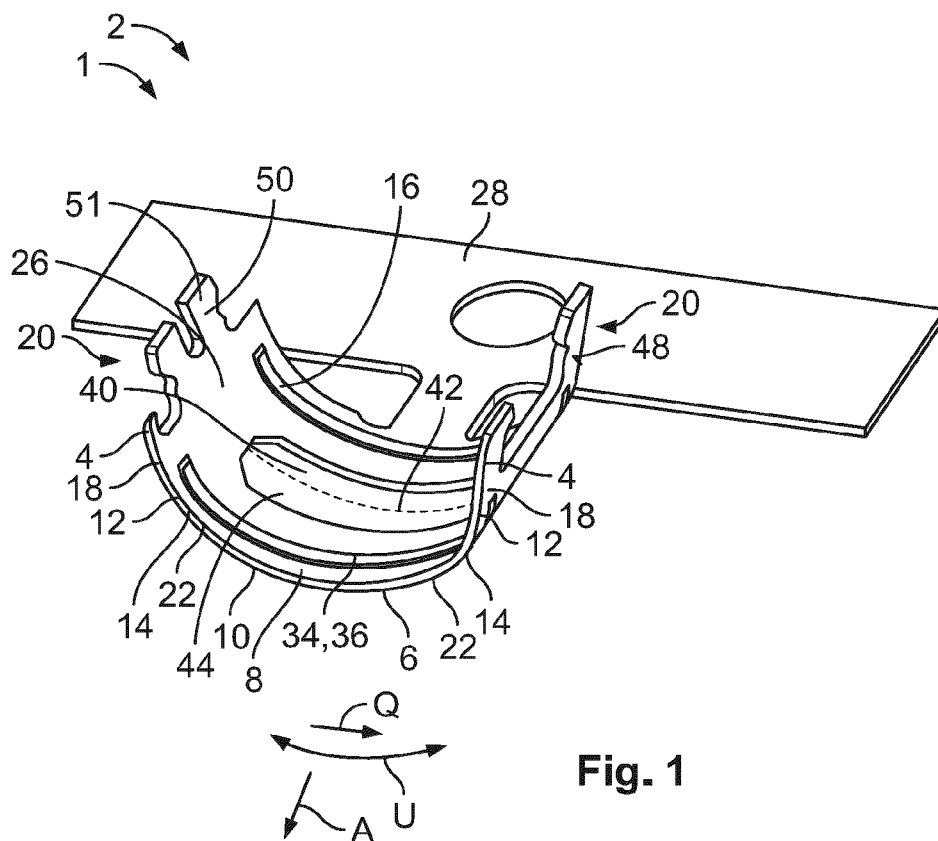
11. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 10, wherein said crimp wings (4) extend in a rectilinear manner to a free end (20).

12. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 11, wherein said crimp wings (4) are provided with mutually complementary positive-fit elements (50) in order to prevent said crimp barrel (1) from opening in a crimped state by way of the positive fit.

13. Crimp barrel (1) prepared for crimping according to one of the claims 1 to 12, wherein said mutually complementary positive-fit elements (50) are shaped as tabs (51) that are adapted to engage behind one another.

14. Crimp assembly (52) comprising an electrical conductor (3) having a predetermined diameter (30) and a crimp barrel (1) prepared for crimping according to one of claims 1 to 13, wherein said first curvature (10) has a larger curvature diameter than said predetermined diameter (30), at least prior to crimping, and wherein the curvature diameter of said second curvature (10) corresponds to said predetermined diameter (30), at least prior to crimping.

15. Crimp assembly (52) according to claim 14, wherein a cross-sectional geometry of said electrical conductor (3) is substantially identical prior to and after crimping.



