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(54) IMPROVED FLARING DEVICE FOR FLARING THE ENDS OF PIPES

VERBESSERTE AUFWEITUNGSVORRICHTUNG ZUM AUFWEITEN DER ENDEN VON ROHREN

DISPOSITIF D'ÉVASEMENT PERFECTIONNÉ POUR L'ÉVASEMENT DES EXTRÉMITÉS DE TUYAUX

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(73) Proprietor: **Andel Technology Polska Sp. z.o.o.**
55-095 Byków (PL)

(72) Inventors:
- **SCOMAZZON, Massimo**
  I-36061 Bassano del Grappa (VI) (IT)
- **TOSIN, Simone**
  I-36060 Pianezze (VI) (IT)
- **PIVA, Hemanuel**
  I-36061 Bassano del Grappa (VI) (IT)

(74) Representative: **Sleczka, Joanna**
Kancelaria Patentowa "Rejman" S.C.
Ul. Hubska 96/100 lok. 143
50-502 Wroclaw (PL)

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Description

[0001] The invention concerns a flaring device according to the preamble of claim 1.

[0002] As is known, flaring devices serve to flare the ends of pipes, in particular of the copper pipes used to make circuits in hydraulic systems of various types.

[0003] The flaring devices of the known type substantially comprise a flaring unit configured in such a way that it advances against the end of the pipe to be flared, which is clamped in a die.

[0004] The flaring unit is provided with a conical flaring element that when in contact with the end of the pipe deforms it and obtains the desired flare.

[0005] Flaring devices of the type described above are disclosed, for example, in the patent document CN2794679 and include the use of several interchangeable dies with different diameters, which are associated with a flaring unit through mechanical fixing means, said flaring unit being provided with screw means for the advance movement towards the die.

[0006] The operator sets the flaring unit rotating, in such a way as to make it advance against the die and force the conical flaring element with which it is provided against the end of the pipe to be flared.

[0007] Flaring devices are also known, in which the die is just one and comprises two jaws that open like calipers and, cooperating with each other through contact, define a plurality of flared holes with different diameters, wherein each half of each hole is created in one of said jaws.

[0008] The die and the flaring unit are connected to each other through mechanical means that make it possible to arrange the conical flaring element with which the flaring unit is provided at the level of the hole made in the die whose diameter is suited to clamp the pipe to be flared.

[0009] All of the flaring devices mentioned above pose the drawback that the replacement of the dies or the displacement of the flaring element on the same die, at the level of the hole suited to accommodate the pipe to be flared, requires long processing times that affect processing costs.

[0010] Furthermore, said flaring devices can be operated only manually.

[0011] The patent document US5090226 is also known, which describes a flaring device comprising a supporting structure configured in such a way that it supports a motor suited to drive a flaring unit and removably houses a flaring die.

[0012] The supporting structure is furthermore provided with a grip that makes the flaring device easy to manoeuvre for the operator.

[0013] The coupling of the die with the supporting structure is obtained by means of a connection ring provided with coupling projections that allow the die to be axially fixed to the supporting structure.

[0014] The flaring device disclosed in the patent mentioned above thus makes it possible to replace the die working on the connection element.

[0015] The drawback it poses lies in that each operation intended to remove the connection element, replace the die and fix a new die is rather long and when it is necessary to flare many pipes having a wide range of different diameters this considerably prolongs the time necessary to carry out the flaring process. Furthermore, another drawback is constituted by the high cost of said flaring devices, which is due especially to the production of the dies and of the connection rings.

[0016] A further and not less important drawback is constituted by the fact that it is impossible to operate the flaring device manually and therefore it cannot be used in areas where there is no power supply.

[0017] The document EP 0 501 928 A1 is also known, which describes a flaring device comprising a body provided with a lower jaw to which an upper jaw is hinged, wherein said jaws, when they are coupled together and opposite each other, define a seat whose inner profile is in the shape of a truncated cone, which is suited to accommodate a flaring die whose outer profile is in the shape of a truncated cone, too.

[0018] With regard to the flaring die, it comprises a lower portion and an upper portion that when coupled together, one opposite the other, define the housing for the pipe to be flared.

[0019] Furthermore, in the upper portion of the flaring die there is a projecting pin that fits in a corresponding hole provided in the upper jaw, in such a way as to define the position of the flaring die when this is received in the seat defined between the jaws.

[0020] Finally, there are apposite clamping means that maintain the jaws clamped against each other and constrain the flaring die arranged between them in the operating position.

[0021] Also the flaring device described above poses the drawback that each operation for mounting/removing the die in/from the corresponding seat between the jaws requires the clamping means to be clamped/opened.

[0022] Furthermore, the operation for mounting the die in the corresponding seat between the jaws requires that the pin provided on the upper portion of the die be first centered on and then inserted in the corresponding hole present in the upper jaw.

[0023] Substantially, in order to mount a die between the jaws it is necessary to:

- open the clamping means;
- lift the upper jaw from the lower jaw with a caliper-like rotation;
- place the lower die in the lower jaw;
- place the upper die in the upper jaw, taking care to center the pin in the corresponding hole;
- lower the upper jaw towards the lower jaw with a caliper-like rotation and position them in contact with each other, taking care that the respective dies correctly adhere to each other;
- clamp the clamping means.

[0024] It can thus be understood that the flaring device described in the above mentioned patent document poses the drawback that each die mounting/removal operation is long and complex.

[0025] Furthermore, the entire assembly constituted by the jaws with the respective reference elements, by the hinge for opening/clamping the jaws and by the clamping means is expensive to produce.

[0026] The present invention intends to overcome all of the drawbacks described above.

[0027] In particular, the invention concerns a flaring device that allows the flaring dies to be replaced more rapidly compared to the known flaring devices.

[0028] It is another object of the invention to provide a flaring device whose production costs are lower than those of known flaring devices equivalent to it. It is another, yet not less important object of the invention to provide a flaring device having such construction characteristics that it can be operated both manually and through a motor.

[0029] The objects listed above are achieved by a flaring device according to claim 1. Preferred embodiments of the invention are defined in the dependent claims.

[0030] Advantageously, in the flaring device of the invention replacing the dies is easier and quicker than in the known flaring devices.

[0031] Consequently, it also offers the advantage of reducing the costs of the flaring operations.

[0032] The objects and advantages described above are achieved by the flaring device that is the subject of the invention, which is described here below with reference to the attached drawings, wherein:

- Figure 1 shows a view of the flaring device according to a preferred embodiment of the invention;
- Figure 2 shows an axonometric view of a portion of the flaring device of Figure 1;
- Figure 3 shows a sectional view of Figure 1 obtained according to the drawing layer of Figure 1;
- Figure 4 shows the sectional view of Figure 3 in a different operating configuration;
- Figure 5 shows an axonometric view of the flaring die suited to be associated with the flaring device represented in Figures from 1 to 4;
- Figures 6 and 7 show two plan views of the die of Figure 5 respectively in the clamped and in the open configuration;
- Figure 8 shows a partial sectional view of the die of Figure 5;
- Figures 9 and 10 show the flaring device of Figures 3 and 4 in two steps of the flaring process;
- Figures from 11 to 14 show different views of a variant embodiment of the flaring die shown in Figures from 5 to 8;
- Figures from 15 to 17 show different views of another variant embodiment of the flaring die shown in Figures from 5 to 8;
- Figures from 18 to 21 show different views of a further variant embodiment of the flaring die shown in Figures from 5 to 8;
- Figures from 22 to 25 show different views of another different embodiment of the flaring die shown in Figures from 5 to 8.

[0033] The flaring device according to a preferred embodiment of the invention is represented in Figures from 1 to 4, where it is indicated as a whole by **1.**

[0034] It is used to flare the ends of pipes **T,** as shown in Figures 9 and 10, and comprises a main body **2** that develops along a mainly longitudinal direction defined by a longitudinal axis **X.**

[0035] In the main body **2** there are a flaring unit **3** provided with a flaring cone **4** configured in such a way that it interacts with the end of the pipe **T** to be flared and a die carrier **10** that accommodates a flaring die **8,** arranged in front of the flaring unit **3.**

[0036] The flaring die **8,** which can be observed in Figures from 5 to 8, is accommodated in the die carrier **10** and is provided with a centre channel **9** configured so as to house the pipe **T** to be flared.

[0037] In the embodiment described herein, the die carrier **10** is fixed to the main body **2** by means of screws **10a.**

[0038] A different embodiment is however possible, in which the die carrier **10** constitutes a single piece together with the main body **2.**

[0039] According to the invention, in the die carrier **10** there is a shaped seat **11** that is configured so as to accommodate the flaring die **8** and communicates with a shaped opening **14** made in the main body **2** and included between the flaring unit **3** and the die carrier **10,** said shaped seat **11** being defined by a conical inner surface **12** with taper diverging towards the flaring unit **3** and configured so that it can be coupled with the conical outer surface **13** of the flaring die **8.** As regards the shaped opening **14,** it can be observed that it is made in the lateral surface **2a** of the main body **2** and its length **14a,** measured along the longitudinal axis **X,** exceeds the length **8a** of the flaring die **8,** measured along the longitudinal axis **X,** too.

[0040] As regards the width **14b** of the shaped opening **14,** it can be observed that said width, measured crosswise with respect to the longitudinal axis **X,** exceeds the width **8b** of the flaring die **8** and also the width **11b** of the shaped seat **11,** both measured crosswise with respect to the longitudinal axis **X.**

[0041] Finally, it can be observed that the width **14b** of the shaped opening **14,** measured crosswise with respect to the longitudinal axis **X,** is shorter than the width **2b** of the main body **2,** measured crosswise with respect to the longitudinal axis **X,** too.

[0042] Finally, the shaped opening **14** makes up a pocket that extends over a portion of the lateral surface of the main body **2.**

[0043] It allows the flaring die **8** to be inserted in the corresponding die carrier **10** through two successive dis-

placements that comprise:

- a first displacement in a direction that is orthogonal to the longitudinal axis **X,** allowing the flaring die **8** to be inserted in the main body **2** in a coaxial position with respect to the longitudinal axis **X;**
- a second displacement along the longitudinal axis **X** and towards the die carrier **10,** allowing the conical inner surface **12** of the shaped seat **11** and the corresponding conical outer surface **13** of the flaring die **8** to be placed in contact with each other.

[0044] It can also be observed that the die carrier **10** is provided with a through opening **15** that develops according to the direction defined by the longitudinal axis **X** and communicates with the shaped opening **14.**

[0045] Said through opening **15** allows the operator holding the portion of the pipe **T** that projects from the flaring die **8** to insert the flaring die **8,** with the pipe **T** to be flared associated with it, first inside the shaped opening **14** and then in the die carrier **10,** as can be observed in Figures 9 and 10.

[0046] The special construction structure of the flaring device of the invention, and in particular the presence of the shaped opening **14** with the dimensional characteristics indicated above, allows the flaring die to be mounted/removed more quickly.

[0047] Furthermore, as the die carrier **10** is produced in a single piece, the clamping/opening hinge means and the locking means described in the known patent document EP 0 501 928 A1 are eliminated.

