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Description

[0001] The invention relates to a spraying device with a bearing surface for mounting on a quick-change adapter and a quick-change adapter for mounting a
5 spraying device.

[0002] Spraying devices, such as e.g. spray guns, are used for the application of coatings on workpieces, especially in line- and mass production, where the spraying devices may be programmed to automatized workflows. Within the process, as part of a
10 workflow, i.e. when processing a workpiece, both spacial settings and changes in the way in which a material is dispensed, (quantity change, change of spraying cone) can be specified.

[0003] Known automatic material-spraying devices have a movable component,
15 usually in the form of a robot arm. On the robot arm, a spraying device is placed by means of an adapter. Common are for example adapters with supply pipes or with supply channels integrated in the adapter that supply the spraying device with the required fluids. These adapters can be designed as so called quick-change adapters, which allow a quick replacement of spraying devices.

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[0004] Such spraying devices with quick-change adapter are known e.g. from DE
10 2006 019 363 B4.

[0005] In order to connect the quick-change adapter with the spraying device,
25 there is according to DE 10 2006 019 363 B4 provided a manually rotatable eccentric arm. When changing the spraying gun or the or the spraying device, the robot must be stopped in order to be able to carry out the conversion.

[0006] From DE 39 27 880 A1 is known a method and a coating device for objects
30 with a frequent change of colour material. In case of a serial colour-coating of objects, frequent colour changes may be required. There are cases where almost every object is to be coated with a different colour than the previous one, whereby it is possible to select among a number of different colour materials.

35 [0007] Due to the required colour change, various problems arise in connection with the paint supply, and especially with the cleaning of the spraying device in relation

to the connecting lines to the colour supply system. Since the relevant lines must be completely cleaned, i.e. emptied, spooled and dried, before each colour change, in the known coating system, a considerable loss of colour, and in particular the load to the environment, had to be foreseen. To solve these problems, in DE 39 27 880 A1 there
5 is described a number of coating stations, and in each coating station there is provided two respective spraying devices in the form of spraying guns for – e.g. in the case of truck bodies – spraying the left and the right side.

[0008] Each coating station has a multiple number of connections that via stops
10 are connected to material containers of different colours. In order to ensure an uninterrupted coating of the object with more colours, the spraying guns must be connected to the relevant stop lines in a predetermined order in the coating stations. Such a system is complicated and accordingly expensive. In addition, the stop lines must be cleaned during the change of colours, and the spraying device has to be repositioned,
15 why quick-change couplings are necessary.

[0009] DE 20 2004 021 742 U1 discloses a paint application system in which a number of robots, each with a respective spraying device, is provided in a colour-applying cabin. The use of a number of robots is complicated and expensive.
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[0010] DE 10 2004 036 230 A1 discloses a coating device in the form of a coating pistol, which by means of the robot can be optionally equipped with coating cartridges, which are kept in a storage container. The use of one and the same device with different coating materials requires the cleaning of the spraying device before the change of
25 material.

[0011] DE 38 82 473 T2 describes a coating device with a robot, to the arm of which a spraying device is attached. The robot is connected to several paint reservoirs via a valve housing. During a coating cycle, the programmable controller provides timing signals to the valve housing so as to supply the paint from a desired reservoir. The
30 problem with this device is that only one spraying device is used for different materials.

[0012] From DE 600 09 308 T2 both a device and a method for coating objects are known, wherein a spraying device is releasably arranged on a robot arm, which
35 device by means of the robot arm can be moved to the respective component to be coated. In the spraying device, a loading holder is integrated, which can be filled with

the coating material, so that only small amounts of the coating material can be applied depending on the field of application.

[0013] Another disadvantage of this invention is that, in order to fill the spraying
5 device, this must always be separated from the robot arm. The connection and disconnection of the spraying device with the robot arm takes place in a station by means of a rotational connection, in which a ring of the spraying device must be rotated relative to a ring member of the robot arm. For this purpose, a complicated mechanical actuation device is required in the station. By means of this rotational connection, a lock of
10 the spraying device is provided on the robot arm. A form tight connection of the spraying device is however not provided. This has the disadvantage that, between the robot arm and the spraying device, cleaves may occur through which the spraying material may leak.

[0014] From DE 196 50 781 A1 a spray coating device is known, in which a spraying
15 device is releasably fixated on an adapter. By a relative rotation of the spraying device and a support plate of the adapter, the two components are pulled against each other by two rotational clamping-connecting means and secured by a locking means against rotation. One of the rotational clamping connection means is similar to a bayonet closure. A disadvantage of this spray coating device is however that it is necessary
20 to provide a rotational clamping connection means for fixation of the rotational movement, which connecting means must be carried out manually and is complicated to carry out and furthermore gives rise to disturbances and demands maintenance.

