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Connecting device for a medical infusion system

[0001] The invention relates to a connecting device for a medical infusion system, having a connection piece which has a connecting profile for the connection of a functional part of the infusion system, and having a resiliently flexible, cup-like valve body which is arranged in the connection piece and has a valve casing and a cap-shaped top region which is provided with a slit arrangement, and having a dimensionally stable base portion on which a base ring of the valve casing is supported and which is firmly connected to the connection piece.

[0002] A connecting device of this kind of a medical infusion system is well known from US 2012/0089086 A1. The well-known connecting device has a connection piece which is provided with a Luer connector for attachment of a syringe. In the connection piece is provided a resiliently flexible, cup-like valve body which has a valve casing and a cap-shaped top region, wherein a slit is provided. The valve casing of the valve body has a base ring which is fixed in the connection piece.

[0003] A further connecting device is generally known from EP 1 217 284 B1. The connecting device has a connection piece in which a valve body is integrated. The valve body seals off the connection piece in the unloaded initial state and is embodied in a cup-like and resiliently flexible manner. The valve body is produced in one piece from an elastomer material. A top region of the valve body is provided with a slit arrangement which widens in the event of elastic deformation of the valve body and thus allows throughflow through the valve body. Elastic deformation of the valve body occurs when the connection piece is connected to a further functional part of the medical infusion system, in particular an infusion syringe, a hose system or the like.

[0004] EP 1 470 352 B1 shows a further connecting device for a medical infusion system, in which an elastically deformable valve body is likewise integrated in a connection piece, said valve body being formed in a cup-like manner and having an openable slit arrangement in a cap-shaped top region.

[0005] A further connecting device is known from WO 2013/017698 A1. The known connecting device has a connection piece which is provided with Luer profiles in order to allow the connection of a functional part, provided with a complementary Luer connector, of the medical infusion system. Integrated in the connection piece, in order to seal off an opening in the connection piece, is a cup-like valve body, which is produced integrally from an elastically deformable material. The valve body expands substantially continuously from a cap-shaped top region to a base ring, with the result that the valve body has a bell shape. The valve body is provided with a slit arrangement

in its top region in the same way as is the case in the valve bodies of the previously described connecting devices.

[0006] It is the object of the invention to create a connecting device of the type mentioned at the beginning, which allows reliable connection and disconnection of a functional part without fluid loss or fluid contamination occurring.

[0007] This object is achieved by the features of claim 1. This allows the valve body to be opened easily by elastic deformation and allows the valve body to be reset reliably into an unloaded, closed initial state. The solution according to the invention is suitable in a particularly advantageous manner for use in a connecting device in the form of a three-way stopcock. The firm connection of the dimensionally stable base portion to the connection piece can be provided by a releasable or non-releasable connection. Alternatively, the connection piece and the dimensionally stable base portion can be connected integrally together. The connection piece can be embodied as a dimensionally stable cover which is firmly connectable to the base portion and accommodates the valve body and is also fixed relative to the base portion. The valve body can be fixed by means of its base ring in the region of the dimensionally stable base portion in a force-fitting manner by clamping and/or in a cohesive manner by adhesive bonding or welding. The slit arrangement of the top region of the valve body is either embodied as a closed slit, in particular in the form of an incision, or in the manner of a partially open slot. The term “slit arrangement” accordingly includes both a closed and a partially open design.

[0008] In one configuration of the invention, a wall of the valve casing thickens from the top region to the base ring. As a result, there is elastic flexibility which reduces from the top region to the base ring. The thickening is embodied in a discontinuous and non-linear manner.

[0009] In a further configuration of the invention, a contact area of the base ring is formed at least partly in a conical manner, and the dimensionally stable base portion is formed in a complementary conical manner in order for the base ring to be supported extensively on the base portion. As a result, reliable centring and fixing of the base ring of the valve body to the dimensionally stable base portion is achieved. Therefore, in particular easier fitting of the valve body in the connection piece and on the base portion is achievable.

[0010] In a further configuration of the invention, an outer face of the cap-shaped top region is formed in a planar manner and terminates flush with a peripheral edge of the connection piece. A peripheral edge of the connection piece is in particular a chamfer of the peripheral region of the connection piece. Alternatively, the peripheral edge of the connection piece can also be

understood as being an outer peripheral face of the connection piece. As a result of the planar design of the outer face, easy cleaning and disinfection of the top region and of the peripheral region of the connection piece are achievable by simple wiping or swabbing by means of a disinfectant wipe. This makes handling easier for the medical personnel. The smooth surfaces additionally prevent contamination of the outer face of the top region or of the peripheral region of the connection piece.

[0011] In a further configuration of the invention, an inwardly directed contour of the cap-shaped top region is formed in a dome-like manner. The dome-like design can be formed as a convexity or as a polygonal or conical tip. As a result, the top region is thickened, and so improved and damage-free introduction of the slit arrangement into the top region is achievable.

[0012] The object underlying the invention is also achieved in that the dimensionally stable base portion has an annular mating shoulder which projects into the base ring of the valve casing in the direction of the top region. The annular mating shoulder serves to limit projection of a tip of a functional part into the connection piece, and accordingly into the valve body, when this functional part is connected to the connection piece. As a result of the projection depth being limited, overloading of the elastic deformation of the valve body is avoided, resulting in longer durability of the valve body. In addition, high releasing forces upon disconnection of the functional part are avoided. The functional part to be connected preferably has a male Luer tip of a Luer slip or Luer lock connector, which projects into the connection piece with the valve body being elastically deformed.

[0013] In one configuration of the invention, the mating shoulder has a planar end face oriented radially with respect to a longitudinal centre axis of the connection piece. As a result, the functional part connected to the connection piece meets the mating shoulder in an extensive and abutting manner, resulting in particularly reliable and precise limiting of the penetration depth of the functional part.

[0014] In a further configuration of the invention, the base portion has an annular groove which surrounds the mating shoulder, into which some of the valve casing protrudes in the event of elastic deformation, and which forms a free annular space in the unloaded initial state of the valve body. The free space formed in this way allows the material of the valve casing to yield elastically, and so axial compression of the valve body is achievable. The axial compression additionally defines axial pretensioning, which ensures that the valve body reliably returns to its unloaded initial state again, in which the connection piece is sealed off again, following disconnection of the functional part.

[0015] In a further configuration of the invention, the annular groove has a stepped annular profile. The stepped annular profile preferably reproduces a complementary gradation of an internal contour of the base ring of the valve body, in order to define improved axial compression in the form of step-like force generation. The step-like force generation results from that fact that, in the event of axial deformation, the complementary annular steps support one another briefly up to a defined increase in force.

[0016] The object underlying the invention is also achieved in that an internal contour of the valve casing is provided, at a distance from an inner face of the top region, with a radially outwardly extended annular recess which defines in particular a flexure bearing for the valve casing in the event of elastic deformation of the valve body. The annular recess forms a radial annular free space into which the top region can protrude in the event of elastic deformation and inward buckling, while more space is available inside the valve duct for the penetration of the syringe of the solid-body part. In addition, in the event of axial compression of the valve body, this ensures annular buckling, i.e. inversion, of the top region inwards in the direction of the base ring, with the result that the slit arrangement widens and corresponding outer-face regions of the top region and of the valve casing bear extensively against a correspondingly penetrating Luer tip of the functional part. This results in a particularly good seal between the valve body and functional part. Upon disconnection and accordingly axial extraction of the Luer tip, the inwardly inverted portions of the valve body are perforce entrained outwards again, such that the valve body returns to its initial state again, in which it seals off the connection piece.