[0048] As regards the flaring unit **3,** it can be observed that it comprises a centre core **16** coaxially associated into the main body **2** according to the longitudinal axis **X** and the already mentioned flaring cone **4,** belonging to the centre core **16,** facing towards the flaring die **8.**

[0049] Manoeuvring means **19** are also provided for displacing the centre core **16** coaxially inside the main body **2** and along the longitudinal axis **X.**

[0050] The manoeuvring means **19,** as can be observed, comprise a tube **20** mechanically associated with the centre core **16** through a connection rod **27** and provided with a manoeuvring tang **21** that projects from the main body **2** on the opposite side of the flaring cone **4** and with screw means **22** that connect the tube **20** to a sleeve **25** located inside the main body **2.**

[0051] As regards the screw means **22,** it can be observed that they comprise a male thread **23** created on the outside of the tube **20** and a female thread **24** configured so that it matches the male thread **23** and created in the sleeve **25.** The sleeve **25** is stably coupled into the main body **2** and the centre core **16** slides inside it according to the longitudinal axis **X.**

[0052] There is also a bearing **26,** preferably but not necessarily of the type with rollers, which is arranged so as to be coaxially aligned with the sleeve **25** inside the main body **2** and in which the centre core **16** slides.

[0053] The tube **20,** as already explained, is mechanically associated with the centre core **16** through the connection rod **27,** which has a first end **27a** fixed to the centre core **16** and a second end **27b,** opposite the first end **27a,** which is slidingly associated in the tube **20** through a pin **28** fixed to the second end **27b** and slidingly associated in a slot **29** made in the tube **20.**

[0054] Furthermore, it is possible to observe the presence of an elastic unit **30** coaxially associated with the outside of the connection rod **27** and interposed between the centre core **16** and the tube **20.**

[0055] The elastic unit **30** in turn comprises a counteracting ring **31** associated in an intermediate position with the connection rod **27** and two elastic elements comprising a first elastic element **32,** included between the counteracting ring **31** and the centre core **16,** and a second elastic element **33** that is included between the same counteracting ring **31** and the tube **20.**

[0056] It can furthermore be noted that the manoeuvring tang **21** of said tube **20** is provided with shaped portions **21a** suited to be coupled with mechanical rotation means, like for example and electric screwer, but also configured to allow a possible manual manoeuvre to be performed on the tube **20** by rotating it manually using a manoeuvring wrench of the type known per se.

[0057] As regards the flaring cone **4,** it can be noted that it is provided with a pin **7** housed in a hole **7a** made in the centre core **16** where it defines a direction **Y** incident on the longitudinal axis **X** in the vertex **4a** of the flaring cone **4.**

[0058] Furthermore, rolling means **17** are interposed between the pin **7** and the hole **7a,** wherein said rolling means preferably but not necessarily comprise one or more bearings and rollers.

[0059] The configuration of the flaring unit just described above allows the flaring cone **4** to be moved forward against the pipe **T** to be flared when the tube **20** is set rotating through the manoeuvring tang **21.**

[0060] In this way, the screw means **22** make the centre core **16** and the flaring cone **4** advance inside the sleeve **25** and the bearing **26** through a sliding movement according to the longitudinal axis **X.**

[0061] At the same time, the connection rod **27** also sets the centre core **16** rotating around the same longitudinal axis **X** in such a way as to transmit a conical movement to the flaring cone **4** whose lateral surface **4b** comes into contact with the end of the pipe **T** and deforms it, producing the flare **S** that can be observed in Figure 10.

[0062] In particular, the flare **S** at the end of the pipe **T** is obtained through plastic deformation of the end of the pipe **T** included between the flaring cone **4** and the chamfer **8d** of the flaring die **8** that delimits the centre channel **9** of the flaring die **8** itself.

[0063] The latter, as can be observed in particular in Figures from 4 to 8, comprises two shaped cores **8b, 8c** that are connected to each other and can be mutually opened as a caliper through an elastic rotation unit **40.**

[0064] A half **9a, 9b** of the centre channel **9** is created in each one of the shaped cores **8b, 8c** and the centre

channel is thus formed when both of the shaped cores **8b, 8c** face each other, as shown in Figures 5 and 6.

[0065] As regards the elastic rotation unit **40,** it can be observed that it comprises a pair of pins **41, 42,** each one of which is coupled in a corresponding shaped core **8b, 8c** and is arranged so that it passes through two joining brackets **43, 44,** each one of the latter being housed in a corresponding seat **45, 46** that extends over both of the shaped cores **8b, 8c.**

[0066] Therefore, the shaped cores **8b, 8c** can rotate with respect to each other with a caliper movement that is made elastic by the presence of a helical spring **47** having one end **47a** in contact with the shaped core **8b** to which the pin **41** belongs, while the other end **47b** interferes with the pin **42** belonging to the other shaped core **8c.**

[0067] Therefore, the presence of the helical spring **47** makes the mutual opening and clamping of the shaped cores **8b, 8c** elastic and keeps them clamped, one facing the other, when the pipe **T** to be flared is included between them. Operatively, when it is necessary to flare a pipe **T,** the shaped cores **8b, 8c** of the flaring die **8** are separated in such a way as to accommodate the pipe **T** to be flared in the centre channel **9.**

[0068] When the pipe **T** to be flared is clamped between the shaped cores as a result of the elastic thrust exerted by the helical spring **47,** the operator holds the free end of the pipe **T** to be flared, inserts the flaring die **8** in the shaped seat **11** with a movement directed crosswise with respect to the longitudinal axis **X** and thus makes the flaring die **8** move according to the longitudinal axis **X** in order to insert it in the die carrier **10** in the configuration shown in Figure 9.

[0069] It should be noted that the fact that the taper of the inner surface of the die carrier **10** and the taper of the outer surface of the flaring die **8** match each other guarantees the centering of the pipe **T** to be flared with respect to the longitudinal axis **X** and to the flaring cone **4.**

[0070] At this point it is sufficient for the operator to set the manoeuvring tang **21** of the tube **20** rotating, for example through a motor-driven rotary spindle **V,** so that the centre core **16** advances towards the pipe **T** to be flared, until the flaring cone **4** comes into contact with the pipe **T** and deforms its end obtaining the flare **S** coupled with the chamfer **8d** of the flaring die **8.**

[0071] Once the flaring operation has been completed, it is sufficient to set the manoeuvring tang **21** rotating in the direction opposite the screwing direction in order to move the flaring cone **4** away from the flaring die **8** and allow the latter to be extracted through the shaped opening **14.**

[0072] The shaped cores **8b, 8c** of the flaring die **8** are then opened in order to extract the flared pipe **T.**

[0073] Obviously, the flaring device will be provided with several flaring dies **8,** each having a centre channel **9** with different diameter, so that different pipes can be accommodated therein, but all of them will have the same conical outer surface **13,** so that they can all be accommodated in the same die carrier **10.** Variant embodiments of the flaring die just described above are possible, comprising both of the shaped cores or several shaped cores, in each one of which a portion of said centre channel is created, said centre channel being defined when the shaped cores are maintained adherent to each other by joining means.

[0074] The centre channel has circular cross section and is provided with the chamfer facing towards the flaring unit **3.**

[0075] A variant embodiment of the flaring die is shown in Figures from 11 to 14, where it is indicated as a whole by **50.**

[0076] It can be observed that it comprises two shaped cores **50a, 50b,** which are connected to each other through a hinge element **51,** visible in particular in Figures 13 and 14, which makes it possible to mutually open and clamp them with a caliper movement.

[0077] In each one of the shaped cores **50a, 50b** there is a half **52a, 52b** of the centre channel **52** with truncated cone-shaped profile that is formed when the flaring die **50** is clamped and both of the shaped cores **50a, 50b** that make it up face each other, as can be observed in Figures from 11 to 13.

[0078] There are joining means suited to join the shaped cores, comprising a lever **53** arranged on the opposite side of the hinge **51** and visible in Figures 11 and 14, which constrains the shaped cores **50a, 50b** to each other in the clamped position when these are arranged opposite each other, as shown in Figure 11. For this purpose, the lever **53** has a first end **53a** revolvingly connected to one of the shaped cores through a pin **54,** for example to the first shaped core **50a** of a second end **53b** suited to be manoeuvred by the operator and housed in a seat **55** obtained in the second shaped core **50b.**

[0079] Furthermore, a groove **56** obtained in both of the shaped cores **50a, 50b** and communicating with the seat **55** of the lever **53** houses the body **53c** of the same lever **53** when its second end **53b** is housed in the seat **55,** as shown in Figure 11.

[0080] Starting from the clamped configuration of the flaring die **50** shown in Figure 11, by acting on the second end **53b** of the lever **53** it is possible to rotate the lever **53** until it is arranged in the configuration shown in Figure 14, in which the shaped cores **50a, 50b** that make it up can be separated from each other. Another variant embodiment of the flaring die is represented in Figures from 15 to 17, where it is indicated as a whole by **60.**

[0081] It can be observed that it comprises four shaped cores **60a, 60b, 60c, 60d,** each one of which defines an angular sector of the flaring die **60** for an amplitude of 90°.

[0082] In each one of the shaped cores **60a, 60b, 60c, 60d** there is a quarter **61a, 61b, 61c, 61d** of the centre channel **61** with truncated cone-shaped profile that is formed when the flaring die **60** is clamped and the shaped cores that make it up are maintained mutually adherent by joining means indicated as a whole by **63,** arranged circumferentially outside them, as shown in Figure 15.

[0083] It can be observed, in particular, that the joining means **63** comprise two elastic rings **64, 65** housed in corresponding annular grooves **66, 67** created circumferentially on the outside of the shaped cores **60a, 60b, 60c, 60d.** Usually, the elastic rings **64, 65** force the shaped cores **60a, 60b, 60c, 60d** radially towards the centre, so that they are maintained adherent to one another and to the pipe to be flared that is included between them.

[0084] On the other hand, in order to space the shaped cores **60a, 60b, 60c, 60d** from one another, it is sufficient to force them radially towards the outside, overcoming the elastic force exerted by the elastic rings **64, 65.**

[0085] A further variant embodiment of the flaring die is represented in Figures from 18 to 21, where it is indicated as a whole by **70.**

[0086] It can be observed that it comprises two shaped cores **70a, 70b,** which are connected to each other through a hinge element **71** that makes it possible to mutually open and clamp them with a caliper movement.

[0087] In each one of the shaped cores **70a, 70b** there is a half **72a, 72b** of the centre channel **72** with truncated cone-shaped profile that is formed when the flaring die **70** is clamped and both the shaped cores **70a, 70b** that make it up are facing each other, as shown in Figures 18 and 19.

[0088] On the opposite side of the hinge element **71** there are the joining means comprising a magnetic closure indicated as a whole by **73** that comprises a first magnetic element **74** and a second magnetic element **75,** each one belonging to a corresponding shaped core **70a, 70b,** with opposite polarities and opposing each other.

[0089] In this way, when the flaring die **70** is clamped the shaped cores **70a, 70b** remain adherent to each other due to the mutual magnetic attraction generated by the magnetic elements **74, 75** when they are arranged so that they face each other.

[0090] Another and not less important variant embodiment of the flaring die is shown in Figures from 22 to 25, where it is indicated as a whole by **80.**

[0091] It can be observed that it comprises four shaped cores **80a, 80b, 80c, 80d,** each one of which defines an angular sector of the flaring die **80** for an amplitude of 90°.

[0092] In each one of the shaped cores **80a, 80b, 80c, 80d** there is a quarter **81a, 81b, 81c, 81d** of the centre channel **82** with truncated cone-shaped profile that is formed when the flaring die **80** is clamped.

[0093] The shaped cores **80a, 80b, 80c, 80d** are provided with a plurality of holes **83** parallel to one another and arranged according to a circumference **Z,** drawn with a broken line, concentric with the longitudinal axis of symmetry **Y** of the flaring die **80,** in each one of which a pin **85** provided with a head **86** is inserted.