[0015] The object of the invention is therefor to provide suitable components for a
25 spraying system for a robot-assisted spraying system, which in a simple and time-saving manner allows the implementation of various time-sequential operations during the coating of objects.

[0016] This object is obtained with spraying device having the features according
30 to claim 1.

[0017] The spraying device with a bearing surface for mounting on a quick-change adapter has a housing and a spray head, wherein the bearing surface is provided
35 on the housing. Furthermore, the spraying device has at least one opposite the

bearing surface protruding fastening element with a longitudinal axis L_B , and is characterized in that second means are provided for automatic, detachable fastening to a quick-change adapter, these means comprising the fastening element, and wherein the fastening element has at least one tensioning and locking means which is designed in such a way that in the assembled state of the spraying device, at least one, preferably perpendicular to the longitudinal axis L_B of the fastening element, a displaceable locking element of the quick-change adapter directs away from the bearing surface force in the direction of the longitudinal axis L_B of the fastening element.

10 [0018] The fastening element is designed in such a way that in cooperation with the locking device of the quick-change adapter, an automatic blocking is established, by which simultaneously the spraying device is drawn against the quick-change adapter and tightened. The advantage is that no manual actuation of the locking device is required.

15

[0019] Preferably, the fastener is a pin-shaped element.

[0020] The clamping and locking means of the fastening element comprises at least one recess provided on the outer side of the fastening element. According to a further embodiment, two recesses may be arranged on opposite sides of the fastening element. Further embodiments of the clamping and locking means provide a hole or a projection.

25 [0021] The clamping and locking means further preferably comprise at least a second clamping surface. This second clamping surface cooperates with the locking element and causes the clamping of the spraying device against the quick-change adapter. The second clamping surface may be a curved or a flat surface.

[0022] The second clamping surface may e.g. be an obliquely arranged surface which assumes an angle $\alpha > 90^\circ$ with the longitudinal axis L_B , so that by overrunning this surface, the required force on the locking element is obtained with the locking element. As a result, a force-fit connection is established.

35 [0023] Preferably, the locking element of the quick-change adapter has an oblique – in particular in relation to the clamping surface of the fastening element complementary – first clamping surface.

[0024] According to a further embodiment, a spray extending device is arranged between the housing and the spray head. This spray extending device for example makes it possible to spray into cavities. The spray extending device contains all necessary lines for the supply of the spray head.

5

[0025] Preferably, at least one material container and/or at least one material connection are arranged on the housing of the spray device.

[0026] Furthermore, the housing preferably has at least a first guiding means.

10 This guiding means cooperates with a second guiding means of a storage and changing device. The guiding means on the spraying device may be a projection, a wedge or a rail. Essential for the first guiding means is the co-acting with the second guiding means of an apparatus panel in a magazine of the storage and change device, so that a simple storage of the spraying device in a predetermined end position and a simple
15 removal from the apparatus panels are possible. The first and second guiding means may e.g. be designed according to the tongue-and-groove principle. The spray gun has preferably two first guiding means, preferably on opposite housing sides. Accordingly, the apparatus panel also has two second guiding means.

20 [0027] The object of the invention is also solved with a quick-change adapter having the features of claim 12.

[0028] The quick-change adapter for mounting on a spraying device is characterized in that first means for automatically releasable attachment of a spraying device
25 are provided, which contains a pneumatically, hydraulically or electrically operatable locking device comprising the locking element of a release position in a locking position and vice versa.

[0029] The automatically releasable attachment has the advantage that no manual
30 intervention, and thus no operating staff, is necessary to attach or release the spraying device to the quick-change adapter. The first and second means are matched to one another in such a way that such an automatically releasable attachment can be carried out.

[0030] The locking element is preferably arranged displaceably in the direction of its longitudinal axis. The axial displacement of the locking element for locking and for reaching the release position simplifies the design of the locking device.

- 5 [0031] The locking element has preferably at least one first clamping surface. The first clamping surface may be a curved or flat surface.

[0032] The first clamping surface may e.g. be an oblique plane which occupies an angle $\beta > 90^\circ$ with the longitudinal axis L_R of the locking element, so that when overrunning this surface by means of the fastening element, the desired force is exerted on
10 the fastening element.

[0033] By integrating the locking element with the fastening element of the spraying device, especially with the clamping and locking means, not only a lock is obtained, but also an assistance and thus a spanning of the device in the spraying device
15 against the quick-change adapter.

[0034] The spraying device may be part of a spray system.

- 20 [0035] The spray system has at least two spraying device for applying spraying materials to objects to be coated, such as e.g. work pieces.