[0017] In one configuration of the invention, the base ring has an annular shoulder with a thinned wall region which is formed such that, in the event of axial compressive stress being applied to the valve body from the top region, the valve casing is axially inverted in the region of the base ring. This results in clearly defined axial deformation of the valve body, which allows the valve body to return reliably into an unloaded initial state, without the risk of a permanent kink and accordingly failure of the valve body arising.

[0018] In a further configuration of the invention, the valve casing is formed in a rotationally symmetrical manner and the top region is formed in a rotationally asymmetrical manner, in particular in an oval manner. Advantageously, an opening region of the connection piece, which, with its peripheral region, surrounds the top region of the valve body in the unloaded initial state thereof, is also formed in a complementary oval manner.

[0019] In a further configuration of the invention, the slit arrangement has been introduced along a transverse extent of the top region. This allows reliable opening and closing of the slit arrangement in the event of corresponding elastic deformation.

[0020] The invention also relates to a valve body for a connecting device as described above, wherein the valve body is formed in a resiliently flexible and cup-like manner and is provided with a top region and a valve casing as are embodied on the basis of the above-described features.

[0021] Further features and advantages of the invention can be gathered from the claims and from the following description of preferred exemplary embodiments of the invention, which are illustrated by way of the drawings.

Figure 1 shows a plan view of an embodiment of a connecting device according to the invention in the form of a three-way stopcock,

Figure 2 shows a section through the connecting device according to Figure 1 along the section line II-II in Figure 1,

Figure 3 shows a bottom view of a valve body of the connecting device according to Figure 2,

Figure 4 shows a longitudinal section through the valve body according to Figure 3 along the section line IV-IV in Figure 3,

Figure 5 shows a further longitudinal section through the valve body along the section line V-V in Figure 3,

Figure 6 shows a plan view of the valve body according to Figures 3 to 5,

Figures 7 to 9 show sectional illustrations of different steps in the connection of a functional part to a connection piece of the connecting device according to Figure 2,

Figures 10 to 12 show different functional steps in the further connection of a functional part to a connection piece of another embodiment of a connecting device according to the invention that is similar to Figure 2,

Figures 13 to 16 show sectional illustrations of different functional steps in the connection of a functional part to a connection piece of a further embodiment of a connecting device according to the invention, and

Figures 17 to 20 show sectional illustrations of functional steps in the connection of a functional part to a connection piece of a further embodiment of a connecting device according to the invention.

[0022] A connecting device 1 for a medical infusion system is formed as a three-way stopcock. The connecting device 1 has a housing 2 in which an actuator 6 is mounted in a rotatable manner. A total of three connecting ducts are provided in the housing 2, said connecting ducts being shut off or connected together, depending on the position of the actuator 6. One connecting duct of the housing 2 leads to a connection piece 3. A further connecting duct, arranged at right angles thereto, leads to a connection region 4 and, opposite thereto, a third connecting duct leads to a connection region 5. One of the two connection regions 4, 5 is intended for the connection of a patient line. The other connection region 4, 5 serves to attach a connecting line to a fluid container.

[0023] The connection piece 3 is provided for the temporary connection of a functional part of the infusion system, in particular a syringe, in order to feed additional medicines or the like to the patient line. The connection piece 3 is explained in more detail by way of Figures 2 to 9.

[0024] The connection piece 3 has a dimensionally stable cover 8 which is firmly connected, on its end side facing the housing 2, to a dimensionally stable base portion 7 of the housing 2. The cover 8 is formed in a sleeve-like manner and has, on its side facing the base portion 7, a thickened peripheral region which is firmly connected to the base portion 7, in the present case by welding. The base portion 7 is embodied in a plate-like manner and projects radially outwards relative to a longitudinal centre axis L of the connection piece 3. The base portion 7 surrounds a duct portion that narrows conically with respect to an interior of the housing 2.

[0025] The cover 8 is provided, in its end region remote from the base portion 7, with a passage 10 which is able to be closed by a valve body 11 that is described in more detail in the following text. The passage 10 is enclosed by a thickened peripheral region which is provided with connecting profiles 9 in the form of Luer lock profiles.

[0026] The valve body 11 is formed in a cup-like or bell-like manner and produced in one piece from a resiliently flexible material, in the present case from an elastomer or a thermoplastic elastomer. Particularly advantageously, the valve body 11 is produced from silicone. The valve

body 11 has an external contour which, in the unloaded initial state, bears in a flush and extensive manner against the internal contour of the cover 8 over the entire height of the cover 8. The valve body 11 is provided with a cap-shaped top region 12 which has a rotationally asymmetrical, in the present case oval, area (see in particular Figures 3 and 6). The top region 12 is adjoined by a valve casing 15 which is provided in its lower end region with a base ring 16. The top region 12 is provided with a slit arrangement 14. A surface 13 of the top region 12 is formed in a smooth and planar manner. It is clear from Figure 7 that the surface 13 of the top region 12 terminates flush with a peripheral edge of the passage 10 in the unloaded initial state of the valve body 11 in the cover 8. An oblique chamfer extends outwards from this peripheral edge of the passage 10 as far as an end face of the peripheral region, defining the passage 10, of the cover 8. Accordingly, in the unloaded initial state of the valve body 11, the end face of the peripheral region of the cover 8, including the surface of the top region 12 of the valve body 11, can be cleaned and disinfected easily by medical personnel by means of a disinfectant wipe or the like.

[0027] The valve casing 15 of the valve body 11 is embodied in a rotationally symmetrical manner relative to the longitudinal centre axis L and has a wall which thickens from the top region 12 to the base region 16. The thickening occurs discontinuously and non-linearly, as can be seen from the two visible edges illustrated. The edges are annularly encircling. In this case, the valve casing 15 has a first wall portion that adjoins the top region 12, widens in a frustoconical manner and has a constant thickness. This first wall portion is adjoined, in the direction of the base ring 16, by a second wall portion, the inner wall of which extends cylindrically and coaxially with the longitudinal centre axis L, and the outer wall of which extends in a manner bulging further outwards in the direction of the base ring 16. This central wall portion is adjoined by the base-side wall portion, which comprises the base ring 16. In this region, the inner wall extends in a narrowed manner from the cylindrical central region to the base portion, resulting in an inner wall portion that tapers conically downwards.

[0028] The inner wall widens conically again towards an end side of the base ring 16, forming a contact area 18. Accordingly, an egg-like or O-like internal contour 17 arises over the height of the valve casing 15 (Figures 4 and 5).

[0029] An inner face, directed into the interior of the valve casing 15, of the top region 12 is formed as a dome-like contour 19, as can be gathered from Figure 5.