[0094] The joining means comprise said pins **85** and an annular ring nut **87** provided with a plurality of slotted holes **88,** which is arranged so that it faces and is in contact with the shaped cores **80a, 80b, 80c, 80d** and is included between the underhead of each head **86** of the pins **85** and the underlying shaped cores **80a, 80b, 80c, 80d.**

[0095] Each one of said pins **85** is thus inserted also in a corresponding slotted hole **88,** wherein each slotted hole **88** defines a longitudinal axis of symmetry **X** that, as shown in Figures 24 and 25, is tangential to the already mentioned circumference **Z** to which the centres **89** of the pins **85** and of the respective heads **86** belong.

[0096] In this way, when the annular ring nut **87** is rotated, the walls of the slotted holes **88** force the pins **85,** and thus also the shaped cores **80a, 80b, 80c, 80d** that are integral with them, to move away from or towards each other in a radial direction with respect to the longitudinal axis of symmetry **Y** of the flaring die **80.**

[0097] Thus, for example, in the configuration shown in Figure 24 the shaped cores **80a, 80b, 80c, 80d** are close to each other, as the pins **85** are in the position nearest to the longitudinal axis of symmetry **Y** and clamp the pipe to be flared between them.

[0098] Vice versa, if the annular ring nut **87** is rotated in the configuration shown in Figure 25, the pins **85** come to be in the position furthest away from the longitudinal axis of symmetry **Y** of the flaring die **80,** which therefore is in the open configuration with the shaped cores **80a, 80b, 80c, 80d** spaced from one another.

[0099] Based on the description provided above, it can be understood that the flaring device that is the subject of the invention achieves all of the set objects.

[0100] In particular, the flaring device of the invention allows the flaring dies to be rapidly replaced compared to the known flaring devices equivalent to it and thus shortens the processing times compared to the known art.

[0101] Furthermore, the flaring device of the invention has lower production costs than the known flaring devices equivalent to it that are motor driven.

[0102] Finally, the flaring device of the invention can be operated either manually or through a motor, for example using screwers of the known type.

[0103] During the construction process, the flaring device of the invention can be subjected to modifications or construction variants intended to improve its functionality or make its construction more economical.

[0104] It is understood, however, that said possible modifications or variants must all be considered protected by the present invention, provided that they fall within the scope of the following claims.

Claims

1. Flaring device (1) suited to flare the ends of pipes (T), comprising a main body (2) that develops along a mainly longitudinal direction defined by a longitudinal axis (X), the following being provided in said main body (2):

- a flaring unit (3) configured in such a way as to interact with the end of said pipe (T) to be flared;
- a die carrier (10) arranged at the front of said flaring unit (3);
- a flaring die (8; 50; 60; 70; 80) configured in such a way that it can be accommodated in said die carrier (10) and provided with a centre channel (9) configured so as to house said pipe (T) to be flared;

said die carrier (10) being provided with a shaped seat (11) configured so as to accommodate said flaring die (8; 50; 60; 70; 80) and communicating with a shaped opening (14) made in said main body (2), said shaped opening (14) being included between said flaring unit (3) and said die carrier (10), said shaped seat (11) being defined by a conical inner surface (12) whose taper diverges towards said flaring unit (3) and being configured so that it matches the conical outer surface (13) of said flaring die (8; 50; 60; 70; 80),
characterized in that said shaped opening (14) is made in the lateral surface (2a) of said main body (2), **in that** the length (14a) of said shaped opening (14), measured along said longitudinal axis (X), exceeds the length (8a) of said flaring die (8; 50; 60; 70; 80), also measured along said longitudinal axis (X), and **in that** the width (14b) of said shaped opening (14), measured crosswise with respect to said longitudinal axis (X), exceeds the width (8b) of said flaring die (8; 50; 60; 70; 80) and the width (11b) of said shaped seat (11), both measured crosswise with respect to said longitudinal axis (X).

2. Flaring device (1) according to claim 1, **characterized in that** the width (14b) of said shaped opening (14), measured crosswise with respect to said longitudinal axis (X), is smaller than the width (2b) of said main body (2), also measured crosswise with respect to said longitudinal axis (X).

3. Flaring device (1) according to any of the preceding claims, **characterized in that** said die carrier (10) is provided with a through opening (15) that develops along the direction defined by said longitudinal axis (X) and that communicates with said shaped opening (14).

4. Flaring device (1) according to any of the preceding claims, **characterized in that** said flaring unit (3) comprises:

- a centre core (16) coaxially associated into said main body (2) according to said longitudinal axis (X);
- a flaring cone (4) belonging to said centre core (16) and facing towards said flaring die (8; 50; 60; 70; 80);
- manoeuvring means (19) suited to move said centre core (16) coaxially inside said main body (2) and along said longitudinal axis (X).

5. Flaring device (1) according to claim 4, **characterized in that** said flaring cone (4) is provided with a pin (7) housed in a hole (7a) made in said centre core (16) where it defines a direction (Y) incident on said longitudinal axis (X), rolling means (17) being interposed between said pin (7) and said hole (7a).

6. Flaring device (1) according to claim 4 or 5, **characterized in that** said manoeuvring means (19) comprise:

- a tube (20) mechanically associated with said centre core (16) and provided with a manoeuvring tang (21) that projects from said main body (2) on the opposite side of said flaring cone (4);
- screw means (22) for connecting said tube (20) inside said main body (2).

7. Flaring device (1) according to claim 6, **characterized in that** said screw means (22) comprise a male thread (23) created on the outside of said tube (20) and a female thread (24) created in a sleeve (25) that is stably coupled into said main body (2) and into which said centre core (16) is slidingly coupled.

8. Flaring device (1) according to claim 7, **characterized in that** it comprises a bearing (26) arranged in such a way that it is coaxially aligned with said sleeve (25) and interposed between said main body (2) and said centre core (16).

9. Flaring device (1) according to any of the preceding claims, **characterized in that** said tube (20) is mechanically associated with said centre core (16) through a connection rod (27) having a first end (27a) fixed to said centre core (16) and a second end (27b), opposite said first end (27a), slidingly associated into said tube (20) to which it is connected through a pin (28) fixed to said second end (27b) and slidingly associated into a slot (29) made in said tube (20).

10. Flaring device (1) according to claim 9, **characterized in that** it comprises an elastic unit (30) coaxially associated with the outside of said connection rod (27) and interposed between said centre core (16) and said tube (20).

11. Flaring device (1) according to any of the preceding claims, **characterized in that** said flaring die (8; 50; 60; 70; 80) comprises two or more shaped cores (8b, 8c; 50a, 50b; 60a, 60b, 60c, 60d; 70a, 70b; 80a, 80b, 80c, 80d), in each one of which there is a section (9a, 9b; 52a, 52b; 61a, 61b, 61c, 61d; 72a, 72b; 81a,

81b, 81c, 81d) of said centre channel (9; 52; 61; 72; 82) that is defined when said shaped cores (8b, 8c; 50a, 50b; 60a, 60b, 60c, 60d; 70a, 70b; 80a, 80b, 80c, 80d) are maintained adherent to each other by joining means, said centre channel (9; 52; 61; 72; 82) having circular cross section and being provided with a chamfer (8d) facing towards said flaring unit (3).

12. Flaring device (1) according to claim 11, **characterized in that** said flaring die (8) comprises two shaped cores (8b, 8c) that are connected to each other and are suited to be mutually opened like calipers through an elastic rotation unit (40), a half (9a, 9b) of said centre channel (9) being present in each one of said shaped cores (8b, 8c).

13. Flaring device (1) according to claim 12, **characterized in that** said elastic rotation unit (40) comprises a pair of pins (41, 42), each coupled into a corresponding shaped core (8b, 8c) and arranged so that it passes through at least one joining bracket (43, 44) housed in a seat (45, 46) that extends over both of said shaped cores (8b, 8c), wherein a helical spring (47) is externally coupled with at least one of said pins (41), said helical spring having one end (47a) that is placed in contact with one of said shaped cores (8b) and the other end (47b) that interferes with the other pin (42).

14. Flaring device (1) according to claim 11, **characterized in that** said flaring die (50; 70) comprises two shaped cores (50a, 50b; 70a, 70b), in each one of which there is a half (52a, 52b; 72a, 72b) of said centre channel (52; 72), said shaped cores (50a, 50b; 70a, 70b) being connected to each other through a hinge element (51; 71) that allows them to be opened like calipers and being provided with joining means arranged on the opposite side of said hinge element (51; 71).

15. Flaring device (1) according to claim 14, **characterized in that** said joining means comprise a lever (53) having a first end (53a) connected to a first shaped core (50a) through a pin, a second end (53b) suited to be manoeuvred by the operator and configured so that it can be housed in a seat (55) provided in a second shaped core (50b), and a body (53c) included between said ends (53a, 53b), configured so that it can be housed in a groove (56) obtained in both of said shaped cores (50a, 50b).

16. Flaring device (1) according to claim 14, **characterized in that** said joining means comprise a magnetic closure (73) comprising a first magnetic element (74) and a second magnetic element (75) opposing each other, each belonging to a corresponding shaped core (70a, 70b).

17. Flaring device (1) according to claim 11, **characterized in that** said flaring die (60) comprises four shaped cores (60a, 60b, 60c, 60d), in each one of which there is a quarter of said centre channel (61), said joining means comprising at least one elastic ring (64, 65) housed in an annular groove (66, 67) created on the outside of said shaped cores (60a, 60b, 60c, 60d).

18. Flaring device (1) according to claim 11, **characterized in that** said flaring die (80) comprises four shaped cores (80a, 80b, 80c, 80d), in each one of which there is a quarter of said centre channel (82), said shaped cores (80a, 80b, 80c, 80d) being connected to one another through said joining means which comprise a plurality of pins (85) provided with a terminal head (86) and inserted in holes (83) made in said shaped cores (80a, 80b, 80c, 80d) and in slotted holes (88) made in an annular ring nut (87) included between said shaped cores (80a, 80b, 80c, 80d) and said terminal heads (86) of said pins (85), the rotation of said annular ring nut (87) being suited to transmit to said shaped cores (80a, 80b, 80c, 80d) a radial movement away from or towards each other.

Patentansprüche

1. Aufweitungseinrichtung (1) bestimmt zum Aufweiten von Rohrenden (T), aufweisend einen Hauptkörper (2) der sich entlang einer im Wesentlichen länglichen Richtung erstreckt, die durch die Längsachse (X) bestimmt ist, wobei der genannte Hauptkörper(2) Folgendes aufweist:

- eine Aufweitungseinheit (3) derart eingerichtet, dass sie mit dem Ende des genannten aufzuweitenden Rohrs (T) zusammenwirkt;
- einen Stanzträger (10) angeordnet an der Front der genannten Aufweitungseinheit (3);
- eine Aufweitungsstanze (8; 50; 60; 70; 80) derart aufgebaut, dass sie im genannten Stanzträger (10) angeordnet werden kann, und ausgestattet mit einem Mittelkanal (9) derart aufgebaut, dass er das genannte aufzuweitende Rohr (T) aufnimmt;

Wobei der genannte Träger (10) mit einer ausgeformten Aufnahme (11) ausgestattet ist, das bestimmt ist, die genannte Aufweitungsstanze (8; 50; 60; 70; 80) aufzunehmen und mit einer geformten Öffnung (14) im genannten Hauptkörper (2) verbunden ist, wobei die genannte geformte Öffnung (14) zwischen der genannten Aufweitungseinheit (3) und dem genannten Träger (10) zwischengeordnet ist, wobei die genannte geformte Aufnahme (11) als Kegelinnenfläche (12) definiert ist, deren Verjüngung in Richtung der genannten Aufweitungseinheit (3)

gerichtet ist und derart eingerichtet ist, dass es an die Kegelaußenfläche (13) der genannten Aufweitungsstanze (8; 50; 60; 70; 80) passt, **gekennzeichnet dadurch, dass** die genannte Öffnung (14) in der Seitenfläche (2a) des genannten Hauptkörpers (2) eingearbeitet ist, und dass die Länge (14a) der genannten geformten Öffnung (14), entlang der genannten Längsachse (X) gemessen, die Länge (8a) der genannten Aufweitungsstanze (8; 50; 60; 70; 80), ebenfalls entlang der genannten Längsachse (X) gemessen, überschreitet, und dass die Breite (14b) der genannten geformten Öffnung (14), quer zur genannten Längsachse (X) gemessen, die Breite (8b) der genannten Aufweitungsstanze (8; 50; 60; 70; 80) und die Breite (11b) der genannten geformten Aufnahme (11), beide quer zur genannten Längsachse (X) gemessen, überschreitet.