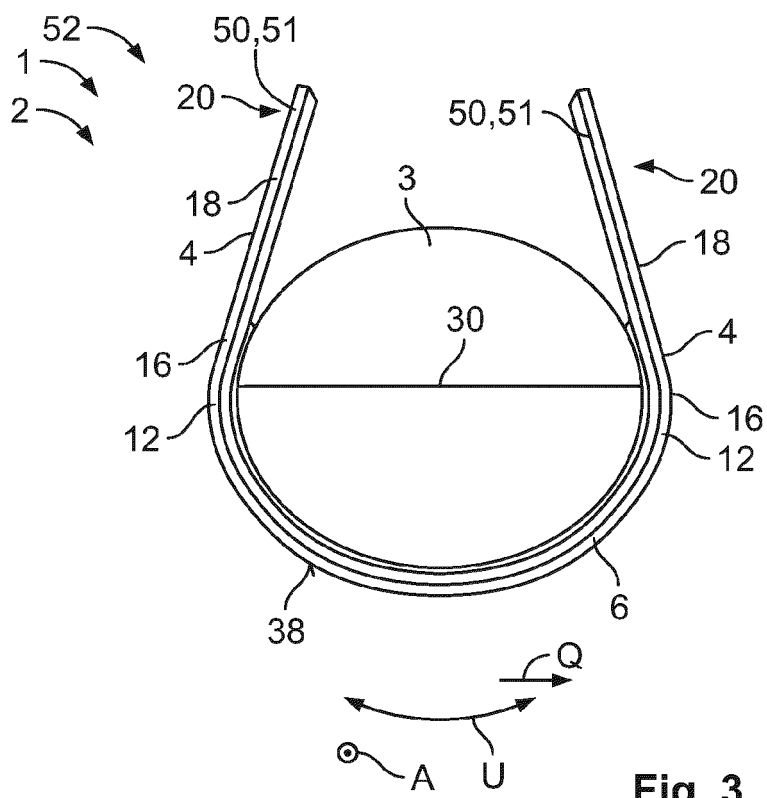


Fig. 3

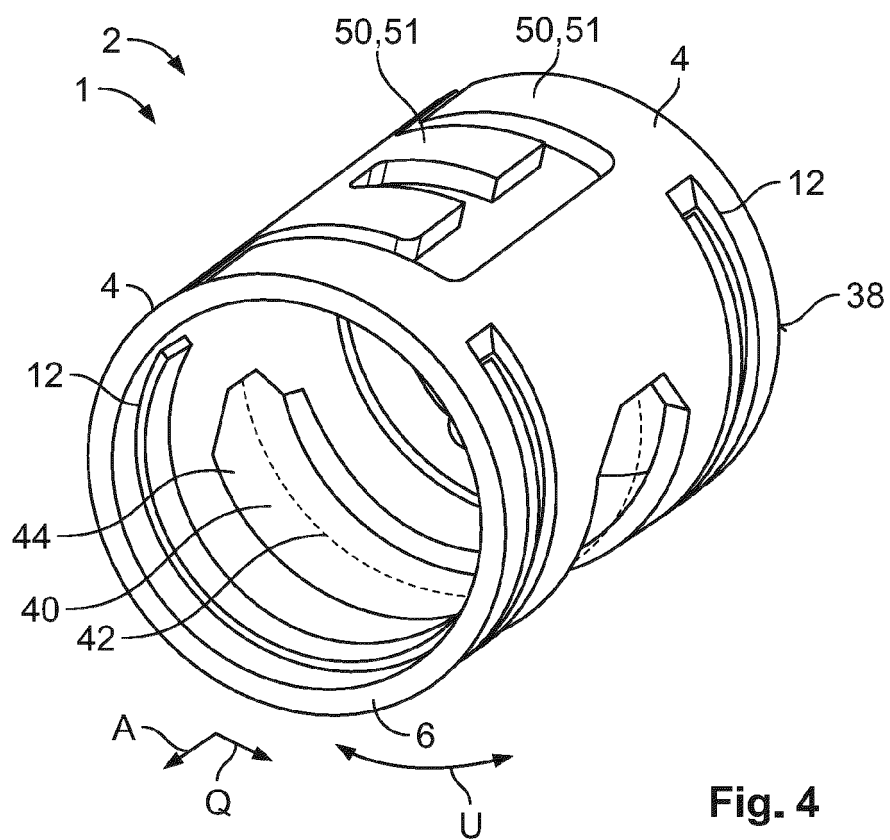


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 21 15 4322

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2019/063641 A1 (TE CONNECTIVITY GERMANY GMBH [DE]) 4 April 2019 (2019-04-04) * the whole document * -----	1-15	INV. H01R4/20 ADD. H01R9/05
			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 26 May 2021	Examiner Gomes Sirenkov E M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 21 15 4322

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-05-2021

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2019063641 A1	04-04-2019	CN 111149258 A	12-05-2020
		DE 102017217476 A1	04-04-2019
		EP 3688843 A1	05-08-2020
		JP 2020535606 A	03-12-2020
		KR 20200053616 A	18-05-2020
		US 2020227842 A1	16-07-2020
		WO 2019063641 A1	04-04-2019