[0030] The passage 10 in the cover 8 can be formed in a rotationally symmetrical or rotationally asymmetrical manner. In the case of a rotationally asymmetrical top region 12, the passage 10 is preferably also formed in a complementary rotationally asymmetrical manner.

[0031] As can be seen in Figures 2 and 7 to 9, the conical contact area 18 of the base ring 16 of the valve body 11 is assigned a complementary conical supporting face 19 in the region of the base portion 7, with the result that the valve body 11 is supported extensively on the base portion 7 over its entire radial width in the region of the base ring 16.

[0032] The slit arrangement 14 is oriented transversely to a longitudinal extent of the oval top region 12, as can be seen from Figures 4 to 6. The slit arrangement 14 extends centrally along the longitudinal centre axis L through the top region 12.

[0033] As soon as a tip of a functional part F (see Figures 7 to 9) to be connected to the connection piece 3 is now guided up to the connection piece 3 from the outside, the tip comes into contact with the outer face of the top region 12 extensively and pushes the top region 12 into the interior of the cover 8. In the process, the slit arrangement 14 widens and the elastically deformed portions of the top region 12 bear against the outside of the tip upon further penetration of the tip of the functional part F. Upon disconnection and resultant removal of the tip towards the outside, the top region 12 returns to the initial state according to Figure 7 again.

[0034] The connecting device according to Figures 10 to 12 corresponds substantially to the above-described connecting device according to Figures 1 to 9. Functionally identical parts and portions are provided with the same reference signs with addition of the letter a. In order to avoid repetitions, reference is made to the disclosure for the embodiment according to Figures 1 to 9. The connection piece 3a corresponds substantially to the connection piece 3 of the connecting device according to Figures 1 to 9. The cover 8a and the valve body 11a are formed identically to the cover 8 and the valve body 11 according to Figures 1 to 9. The cover 8a can in particular have been connected cohesively to the base portion 7a by welding. Particularly advantageously, the cover 8a is connected releasably to the base portion 7a of the housing, in particular by way of a screw connection. This makes it possible to easily exchange the valve body 11a.

[0035] The cover 8 and the covers 8b and 8c, described below, of the embodiments according to Figures 13 to 20 can also – depending on the embodiment – be connected releasably or non-releasably to the respective base portion 7, 7b, 7c. The releasable connection takes place advantageously by way of a screw connection.

[0036] An essential difference of the base portion 7a from the base portion 7 is that the base portion 7a is provided, next to the conical supporting face 18a for the base ring 16a of the valve body 11a, with an integrally formed, annular mating shoulder 20 which projects in a cylindrical manner into the internal contour of the valve body 11a towards the top region of the valve body

11a. The mating shoulder 20 is provided with a planar end face 21 that extends radially relative to the longitudinal centre axis L. The mating shoulder 20 serves as a stop for the tip of the functional part F, such that the penetration depth of the tip of the functional part into the connection piece 3a is limited. The tip of the functional part F is provided with a complementary planar end face which is extended radially with respect to the longitudinal centre axis L in the connected state of the functional part and accordingly rests in an extensive and flush manner on the end face 21 of the mating shoulder 20 (Figure 12).

[0037] The fact that the mating shoulder 20 limits the penetration depth of the tip ensures that the valve body 11a is not deformed too greatly, which could result in damage to the valve body 11a. Moreover, the limiting of the penetration depth of the tip ensures that the tip does not become wedged in the region of the passage of the connection piece 3a, and so the functional part, including the tip, can be disconnected without great application of force.

[0038] The valve device according to Figures 13 to 16 has a connection piece 3b which is fastened to a base portion of the housing in a manner that is not illustrated in more detail. Functionally identical parts and portions of the connecting device and of the connection piece 3b are provided with the same reference signs with addition of the letter b. In this embodiment, too, reference is made to the above-described embodiments in order to avoid repetitions with regard to the functionally identical parts and portions. The differences of the connection piece 3b will be dealt with in the following text.

[0039] The valve body 11b is formed as a one-piece elastomer body in the same way as the valve bodies 11 and 11a according to the above-described embodiments. However, the valve body 11b has a different shape and a different deformation function. The cup-like or bell-like valve body 11b is provided with a top region 12b which is adjoined by a valve casing 15b that transitions into a base ring 16b. The top region 12b is provided with a slit arrangement 14b. The valve casing 15b is provided, at a distance below the top region 12b, in the region of its internal contour, with an annular recess 22 which forms an annular flexure bearing in the valve casing. In addition, at the transition of the valve casing 15b to the base ring 16b, a radially outwardly extended annular step is provided, the wall thickness of which is less than the wall thickness of the valve casing 15b. As a result, a further annular flexure bearing is formed. Finally, in the direction of the top region 12b, the valve casing 15b transitions into the top region 12b likewise with a narrower annular casing region. In this region, too, an annular flexure bearing is accordingly perforce formed. Accordingly, folds or inversions arise in the region of the described flexure bearings as soon as an axial force is exerted on the valve body 11b from the outside. In this case, the flexure bearings are coordinated with one another such that, upon axial compressive stress being applied

to the top region 12b from the outside by a tip of a functional part F, first of all the top region 12b and the valve casing 15b are pushed axially inwards in a substantially non-deformed manner, with the flexure bearing being deformed in the region of the base ring 16b (Figure 14). In the process, a corresponding portion of the valve casing 15b merely comes into abutment against an end face of the base portion of the housing in the indicated manner, such that the valve casing 15b cannot be pushed axially inwards further. The deformed flexure bearing in the region of the base ring 16b perforce exerts an axial opposing force on the valve body 15b, said opposing force causing the valve body 11b to return elastically into the unloaded initial state according to Figure 13 after removal of the compressive stress. If the tip of the functional part F now penetrates further inwards into the connection piece 3b – as can be seen in Figures 14 to 16 – the flexure bearing now collapses in the region of the top region 12b, wherein the narrower annular step in the top region 12b is elastically deformed. An inner side of the top region 12b perforce bears against the internal contour of the valve casing 15b in the region of the recess 22 on account of the expansion of the supporting arrangement 14b, with the result that the top region 12b is pushed inwards and downwards. The valve casing 15b is displaced against the inner wall of the cover 8b, with the result that the valve casing, including the top region 12b, bears in a substantially extensive manner against the external contour of the tip F.

[0040] When the tip F is extracted, the valve body 15b returns to the unloaded initial state according to Figure 13 again.