2. Aufweitungseinrichtung (1) nach Anspruch 1, **gekennzeichnet dadurch, dass** die Breite (14b) der genannten geformten Öffnung (14), quer zur genannten Längsachse (X) gemessen, kleiner ist als die Breite (2b) des genannten Hauptkörpers (2), ebenfalls quer zur genannten Längsachse (X) gemessen.

3. Aufweitungseinrichtung (1) nach einem der vorigen Ansprüche, **gekennzeichnet dadurch, dass** der genannte Träger (10) mit einer Durchgangsöffnung (15) ausgestattet ist die sich entlang der Richtung erstreckt, die durch die genannte Längsachse (X) definiert ist, und mit der geformten Öffnung (14) verbunden ist.

4. Aufweitungseinrichtung (1) nach einem der vorigen Ansprüche, **gekennzeichnet dadurch, dass** die genannte Aufweitungseinheit (3) Folgendes aufweist:

- einen Mittelkern (16) der im genannten Hauptkörper (2) koaxial zur genannten Längsachse (X) angeordnet ist;
- einen Aufweitungskegel (4) gehörend zum genannten Mittelkern (16) und gerichtet zur genannten Aufweitungsstanze (8; 50; 60; 70; 80);
- Manövriermittel (19) eingerichtet zum Bewegen des genannten Mittelkerns (16) koaxial im Innern des genannten Hautkörpers (2) und entlang der genannten Längsachse (X).

5. Aufweitungseinrichtung (1) nach Anspruch 4, **gekennzeichnet dadurch, dass** der genannte Aufweitungskegel (4) mit einem Zapfen (7) ausgestattet ist, der in einem im Mittelkern (16) eingearbeitetem Loch (7a) angeordnet ist, wobei dieser die auf die Längsachse (X) weisende Richtung (Y) definiert, wobei Rollmittel (17) zwischen dem genannte Zapfen (7) und dem genannten Loch (7a) zwischengeordnet sind.

6. Aufweitungseinrichtung (1) nach Anspruch 4 oder 5, **gekennzeichnet dadurch, dass** die genannten Manövriermittel (19) Folgendes aufweisen:

- ein Rohr (20) mechanisch mit dem genannten Mittelkern (16) korreliert und mit einem Manövriergriff (21) ausgestattet, der vom genannten Hauptkörper (2) an der gegenüberliegenden Seite des Aufweitungskegels (4) abweist;
- Schraubmittel (22) zur Verbindung des genannten Rohrs (20) im Innern des genannten Hauptkörpers (2).

7. Aufweitungseinrichtung (1) nach Anspruch 6, **gekennzeichnet dadurch, dass** die genannten Schraubmittel (22) ein an der Außenseite des genannten Rohrs (20) ausgebildetes männliches Gewinde (23) und ein in einer stabil mit dem genannten Hauptkörper (2) verbunden Hülse ausgebildetes weibliches Gewinde (24) aufweisen, und mit diesen der genannten Mittelkern (16) verschiebbar gekoppelt ist.

8. Aufweitungseinrichtung (1) nach Anspruch 7, **gekennzeichnet dadurch, dass** es ein Lager (26) aufweist, dass derart eingerichtet ist, dass es koaxial zur genannte Hülse (25) angeordnet ist und zwischen dem genannten Hauptkörper (2) und dem genannten Mittelkern (16) zwischengeordnet ist.

9. Aufweitungseinrichtung (1) nach einem der vorigen Ansprüche, **gekennzeichnet dadurch, dass** das genannte Rohr (20) mechanisch mit dem genannten Mittelkern (16) mittels eines Verbindungsstabs (27) verbunden ist, der ein erstes an dem genannten Mittelkern (16) fixiertes Ende (27a) und ein zweites, dem ersten Ende (27a) gegenüberliegendes verschiebbar mit dem genannten Rohr (20) verbundene zweite Ende (27b) aufweist, mit welchem es mit einem am zweiten Ende (27b) fixierten Zapfen (28) verschiebbar in einer im genannten Rohr (20) befindlichen Nut (29) angeordnet ist.

10. Aufweitungseinrichtung (1) nach Anspruch 9, **gekennzeichnet dadurch, dass** es eine elastische Einheit (30) aufweist, die koaxial zur Außenseite des genannte Verbindungsstabs (27) angeordnet und zwischen dem genannten Mittelkern (16) und dem genannten Rohr (20) angeordnet ist.

11. Aufweitungseinrichtung (1) nach einem der vorigen Ansprüche, **gekennzeichnet dadurch, dass** die genannte Aufweitungsstanze (8; 50; 60; 70; 80) zwei oder mehr geformte Kerne (8b, 8c; 50a, 50b; 60a, 60b, 60c, 60d; 70a, 70b; 80a, 80b, 80c, 80d) aufweist, in denen sich jeweils ein Abschnitt (9a, 9b; 52a, 52b; 61a, 61b, 61c, 61d; 72a, 72b; 81a, 81b, 81c, 81d) des genannten Mittelkanals (9; 52; 61; 72;

82) befindet, der dadurch definiert ist, dass die genannten geformten Kerne (8b, 8c; 50a, 50b; 60a, 60b, 60c, 60d; 70a, 70b; 80a, 80b, 80c, 80d) in Anlage zueinander mit dem Einsatz von Verbindungsmitteln gehalten werden, wobei der genannte Mittelkanal (9; 52; 61; 72; 82) einen runden Querabschnitt aufweist und mit einer zur Aufweitungseinheit (3) gerichteten Fase (8d) ausgestattet ist.

12. Aufweitungseinrichtung (1) nach Anspruch 11, **gekennzeichnet dadurch, dass** die genannte Aufweitungsstanze (8) zwei geformte Kerne (8b, 8c) aufweist, die miteinander verbunden und eingerichtet sind, um gegeneinander ähnlich wie Backen durch eine elastische Dreheinheit (40) geöffnet zu werden, wobei die jeweils die Hälfte (9a, 9b) des genannten Mittelkanals (9) sich in einem der beiden gennannten geformten Kerne (8b, 8c) befindet.

13. Aufweitungseinrichtung (1) nach Anspruch 12, **gekennzeichnet dadurch, dass** die elastische Dreheinheit (40) ein Paar zweier Zapfen (41, 42) aufweist, die jeweils mit einem passenden geformten Kern (8b, 8c) verbunden und derart eingerichtet sind, dass sie durch mindestens eine Verbindungsklammer (43, 44) angeordnet in einer Aufnahme (45, 46) passen, die über die zwei genannten geformten Kerne (8b, 8c) herausragt, wobei eine Helixfeder (47) außenseitig mit mindestens einem der genannten Zapfen (41) gekoppelt ist, wobei die in der genannten Helixfeder ein Ende (47a) in Anlage an einem der genannten geformten Kerne (8b) angeordnet ist und das andere Ende (47b) mit dem zweiten Zapfen (42) zusammenwirkt.

14. Aufweitungseinrichtung (1) nach Anspruch 11, **gekennzeichnet dadurch, dass** die genannte Aufweitungsstanze (50; 70) zwei geformte Kerne (50a, 50b; 70a, 70b) aufweist, jeweils in jedem davon sich die Hälfte (52a, 52b; 72a, 72b) des genannte Mittelkanals (52; 72) befindet, und die genannten geformten Kerne (50a, 50b; 70a, 70b) miteinander durch ein Scharnierelement (51; 71) verbunden sind, das es ermöglicht, diese wie Backen zu öffnen, und mit an der zum Scharnierelement (51; 71) gegenüberliegenden Seite angeordneten Verbindungsmitteln ausgestattet sind.

15. Aufweitungseinrichtung (1) nach Anspruch 14, **gekennzeichnet dadurch, dass** die genannten Verbindungsmittel einen Hebel (53) aufweisen, der ein erstes mit dem ersten geformten Kern (50a) mittels eines Zapfens verbundenes Ende (53a), und ein zweites Ende (53b) aufweist, das eingerichtet ist zum Manövrieren durch den Bediener und derart gestaltet, das es in eine im zweiten geformten Kern (50b) angeordnete Aufnahme (55) passt, und einen Körper (53c), das sich zwischen den zwei Enden (53a, 53b) befindet, und derart eingerichtet ist, dass es in eine Rille (56) in beiden der geformten Kerne (50a, 50b) passt.

16. Aufweitungseinrichtung (1) nach Anspruch 14, **gekennzeichnet dadurch, dass** die genannten Verbindungsmittel einen magnetischen Verschluss (73) aufweisen, der aus einem erstem magnetischen Element (74) und einem zweiten magnetischen Element (75) besteht, die einander gegenüberliegen, und jeweils zu einem passenden geformten Kern (70a, 70b) gehören.

17. Aufweitungseinrichtung (1) nach Anspruch 11, **gekennzeichnet dadurch, dass** die genannte Aufweitungsstanze (60) vier geformte Kerne (60a, 60b, 60c, 60d) aufweist, in jedem von denen jeweils sich ein Viertel des Mittelkanals (61) befindet, und die genannten Verbindungsmittel mindestens einen in einer Umfangsrille (66, 67) an der Außenseite der genannten geformten Kerne (60a, 60b, 60c, 60d) angeordneten elastischen Ring (64, 65) aufweisen.

18. Aufweitungseinrichtung (1) nach Anspruch 11, **gekennzeichnet dadurch, dass** die genannte Aufweitungsstanze (80) vier geformte Kerne (80a, 80b, 80c, 80d) aufweist, in jedem von denen jeweils sich ein Viertel des Mittelkanals (82) befindet, wobei die genannten geformten Kerne (80a, 80b, 80c, 80d) miteinander mittels genannter Verbindungsmittel verbunden sind, die mehrere Zapfen (85) aufweisen, die mit einem Endkopf (86) ausgestattet und in Öffnungen (83), die in den geformten Kernen (80a, 80b, 80c, 80d) gefertigt sind, und in nutartige Öffnungen (88) in der Umfangsringmutter (87) gesteckt sind , die zwischen die geformten Kerne (80a, 80b, 80c, 80d) und die genannte Endköpfe (86) der genannten Zapfen (85) angeordnet ist, wobei die Rotation der Umfangsringmutter (87) bestimmt ist, um an die geformten Kerne (80a, 80b, 80c, 80d) eine radiale Bewegung voneinander oder zueinander umzuwandeln.