[0036] The spray system further comprises the spraying devices associated with the quick-change adapter. Furthermore, the spray system has a storage-and-changing
25 device that receives at least two spraying devices.

[0037] The advantage of the spray system is that each operation has its own spraying device which can be automatically coupled to the robot arm. Each sprayer is preferably designed for one single operation. For another operation, another spraying
30 device is used. The temporary successive work can thus be carried out without significant downtimes, which were previously necessary for the refitting of the spraying devices to the respective subsequent operation. Additional expenditure for the provision of a plurality of spraying devices in a storage-and-changing device, from which the robot is used, is outweighed by the time saved.

[0038] By adapting the spraying device for the respective working cycle is as an example to understand the supply of the spraying device with the respective used spraying material, the setting of the geometry of the material jet, and the equipment of the spraying device, e.g. with a spray extending device, to penetrate into cavities to be
5 sprayed of the respective object.

[0039] It is thus possible without time delay to spray layers on objects with different materials, e.g. with different colours or paints, which must be placed above each other and/or beneath each other on the surface of the object, and/or furthermore to
10 place the same materials by different jet geometries and/or to place extensions with different jet geometries on outer and/or internal object surfaces. It is not necessary to clean the spraying device at the change of material. Furthermore, spray material is also saved, which would otherwise have been lost during the cleaning process.

15 [0040] Time for changing, e.g. in the case of a change from outer coating to cavity coating, is not necessary, because spraying devices with or without an extension device between the spray head and spray housing can be held ready.

[0041] An adjustment for a change in jet geometry, e.g. from circular jet to flat jet
20 and vice versa, and a thereby associated spray operation in relation to a necessary material change, is not necessary, because there can be spraying devices in the storage-and-change device, in which the desired jet geometry with the desired spray material is provided.

25 [0042] Since all measures, in particular jet geometry, spray material, or equipment can be combined with the spraying devices, the greatest possible flexibility is achieved.

[0043] Another advantage is that several robots are not necessary for the execu-
30 tion of the various operations, but only one robot is required, which, due to the automatic coupling to the relevant spraying device, can change from one operation to the next with no significant time losses. The investment costs for a coating station can thereby be reduced. The spray system can advantageously also be used where, due to space restrictions, only one robot can be used. The space required for the storage-
35 and-changing device is significantly lower than the space requirement for an additional robot.

[0044] In general, the quick-change adapter is attached directly to the robot arm. An indirect arrangement is also possible, e.g. via remote elements.

5 [0045] Remote elements can also be arranged between the quick-change-adapter and the spraying device, so that an indirect arrangement can be provided at this interface. Such remote elements may e.g. be helpful if the starting position of the spraying devices in the storage-and-changing device are changed and a reprogramming of the robot should not be made.

10 [0046] Each spraying device is preferably associated with a material container. It is thus possible to apply different spraying materials on the object to be coated in different work processes.

15 [0047] For small amounts of colour it is advantageous if the material container is located directly on the spraying device. This is preferably a container with a fill volume up to 2 l.

[0048] The material container is preferably part of a material supply apparatus, which is connected to the injection system via at least one conduit. This alternative is
20 advantageous when large quantities of spray materials are needed for the particular operation. The material container with a supplier pump can be arranged at any point of a coating station.

[0049] A conduit system is preferably provided with conduits for the supply of
25 spray material and/or compressed air. Such a delivery system comprises preferably a plurality of conduits, wherein one material supply apparatus or a plurality of material supply devices via conduits is connected with several spraying devices.

[0050] The conduit system for each individual spraying device preferably has a
30 material-circulating conduit. In a material-circulating conduit the spray material is supplied to the injection device, and not required spray material is fed to the material supply apparatus and thus to the material container. This has the advantage that the spray material is constantly directed in circulation and can be kept in motion in the circulation circuit during the pauses between the work operations.

[0051] The conduits of the conduit system are preferably flexible. The flexibility of the conduits, which in particular consist of hoses, has the advantage that the conduit is moved by a movement of the robot arm, whereby the spraying device can be carried with without problems.

5

[0052] The conduit system preferably includes a follow-up device. The follow-up device is preferably places between the material supply device and the spraying device, and may e.g. also include a conduit accumulator.

10 [0053] The first means of the quick-change adaptor for automatically releasable attachment preferably comprises a pneumatically, hydraulically or electrically actuated locking device. The quick-change adaptor is for this purpose connected to appropriate pneumatic, hydraulic or electrical wires connected to appropriate supply-and-control devices, so that when changing the spraying device, the locking device can be controlled accordingly. The respective control devices are preferably included in the robot control or programming. It is thereby possible to create a completely automatic coating system including the robot and the spray system.