[0041] The connection piece 3c according to Figures 17 to 20 is likewise provided in a connecting device as illustrated in Figures 1 and 2. Functionally identical parts and portions are provided with the same reference signs with addition of the letter c. In order to avoid repetitions, reference is additionally made to the disclosure of the above-described embodiments. The connection piece 3c, too, has a cover 8c which is firmly connected in a releasable or non-releasable manner to a base portion 7c of the housing. The cover 8c has, in its end region remote from the base portion 7c, a passage, which is enclosed by a peripheral region that is provided with connecting profiles 9c, in the present case in the form of Luer lock profiles. Integrated in the connection piece 3c is a valve body 11c which is in the form of a one-piece elastomer component. The valve body 11c has a top region 12c which closes the passage through the cover 8c and is provided with a slit arrangement. The base portion 7c is provided with a mating shoulder 20c for limiting the penetration depth of the tip of a functional part F embodied as a male Luer lock part. The mating shoulder 20c has an end face 21c on which the end face of the tip bears in the connected state. The valve body 11c is provided with an annular flexure bearing at the transition of the valve casing 15c to the base ring 16c. The base ring 16c is provided, in the region of its inner side, with two annular steps 24, which are formed such that, in the event of axial compressive stress being

applied by the tip of the functional part F, the valve casing 15c can kink annularly and accordingly be elastically deformed both in the region of the base ring 16c and at the transition between the top region 12c and valve body 15c. In order not to prevent the inversion or kinking inwards in the region of the base ring 16c, a stepped annular groove 23 is provided at the transition between the mating shoulder 20c and a radial annular shoulder of the base portion 7c, said annular groove 23 forming an annular free space. The stepped annular groove 23 extends axially into the base portion 7c and has, at a distance above its bottom, an annular ledge (not designated further), on which a first annular step 24 of the valve casing 15c axially impinges in the event of an axial deformation of the valve body 11c. Upon further axial deformation, the valve body 11c deforms further at the transition from the valve casing 15c to the base ring 16c, with the result that the displaced material of the valve casing 15c protrudes into the free space 23, as can be seen from Figures 19 and 20. As a result of the widening of the slit arrangement, the tip of the functional part F can impinge on the end face 21c of the mating shoulder 20c. The top region 12c bears against the outside of the tip, as can be seen in Figure 20. Upon disconnection of the functional part F, the tip is removed from the passage again, with the result that the valve body 11c returns to the unloaded initial state according to Figure 17 again.

Patentkrav

1. Forbindelsesindretning til et medicinsk infusionssystem med et forbindelsesstykke (3), som omfatter en forbindelsesprofil (9) til forbindelse af en funktionel del (F) af infusionssystemet, og med et elastisk fleksibelt, koplignende ventillegeme (11) der er anbragt i forbindelsesstykket (3) og som omfatter et ventilhus (15) og et lågformet øvre område (12), der er forsynet med et spalteindretning (14), og med en formstabil basissektion (7), på hvilken en basisring (16) af ventilhuset (15) er understøttet, og som er fast forbundet med forbindelsesstykket (3), **kendetegnet ved, at** ventilhuset (15) i ikke belastet starttilstand omfatter en buet indvendig kontur, der startende fra det lågformede øvre område (12) først og fremmest udvides i retning af basisringen (16) og derefter indsnævres igen under dannelse af et O-lignende indre længdesnit, hvilket ventilhus (15) omfatter en første vægsektion, der støder op til det øvre område (12), som udvider sig på en keglestubformet måde og har en konstant tykkelse, hvortil en central første vægsektion støder op i retning af basisringen (16), hvis indvendige væg forløber cylindrisk og koaksialt med en central længdeakse L, og hvis ydervæg forløber buet længere udad i retning af basisringen (16), og hvor den centrale vægsektion støder op til en basissidevægsektion, der omfatter basisringen (16), og i hvilken den indvendige væg tilspidser konisk nedad fra den centrale vægsektion til basissektionen.

2. Forbindelsesindretningen ifølge krav 1, **kendetegnet ved, at** en væg af ventilhuset (15) fortykkes fra det øvre område (12) til basisringen (16).

3. Forbindelsesindretning ifølge krav 1 eller 2, **kendetegnet ved, at** et kontaktareal (18) af basisringen (16) er dannet mindst delvis konisk, og at den formstabile basissektion (7) er udformet på en komplementær konisk måde til flad understøtning af basisringen (16) på basissektionen (7).

4. Forbindelsesindretning ifølge et af kravene 1 til 3, **kendetegnet ved, at** en ydre flade (13) af det lågformede øvre område (12) er dannet på en plan måde og flugter med en perifer kant af forbindelsesstykket (3).

5. Forbindelsesindretning ifølge et af kravene 1 til 4, **kendetegnet ved, at** en indadrettet kontur (19) af det lågformede øvre område (12) er dannet på en kuppelagtig måde.

6. Forbindelsesindretning ifølge indledningen til krav 1 eller ifølge et af de foregående krav, **kendetegnet ved, at** den formstabile basissektion (7a, 7c) omfatter en ringformet modsat skulder (20, 20c), der rager ind i basisringen (16a, 16c) af ventilhuset (15a, 15c) i retning af det øvre område (12a, 12c).

7. Forbindelsesindretningen ifølge krav 6, **kendetegnet ved, at** den modsatte skulder (20, 20c) har en plan endeflade (21, 21c), der er orienteret radialt i forhold til en central længde (L) af forbindelsesstykket (3a, 3c).

8. Forbindelsesindretning ifølge krav 6 eller 7, **kendetegnet ved, at** basissektionen (7c) omfatter en ringformet rille (23), der omgiver den modsatte skulder (20c), i hvilken ventilhuset (15c) delvist rager ind i ved en elastisk deformation, og som danner et frit ringformet rum ved en ikke belastet udgangstilstand af ventillegemet (11c).

9. Forbindelsesindretningen ifølge krav 8, **kendetegnet ved, at** den ringformede rille (23) omfatter en trinvis ringformet profil.

10. Forbindelsesindretning ifølge indledningen til krav 1 eller ifølge et af de foregående krav, **kendetegnet ved, at** en indvendig kontur af ventilhuset (15b) i en afstand fra det indre område af det øvre område (12b) er forsynet med en radialt udad strækkende ringformet fordybning (22), der især definerer et bøjningsleje til ventilhuset (15b) ved elastisk deformation af ventillegemet (11b).

11. Forbindelsesindretningen ifølge krav 10, **kendetegnet ved, at** basisringen (16b) omfatter en ringformet skulder med et fortyndet vægområde, der er udformet således, at ventilhuset (15b) ved aksial kompressionsspænding af ventillegemet (11b) fra det øvre område (12b) undergår en aksial inversion i området af basisringen (16b).

12. Forbindelsesindretning ifølge et af de foregående krav, **kendetegnet ved, at** ventilhuset (15) er dannet på en rotationssymmetrisk måde, og det øvre område (12) er dannet på en rotationsasymmetrisk måde, især på en oval måde.

13. Forbindelsesindretningen ifølge krav 12, **kendetegnet ved, at** spalteindretningen (14) er indført langs en tværgående udstrækning af det øvre område (12).

14. Ventillegeme til en forbindelsesindretning ifølge et af de foregående krav, hvilket ventillegeme er udformet på en elastisk fleksibel og koplignende måde og er forsynet med et øvre område og et ventilhus, som er beskrevet i trækkene i mindst en af de foregående krav.