Revendications

1. Dispositif d'évasement (1) adapté pour évaser les extrémités des tuyaux (T), comprenant un corps principal (2) qui se développe le long d'une direction principalement longitudinale définie par un axe longitudinal (X), les éléments suivants étant prévus dans ledit corps principal (2) :

- une unité d'évasement (3) configurée de manière à interagir avec l'extrémité dudit tuyau (T) à évaser ;
- un porte-matrice (10) disposé à l'avant de ladite unité d'évasement (3) ;

- une matrice d'évasement (8; 50; 60; 70; 80) configurée de telle sorte qu'elle peut être logée dans ledit porte-matrice (10) et munie d'un canal central (9) configuré de façon à loger ledit tuyau (T) à évaser ;

ledit porte-matrice (10) étant muni d'un siège profilé (11) configuré de façon à loger ladite matrice d'évasement (8; 50; 60; 70; 80) et communiquant avec une ouverture profilée (14) réalisée dans ledit corps principal (2), ladite ouverture profilée (14) étant comprise entre ladite unité d'évasement (3) et ledit porte-matrice (10), ledit siège profilé (11) étant défini par une surface intérieure conique (12) dont la conicité diverge vers ladite unité d'évasement (3) et étant configuré de façon à correspondre à la surface extérieure conique (13) de ladite matrice d'évasement (8; 50; 60; 70; 80),
caractérisé en ce que ladite ouverture profilée (14) est réalisée dans la surface latérale (2a) dudit corps principal (2), **en ce que** la longueur (14a) de ladite ouverture profilée (14), mesurée le long dudit axe longitudinal (X), dépasse la longueur (8a) de ladite matrice d'évasement (8; 50; 60; 70; 80), également mesurée le long dudit axe longitudinal (X), **en ce que** la largeur (14b) de ladite ouverture profilée (14), mesurée transversalement par rapport audit axe longitudinal (X), dépasse la largeur (8b) de ladite matrice d'évasement (8; 50; 60; 70; 80) et la largeur (11b) dudit siège profilé (11), toutes les deux étant mesurées transversalement par rapport audit axe longitudinal (X).

2. Dispositif d'évasement (1) selon la revendication 1, **caractérisé en ce que** la largeur (14b) de ladite ouverture profilée (14), mesurée transversalement par rapport audit axe longitudinal (X), est inférieure à la largeur (2b) dudit corps principal (2), également mesurée transversalement par rapport audit axe longitudinal (X).

3. Dispositif d'évasement (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit porte-matrice (10) est muni d'une ouverture traversante (15) qui se développe le long de la direction définie par ledit axe longitudinal (X) et qui communique avec ladite ouverture profilée (14).

4. Dispositif d'évasement (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite unité d'évasement (3) comprend:

- un noyau central (16) associé coaxialement audit corps principal (2) selon ledit axe longitudinal (X);
- un cône d'évasement (4) appartenant audit noyau central (16) et faisant face à ladite matrice d'évasement (8; 50; 60; 70; 80);
- moyens de manoeuvre (19) adaptés pour déplacer coaxialement ledit noyau central (16) à l'intérieur dudit corps principal (2) et le long dudit axe longitudinal (X).

5. Dispositif d'évasement (1) selon la revendication 4, **caractérisé en ce que** ledit cône d'évasement (4) est muni d'une broche (7) logée dans un trou (7a) réalisé dans ledit noyau central (16) où elle définit une direction (Y) incidente sur ledit axe longitudinal (X), des moyens de roulement (17) étant interposés entre ladite broche (7) et ledit trou (7a).

6. Dispositif d'évasement (1) selon la revendication 4 ou 5, **caractérisé en ce que** lesdits moyens de manoeuvre (19) comprennent :

- un tube (20) associé mécaniquement audit noyau central (16) et muni d'une tige de manoeuvre (21) qui fait saillie à partir dudit corps principal (2) du côté opposé dudit cône d'évasement (4) ;
- moyens à vis (22) pour connecter ledit tube (20) à l'intérieur dudit corps principal (2).

7. Dispositif d'évasement (1) selon la revendication 6, **caractérisé en ce que** lesdits moyens à vis (22) comprennent un filetage mâle (23) créé à l'extérieur dudit tube (20) et un filetage femelle (24) créé dans un manchon (25) couplé de façon stable dans ledit corps principal (2) et dans lequel ledit noyau central (16) est couplé de manière coulissante.

8. Dispositif d'évasement (1) selon la revendication 7, **caractérisé en ce qu'**il comprend un palier (26) agencé de telle sorte qu'il est aligné coaxialement avec ledit manchon (25) et interposé entre ledit corps principal (2) et ledit noyau central (16).

9. Dispositif d'évasement (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ledit tube (20) est associé mécaniquement audit noyau central (16) par l'intermédiaire d'une tige de connexion (27) ayant une première extrémité (27a) fixée audit noyau central (16) et une seconde extrémité (27b), opposée à ladite première extrémité (27a), associée de manière coulissante dans ledit tube (20) auquel elle est reliée par l'intermédiaire d'une broche (28) fixée à ladite seconde extrémité (27b) et associée de manière coulissante dans une fente (29) réalisée dans ledit tube (20).

10. Dispositif d'évasement (1) selon la revendication 9, **caractérisé en ce qu'**il comprend une unité élastique (30) associée coaxialement à l'extérieur de ladite tige de connexion (27) et interposée entre ledit noyau central (16) et ledit tube (20).

11. Dispositif d'évasement (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** ladite matrice d'évasement (8; 50; 60; 70; 80) comprend deux ou plusieurs noyaux profilés (8b, 8c; 50a, 50b; 60a, 60b, 60c, 60d; 70a, 70b; 80a, 80b, 80c, 80d), dans chacun desquels il y a un segment (9a, 9b; 52a, 52b; 61a, 61b, 61c, 61d; 72a, 72b; 81a, 81b, 81c, 81d) dudit canal central (9; 52; 61; 72; 82) qui est défini lorsque lesdits noyaux profilés (8b, 8c; 50a, 50b; 60a, 60b, 60c, 60d; 70a, 70b; 80a, 80b, 80c, 80d) sont maintenus adhérents les uns aux autres par des moyens de jonction, ledit canal central (9; 52; 61; 72; 82) ayant une section transversale circulaire et étant muni d'un chanfrein (8d) faisant face à ladite unité d'évasement (3).

12. Dispositif d'évasement (1) selon la revendication 11, **caractérisé en ce que** ladite matrice d'évasement (8) comprend deux noyaux profilés (8b, 8c) qui sont reliés l'un à l'autre et sont adaptés pour être mutuellement ouverts comme un compas à travers une unité de rotation élastique (40), une moitié (9a, 9b) dudit canal central (9) étant présente dans chacun desdits noyaux profilés (8b, 8c).

13. Dispositif d'évasement (1) selon la revendication 12, **caractérisé en ce que** ladite unité de rotation élastique (40) comprend une paire de broches (41, 42), chacune couplée dans un noyau profilé correspondant (8b, 8c) et agencée de sorte qu'elle traverse au moins un support de jonction (43, 44) logé dans un siège (45, 46) qui s'étend sur les deux desdits noyaux profilés (8b, 8c), dans lequel un ressort hélicoïdal (47) est couplé extérieurement à au moins une desdites broches (41), ledit ressort hélicoïdal ayant une extrémité (47a) qui est placée en contact avec un desdits noyaux profilés (8b) et l'autre extrémité (47b) qui interfère avec l'autre broche (42).

14. Dispositif d'évasement (1) selon la revendication 11, **caractérisé en ce que** ladite matrice d'évasement (50; 70) comprend deux noyaux profilés (50a, 50b; 70a, 70b), dans chacun desquels il y a une moitié (52a, 52b; 72a, 72b) dudit canal central (52; 72), lesdits noyaux profilés (50a, 50b; 70a, 70b) étant reliés l'un à l'autre par un élément de charnière (51; 71) qui leur permet d'être ouverts comme un compas et étant munis de moyens de jonction agencés du côté opposé dudit élément de charnière (51; 71).

15. Dispositif d'évasement (1) selon la revendication 14, **caractérisé en ce que** lesdits moyens de jonction comprennent un levier (53) ayant une première extrémité (53a) reliée à un premier noyau profilé (50a) par l'intermédiaire d'une broche, une seconde extrémité (53b) adaptée pour être manoeuvrée par l'opérateur et configurée de sorte à pouvoir être logée dans un siège (55) prévu dans un second noyau profilé (50b), et un corps (53c) compris entre lesdites extrémités (53a, 53b), configuré de sorte à pouvoir être logé dans une rainure (56) obtenue dans les deux desdits noyaux profilés (50a, 50b).

16. Dispositif d'évasement (1) selon la revendication 14, **caractérisé en ce que** lesdits moyens de jonction comprennent une fermeture magnétique (73) comprenant un premier élément magnétique (74) et un second élément magnétique (75) opposés l'un à l'autre, chacun appartenant à un noyau profilé correspondant (70a, 70b).

17. Dispositif d'évasement (1) selon la revendication 11, **caractérisé en ce que** ladite matrice d'évasement (60) comprend quatre noyaux profilés (60a, 60b, 60c, 60d), dans chacun desquels il y a un quart dudit canal central (61), lesdits moyens de jonction comprenant au moins une bague élastique (64, 65) logée dans une rainure annulaire (66, 67) créée à l'extérieur desdits noyaux profilés (60a, 60b, 60c, 60d).

18. Dispositif d'évasement (1) selon la revendication 11, **caractérisé en ce que** ladite matrice d'évasement (80) comprend quatre noyaux profilés (80a, 80b, 80c, 80d), dans chacun desquels il y a un quart dudit canal central (82), lesdits noyaux profilés (80a, 80b, 80c, 80d) étant reliés les uns aux autres par lesdits moyens de jonction qui comprennent une pluralité de broches (85) munies d'une tête d'extrémité (86) et insérées dans des trous (83) réalisés dans lesdits noyaux profilés (80a, 80b, 80c, 80d) et dans des trous oblongs (88) réalisés dans un écrou de bague annulaire (87) compris entre lesdits noyaux profilés (80a, 80b, 80c, 80d) et lesdites têtes d'extrémité (86) desdites broches (85), la rotation dudit écrou de bague annulaire (87) étant adaptée pour transmettre auxdits noyaux profilés (80a, 80b, 80c, 80d) un mouvement radial les uns à l'écart des autres ou les uns vers les autres.