Fig.1

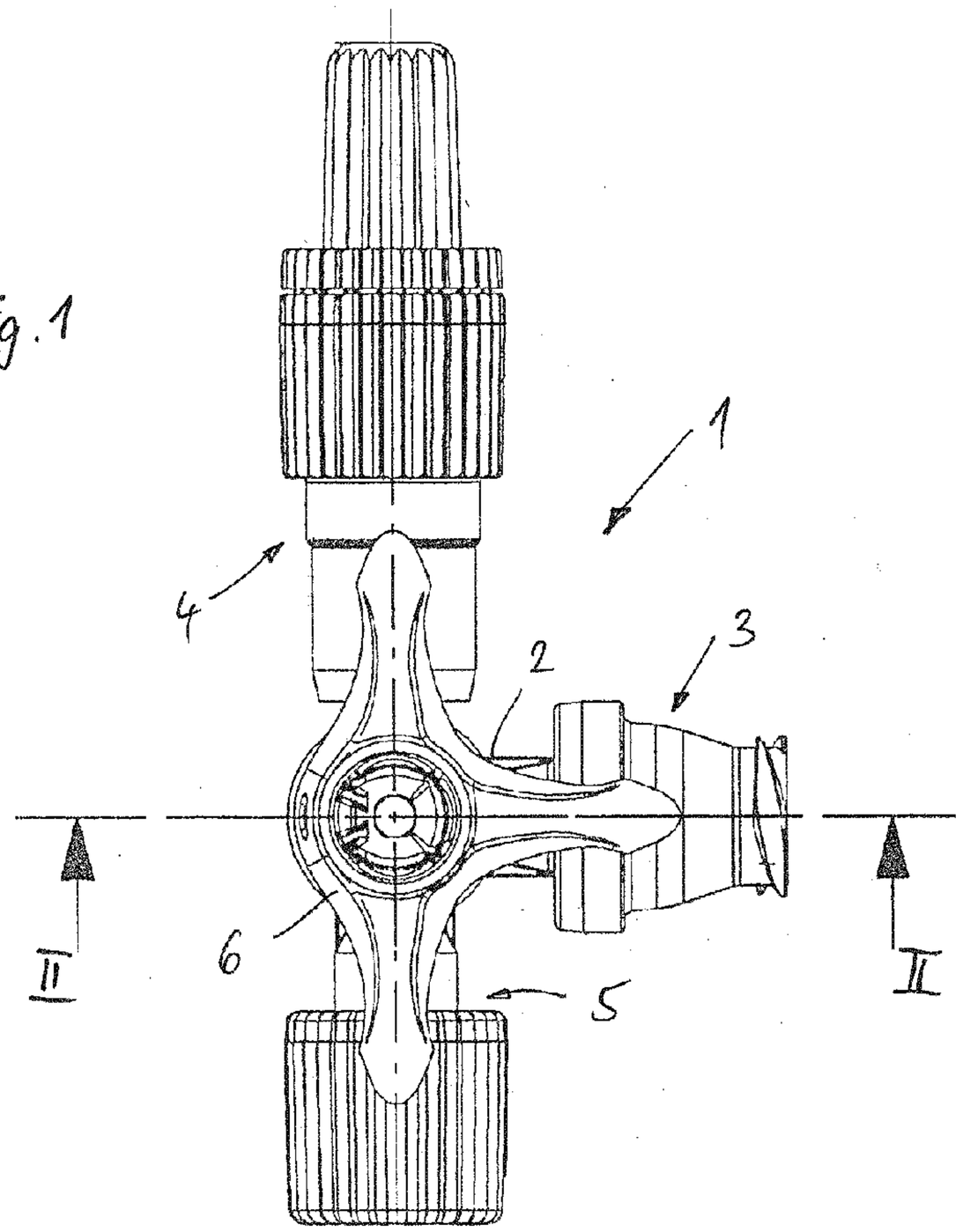


Fig.2

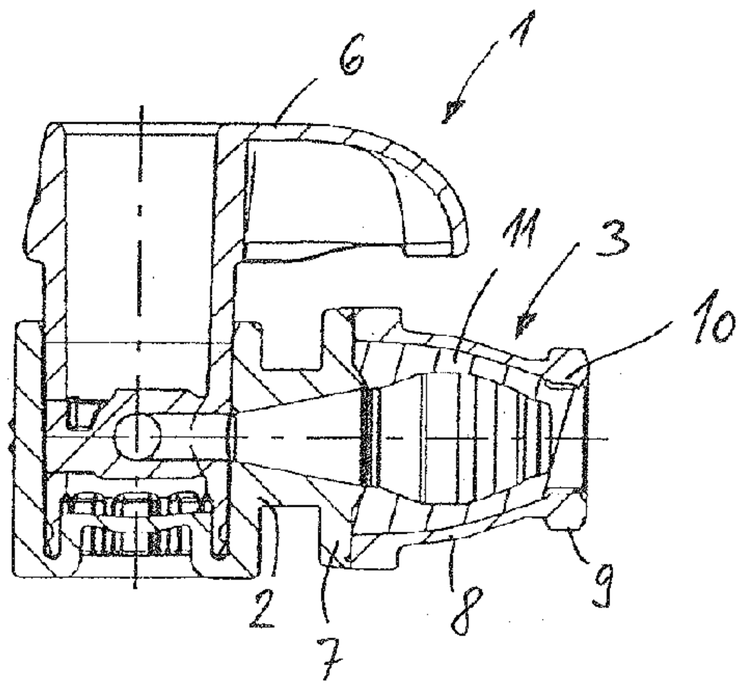


Fig. 3

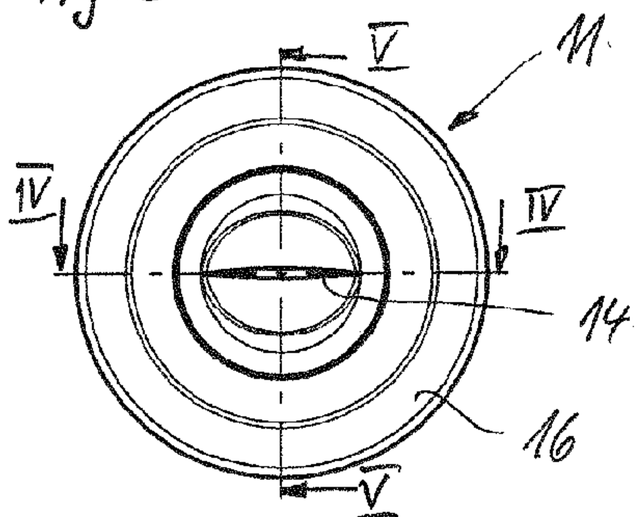


Fig. 4

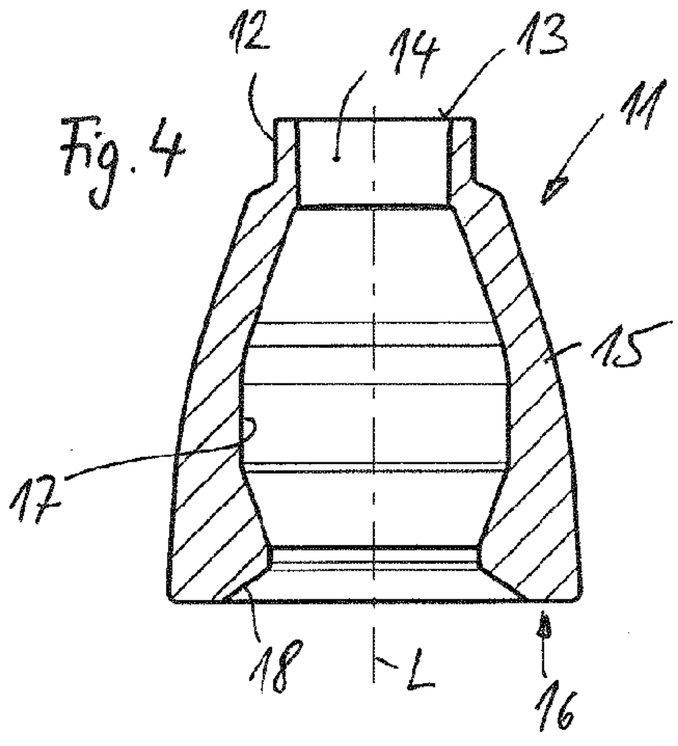


Fig. 5

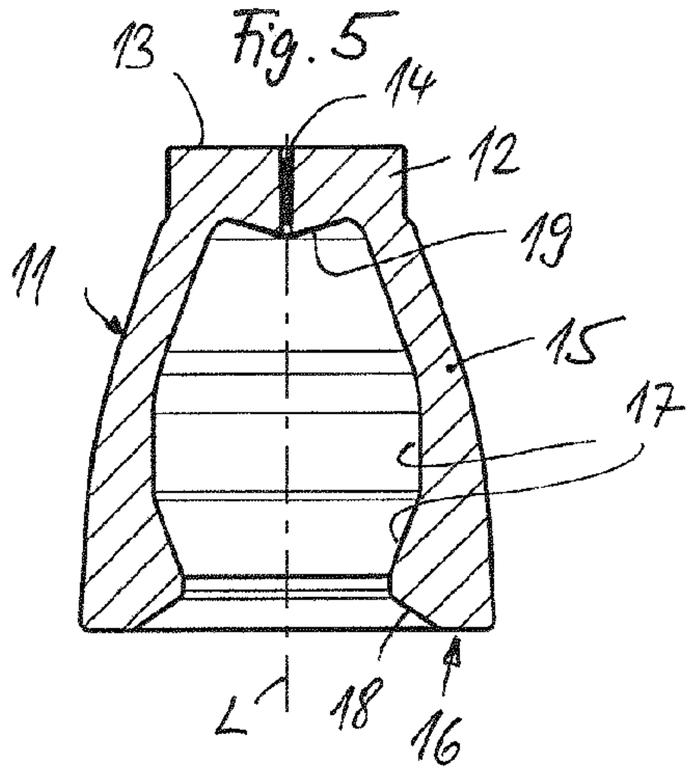
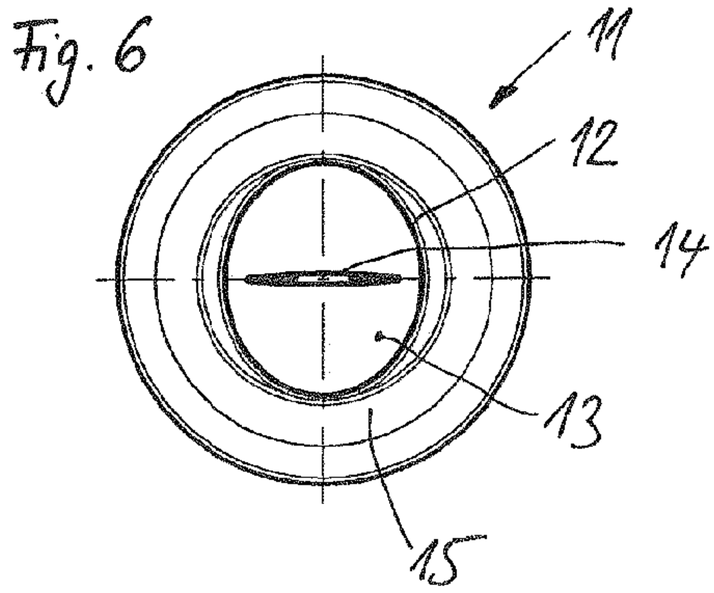