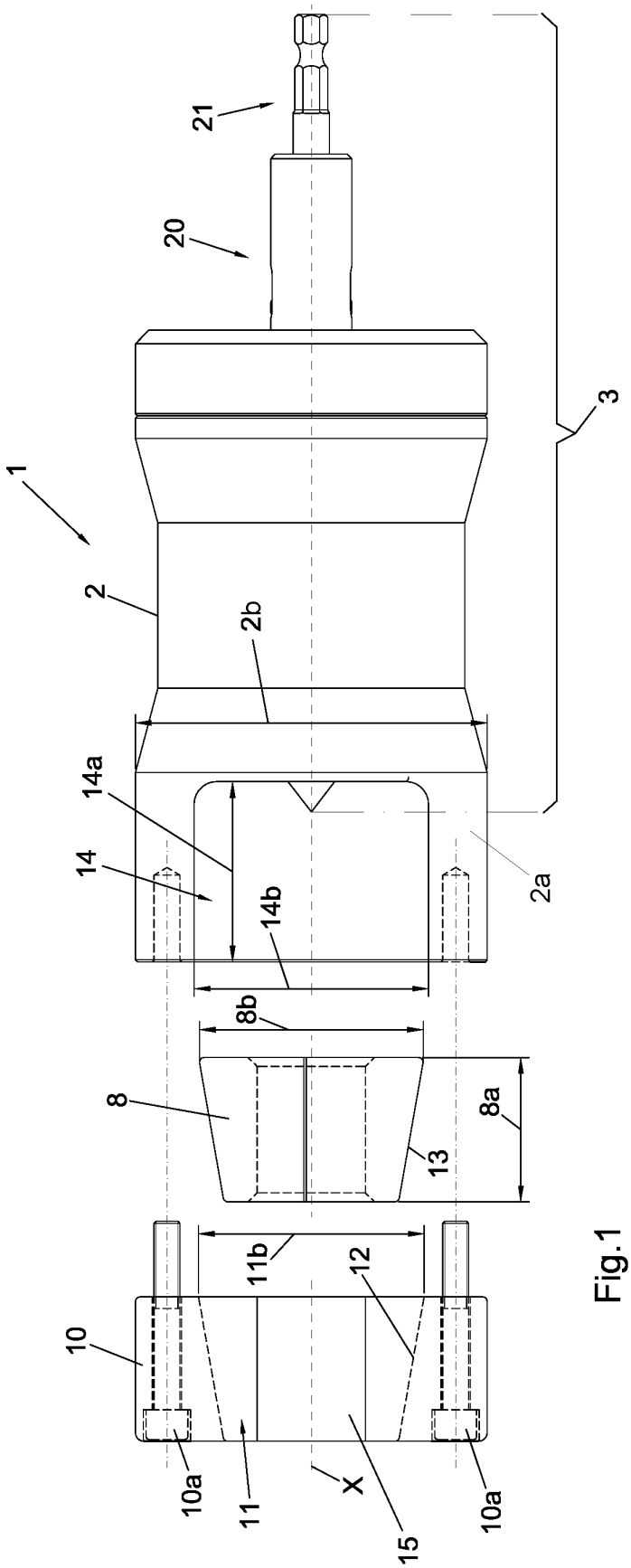

21
20
3
1
2
2b
14a
14
14b
2a
8b
8
8a
13
11b
12
10
10a
11
X
15
10a

Fig.1

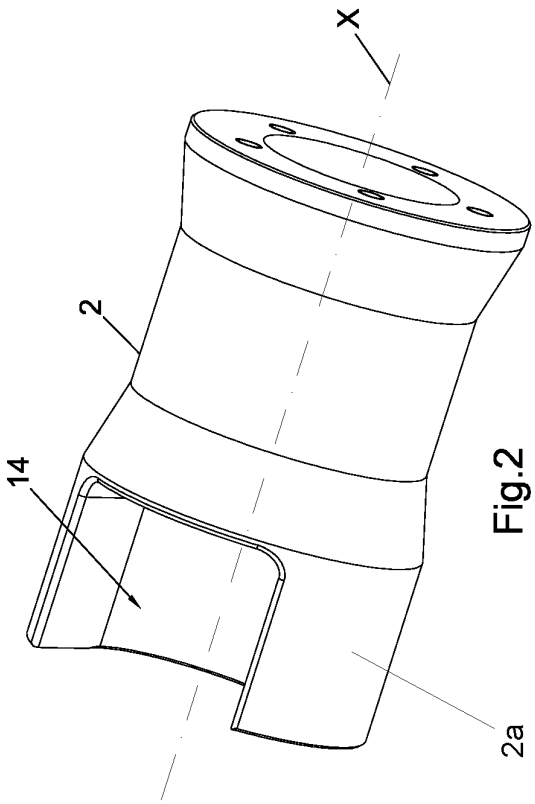

X
2
14
2a

Fig.2

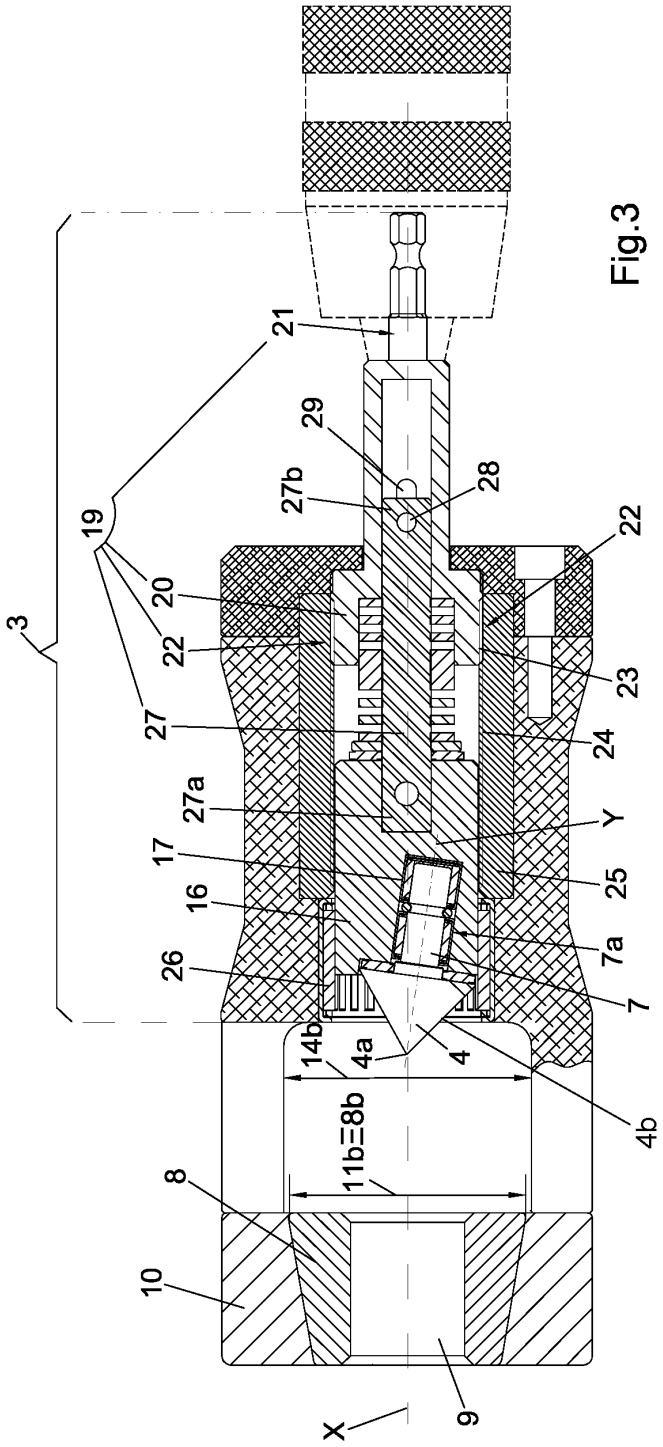
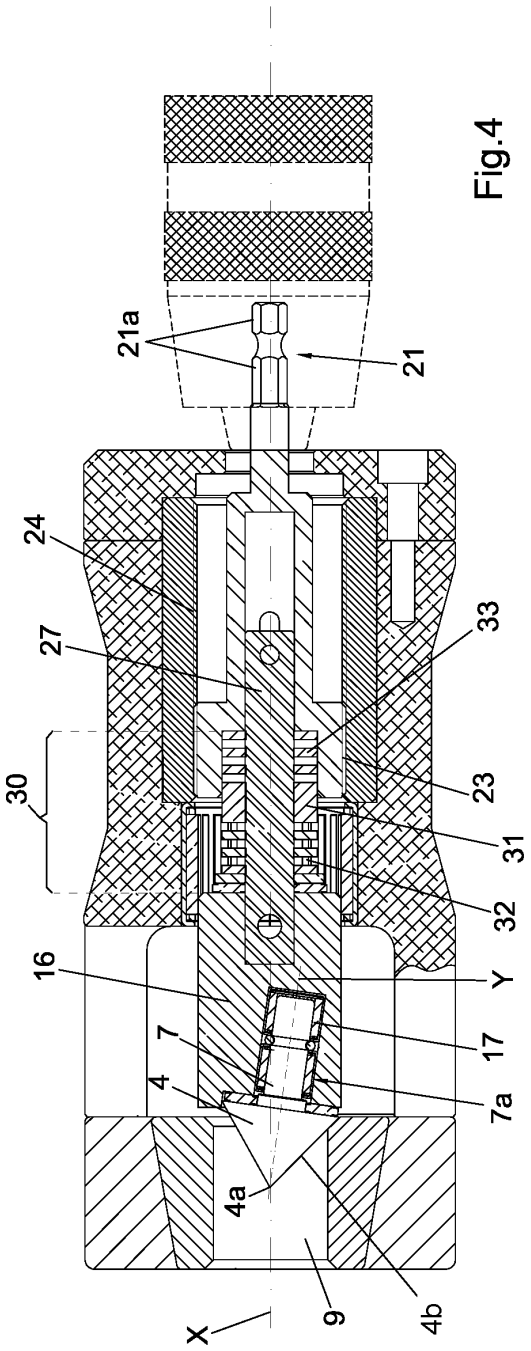

3
21
19
20
22
27
29
27b
28
22
23
24
27a
Y
17
25
16
7a
26
7
14b
4a
4
4b
11b≡8b
8
10
9
X

Fig.3


21a
21
24
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33
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23
31
32
16
Y
17
7
4
7a
4a
9
4b
X