Fig. 6



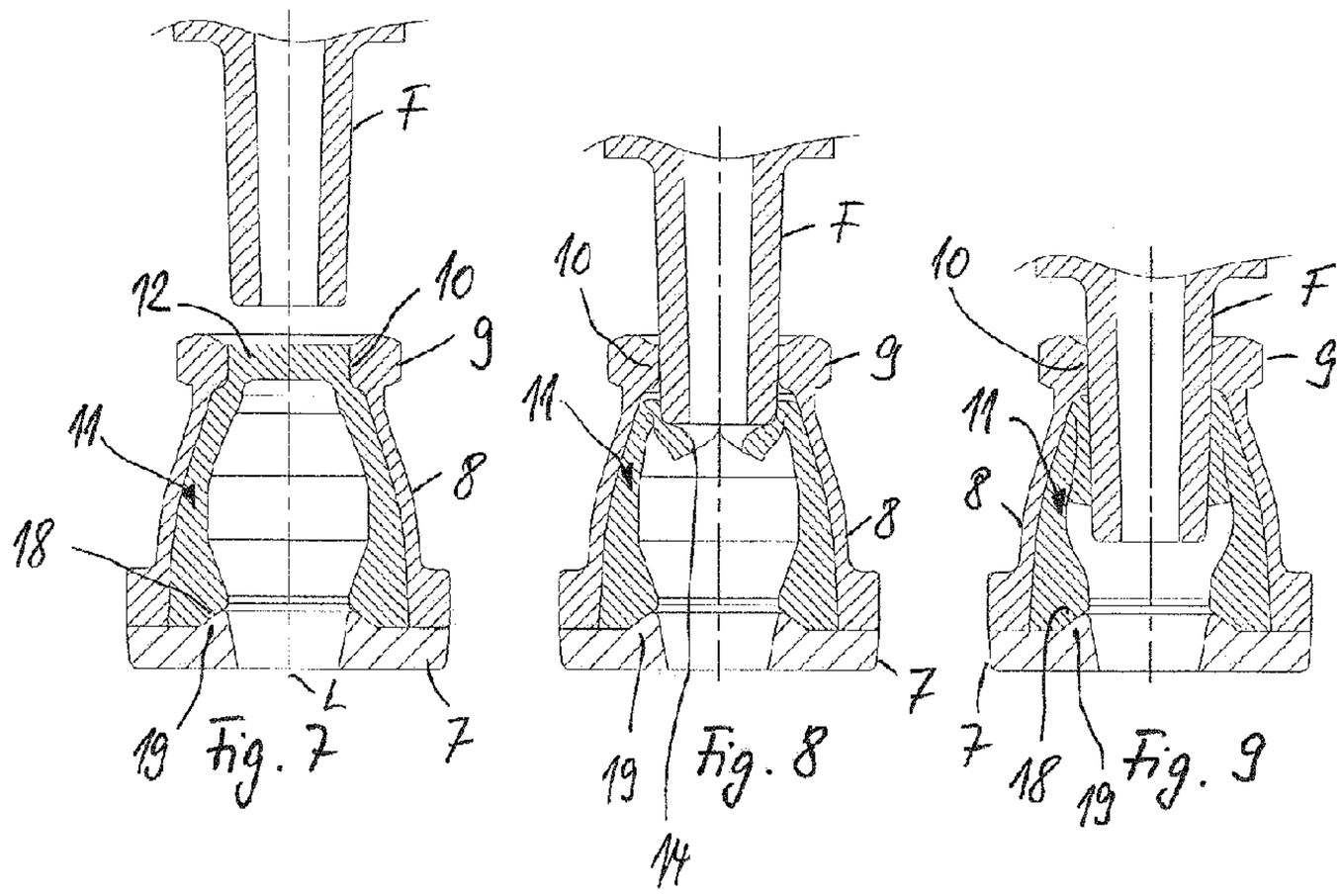


Fig. 7

Fig. 8

Fig. 9

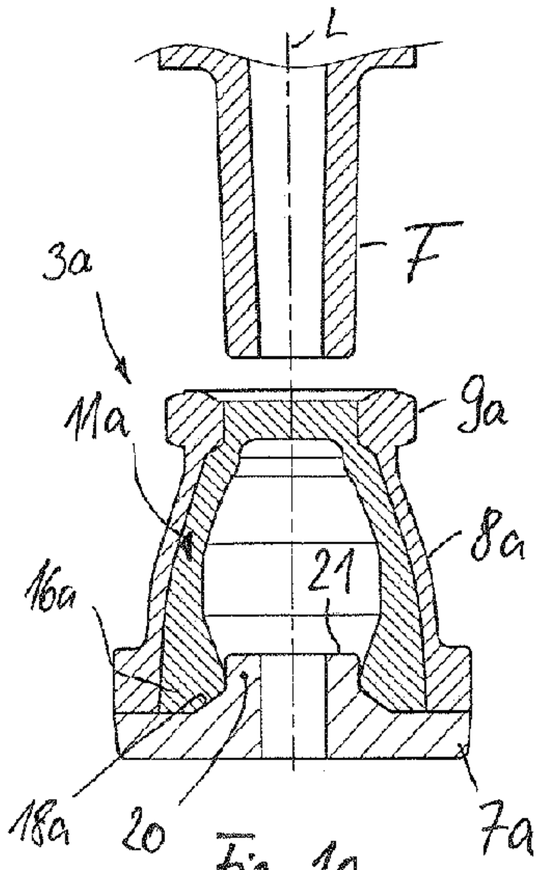


Fig. 10

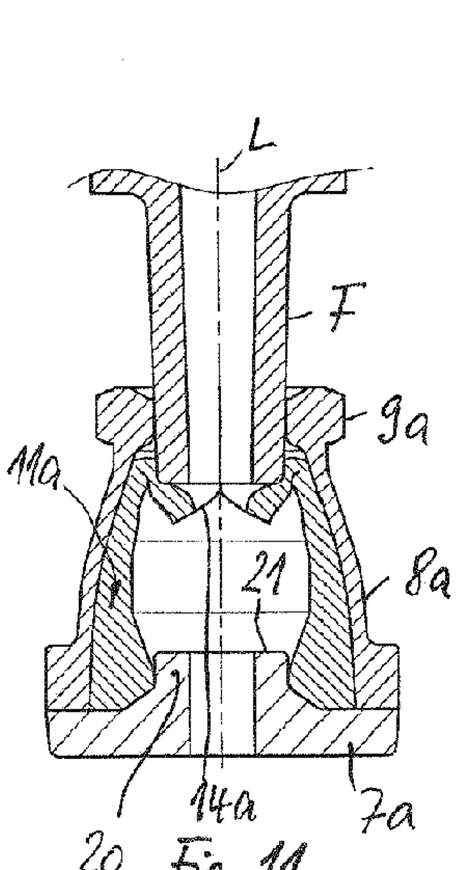


Fig. 11

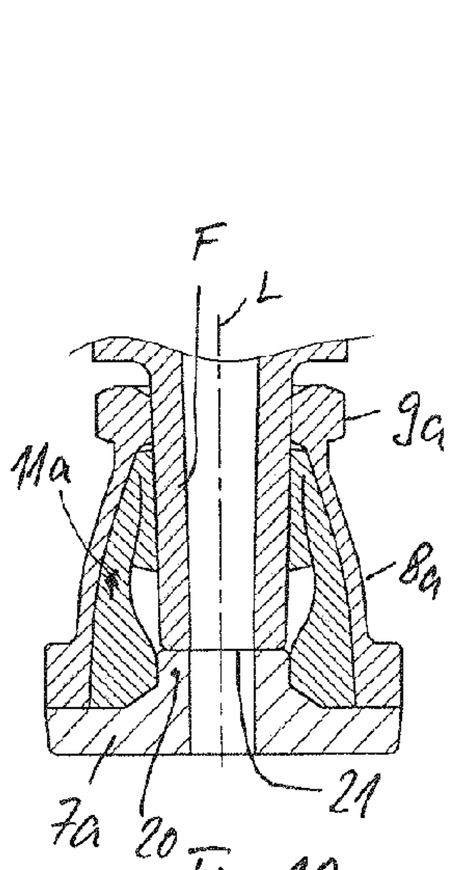


Fig. 12

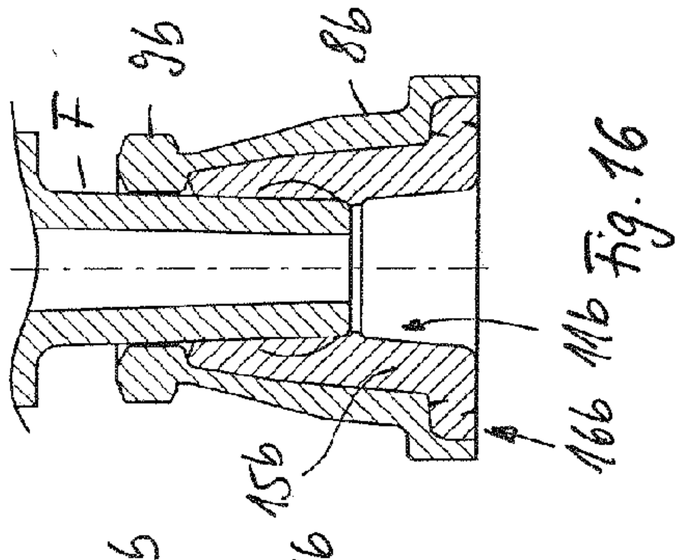