Fig.4

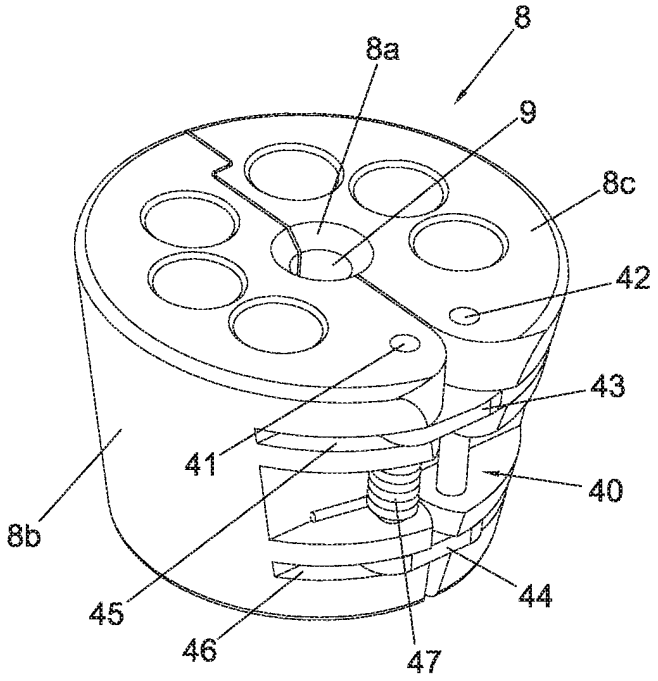


Fig.5

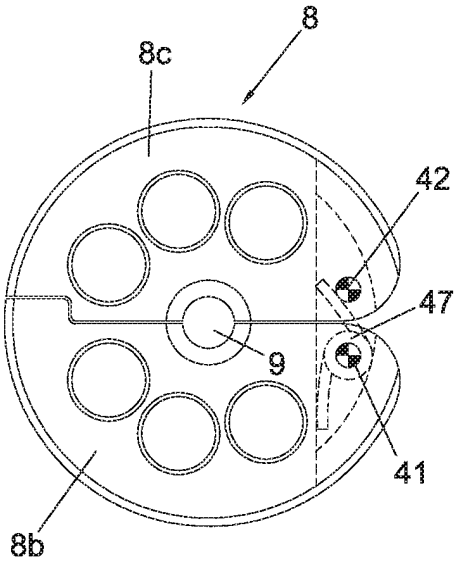


Fig.6

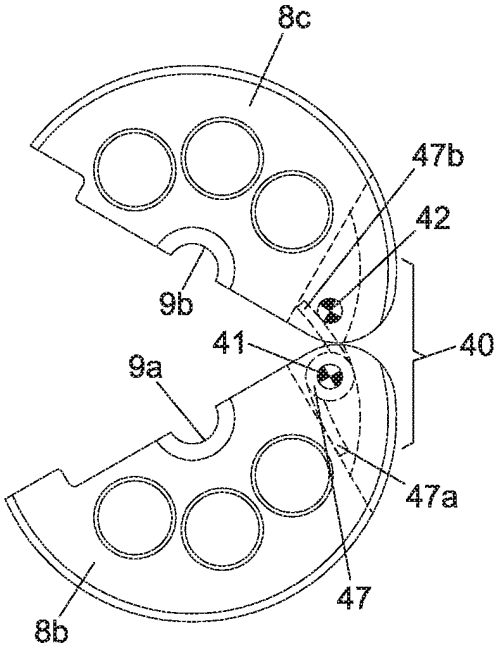


Fig.7

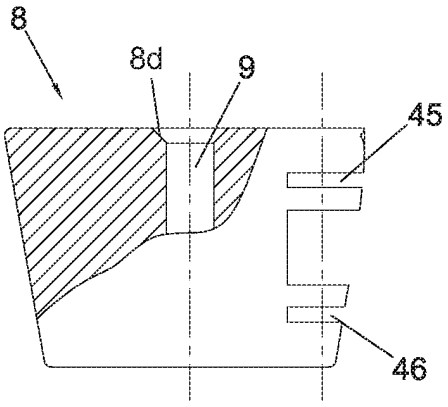
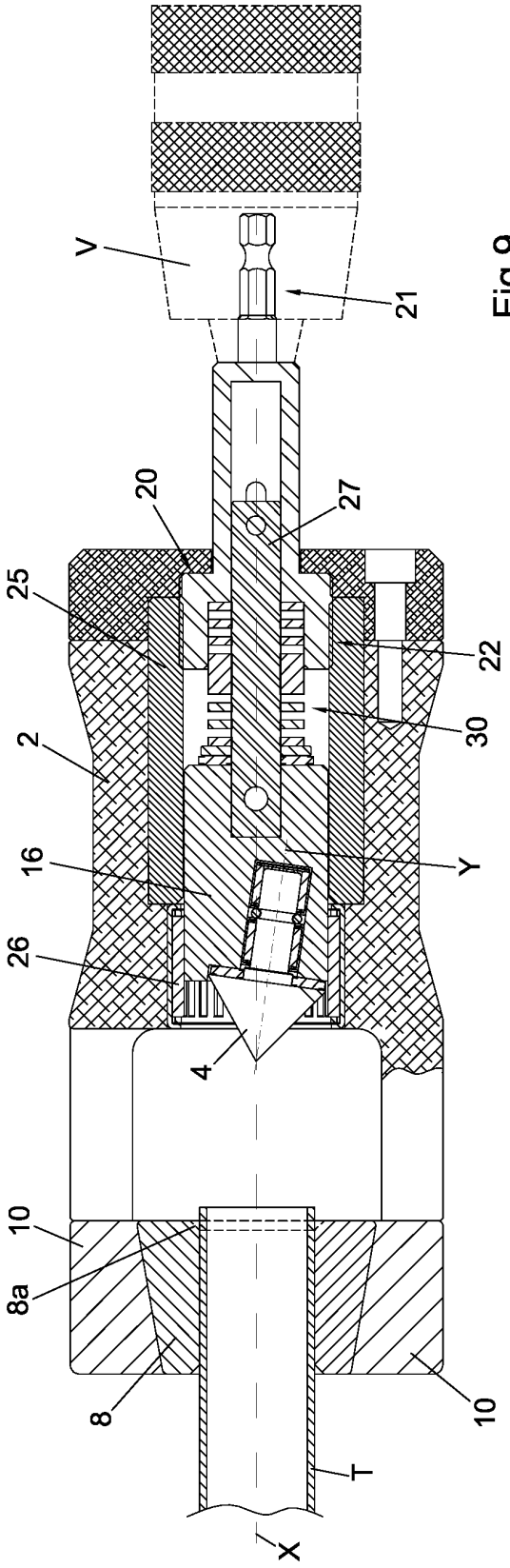


Fig.8


V
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25
22
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16
Y
26
4
10
8a
8
10
T
X

Fig.9

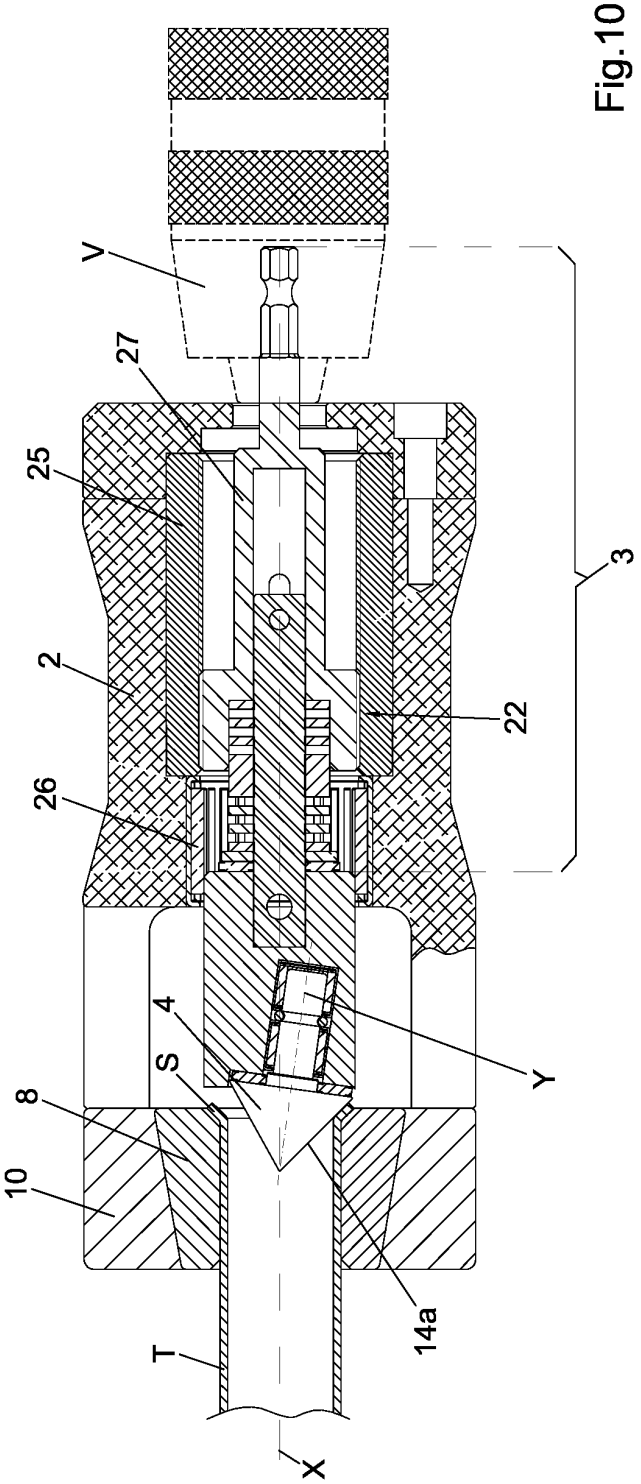

V
27
25
3
2
22
26
4
S
Y
8
10
14a
T
X

Fig.10

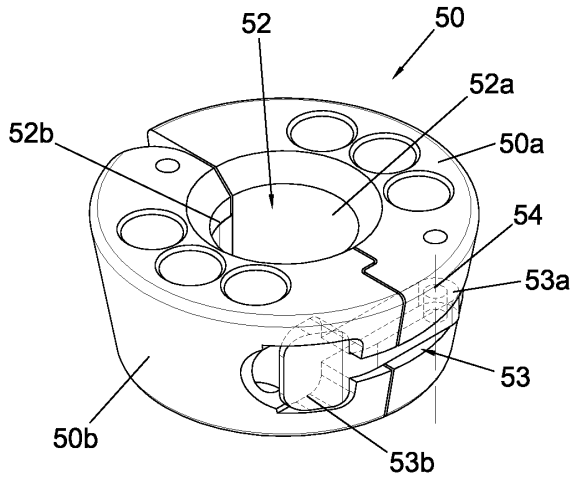


Fig.11

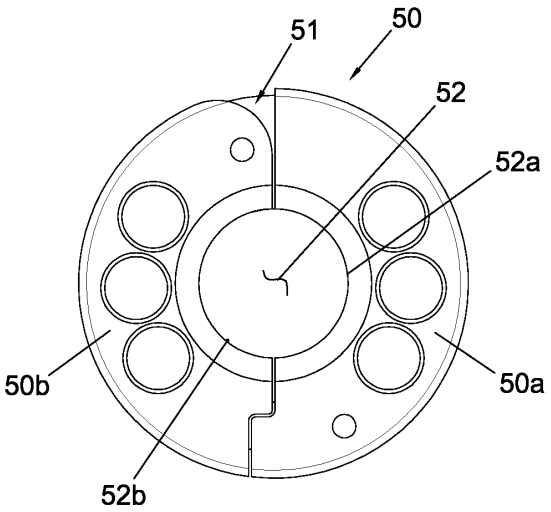


Fig.12

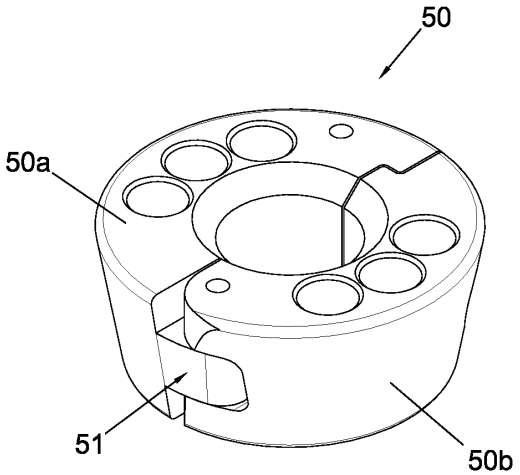


Fig.13

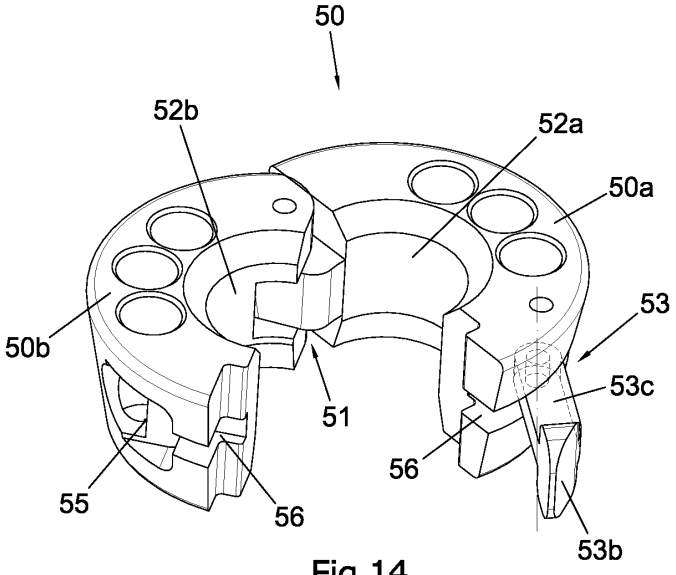


Fig.14

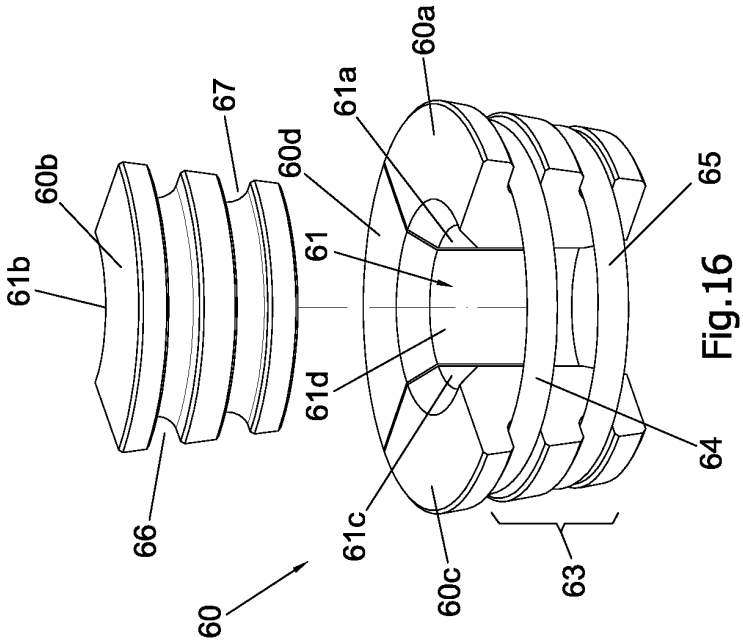


Fig.16

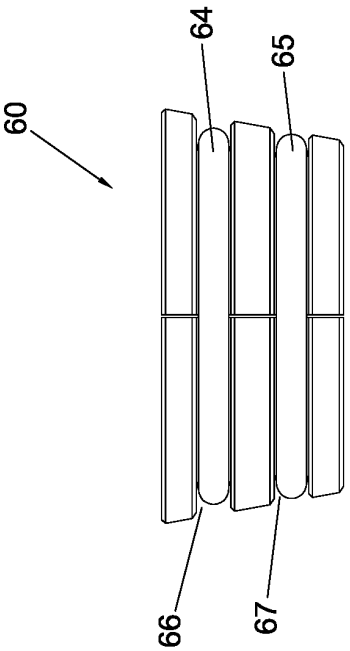


Fig.17

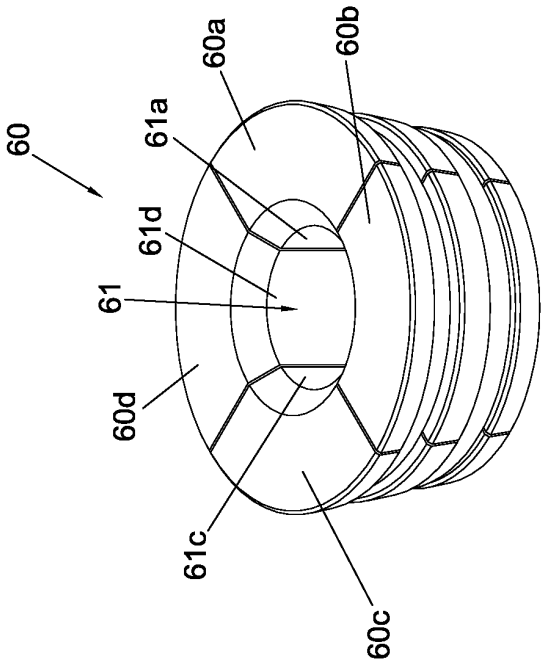


Fig.15

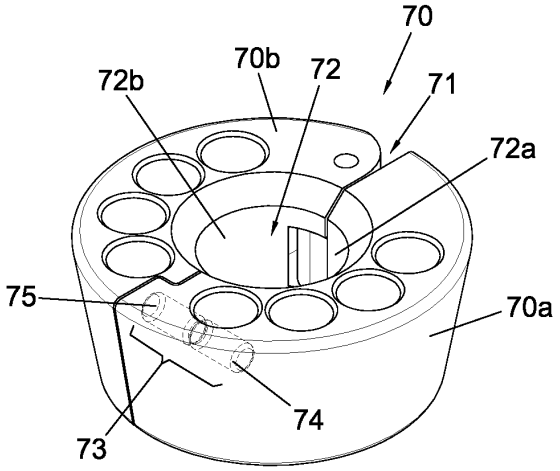


Fig.18

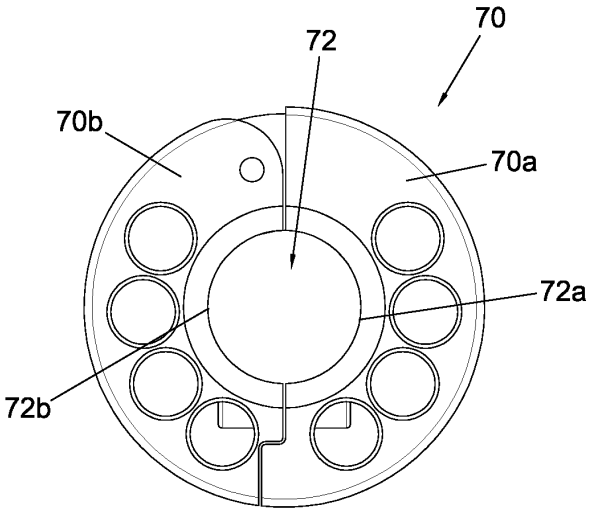


Fig.19

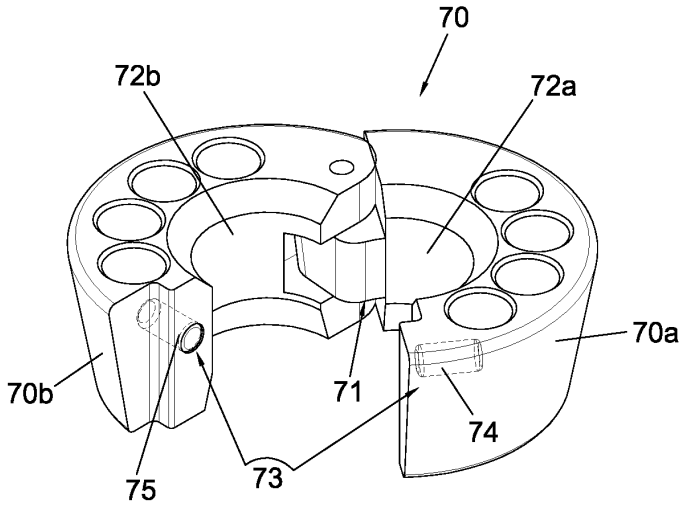
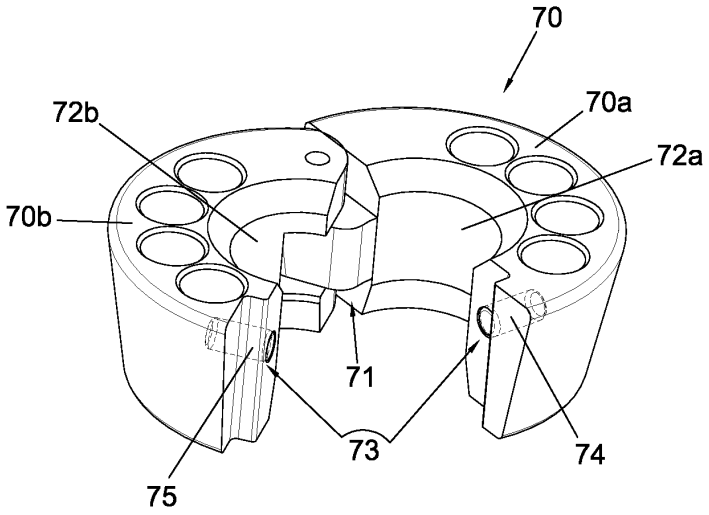


Fig.20



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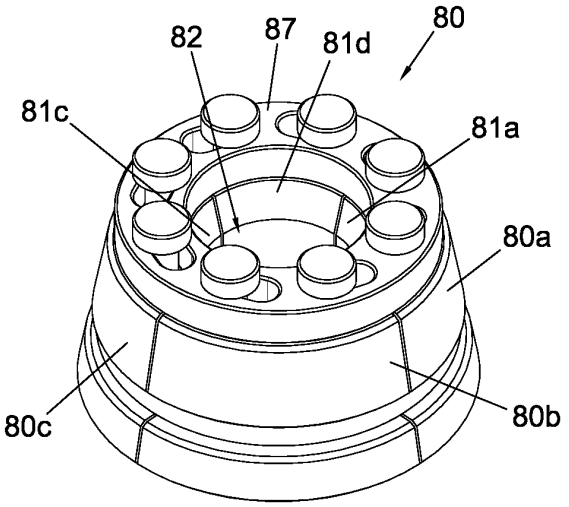

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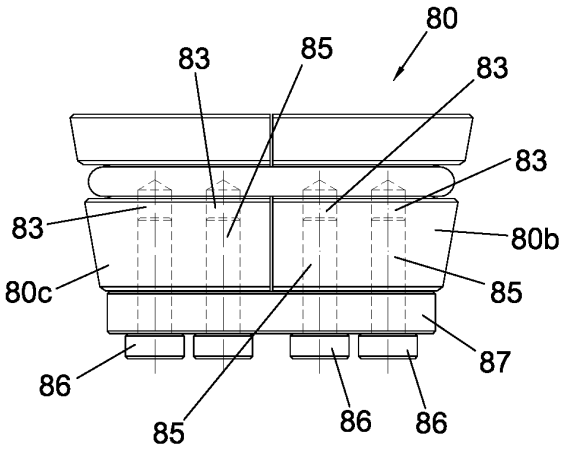

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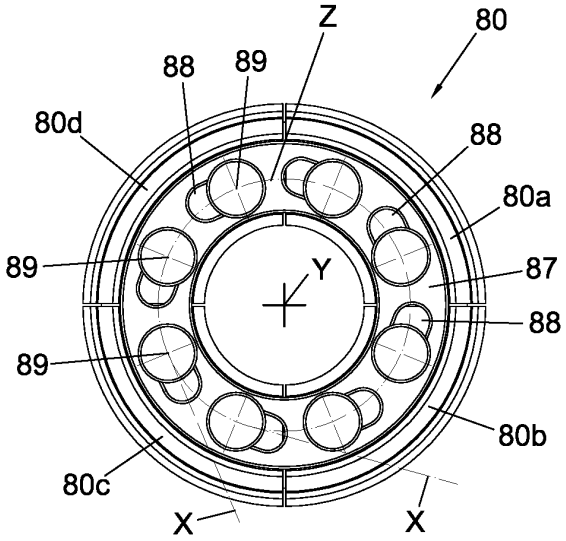

Fig.24

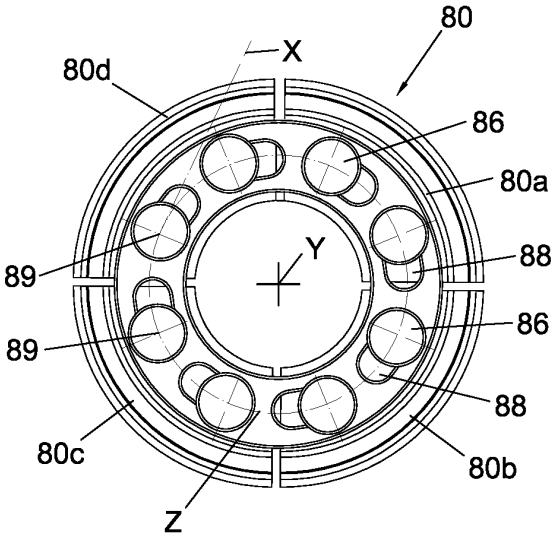

Fig.25

REFERENCES CITED IN THE DESCRIPTION

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- EP 0501928 A1 **[0017] [0047]**