Fig. 16

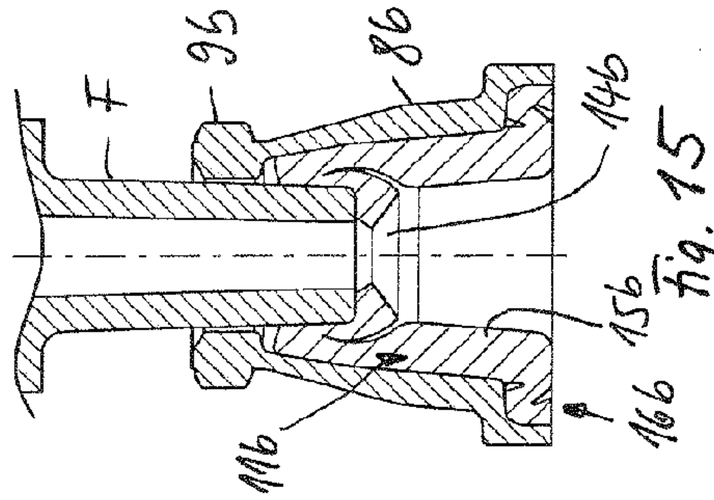


Fig. 15

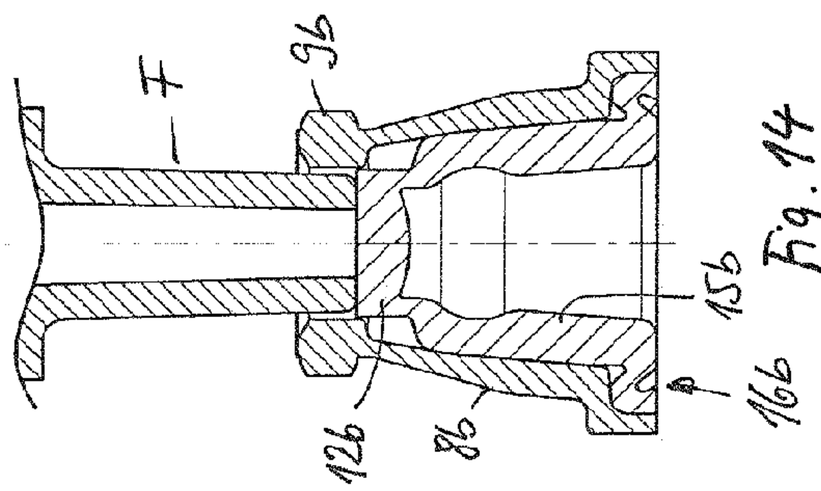


Fig. 14

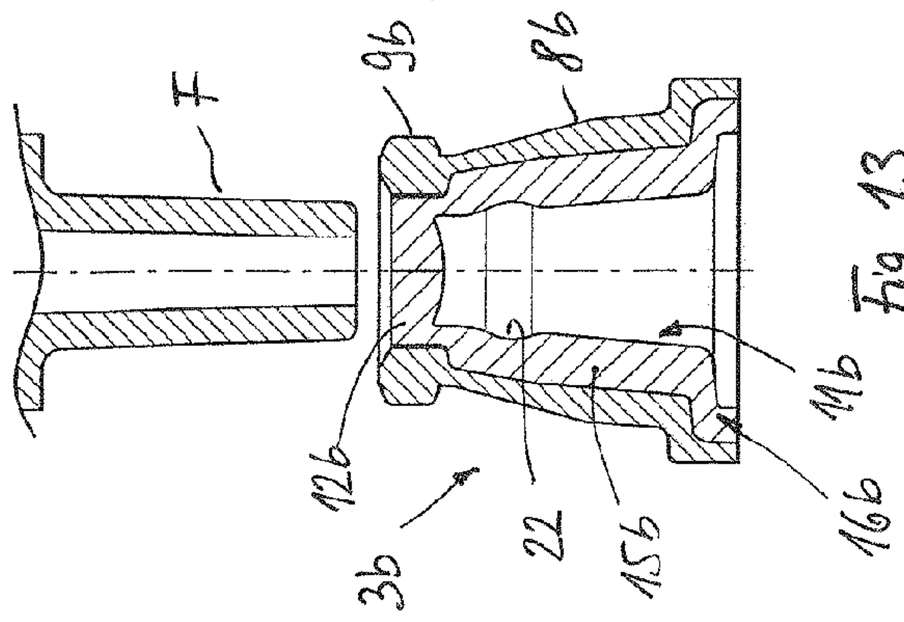


Fig. 13

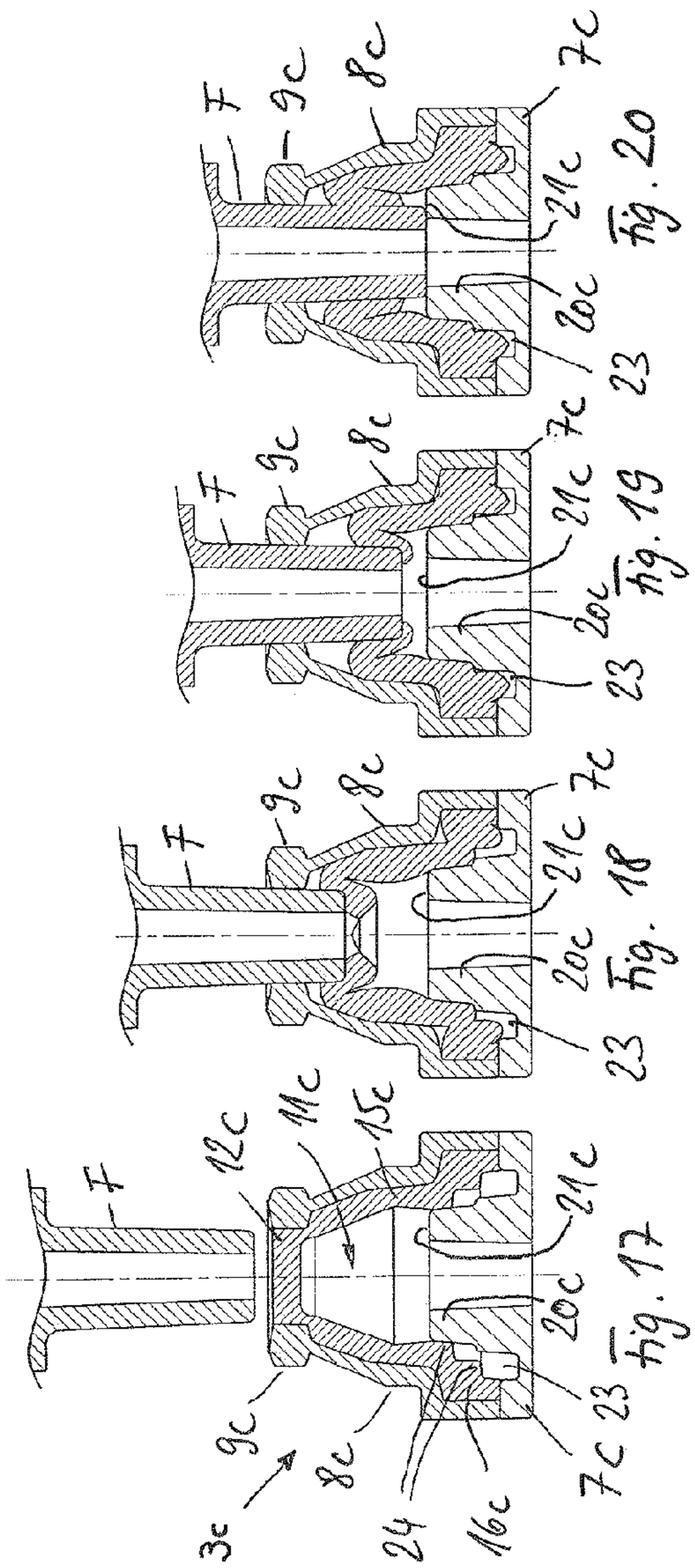


Fig. 20

Fig. 19

Fig. 18

Fig. 17