15 [0054] The locking device preferably has a locking element. The locking element is thereby moved from a release to a locking position and vice versa.

[0055] The second means of the spraying device for automatic, releasable attachment preferably comprises a fastening element. The first and second means are preferably matched to one another, so that the locking element and the fastening element can interact, whereby the locking element and the fastening element preferably form a press-fit connection when the locking element is in the locking position.

25 [0056] The storage-and-changing device preferably has at least one magazine with at least two apparatus panels, where each apparatus panel has a receiving device for a spraying device.

[0057] The apparatus panels may be placed next to each other and/or above each other. Here the arrangement of the apparatus panels next to each other is preferred, because this may e.g. simplify the handling of the conduits of the conduit system and also provide apparatuses that have e.g. an extension device.

35

[0058] The storage-and-changing device preferably has a basic body on which the magazine is arranged. The basic body may e.g. be a rack or frame. The rack can be parked as a mobile unit within a coating station at a suitable location. The base body can also be attached to a wall of the coating station.

5

[0059] The magazine and/or the apparatus panels are preferably arranged pivotably about a horizontal and/or vertical axis on the basic body. Due to the different embodiment of the spraying device, it may be advantageous if the magazine and/or the apparatus panels are pivotably arranged in the described way to facility the recording of the spraying devices by the robot arm. The programming of the robot may also thereby be simplified.

[0060] The simplification of the removal and storage of the spray devices in the storage-and-changing device is also supported if the magazine and/or the apparatus panels are arranged adjustable at the basic body in the vertical and/or horizontal direction. In order to realize this, it is advantageous to attach a traversing device to the basic body, on which in turn the magazine is arranged. A linear displacement device is preferably used as transfer device.

[0061] The receiving device of each apparatus panel preferably comprises at least one second guiding means for the spraying device. The second supply device cooperates with the first guiding means on the spraying device and is adapted for a simple and safe storage of the spraying device. The second guiding means may be a projection, a wedge-shaped projection, or a rail.

25

[0062] The apparatus panel may independent of the design of the second guiding means exclusively consist of the second guiding means.

[0063] The first and second guiding means preferably form a form-fit connection.

30

[0064] The object of the invention is also solved by a method to coating an object with spray material, whereby at least two working operations are carried out timely after each other, and whereby each working operation includes the following successive method steps:

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- a. a robot with a robot arm, which is equipped with a quick-change adapter, according to its pre-programmed sequence, drives a spraying device held in a

storage-and-changing device, which is designed for the respective working operation,

b. a connection element of the spraying device is automatically brought into engagement with a locking element of the quick-change adapter, whereby the

5 spraying device on the quick-change adapter is attached,

c. the robot drives the spraying device to the object to be coated,

d. the object is coated,

e. the spraying device will after the coating be released from the quick-change adapter and stored in the storage-and-changing device.

10

[0065] Exemplary embodiments of the invention will be explained in more detail in the following with reference to the drawings, which show:

Fig. 1 a schematic representation of a coating plant with robot and spraying system,
15

Fig. 2 a perspective representation of a storage-and-changing device, which is equipped with spraying devices,

20 Fig. 3 a perspective representation of a further embodiment of a storage-and-changing device,

Fig. 4 a spraying device and a quick-change adapter in a perspective view before assembly,
25

Fig. 5 a spraying device and a quick-change adapter in a perspective view after assembly,

30 Fig. 6 a side view of the combination of the spraying device and quick-change adapter shown in Fig. 5,

Fig. 7 a vertical section through the combination of spraying device and quick-change adapter shown in Fig. 5 before locking,

35 Fig. 8 a vertical section corresponding to Fig. 7 after locking,

Fig. 9 a spraying device with an extension, and

Fig. 10a-d various embodiments of a fastening element with a locking element associated therewith.

5

[0066] In Fig. 1 is a coating device 5 schematically illustrated, which comprises a robot 2 with a robot arm 4 and a spray system 1. The coating device 5 is used for coating an object 8, which is coated in several work flows, by which a number of spraying devices 10 corresponding to the number of work flows is used.

10

[0067] At the end of the robot arm 4 a quick-change adapter 50 is arranged, which is connected to compressed-air conduits, of which a compressed-air conduit 85 is shown in the drawing. The conduit 85 is guided along the robot arm 4 and is fixed there, and is connected to a not illustrated compressed-air generating device and optionally connected to a (not shown) control device. Above this compressed-air conduit 85 compressed air is fed to the quick-change adapter 50, from where this compressed air is supplied to the assembled spraying device 10, as it will be explained further in connection with Figs. 4 and 6.

20

[0068] The spraying system 1 has a storage-and-changing device 100, which has a basic body 102, which is formed as a frame. The basic body 102 can be arranged anywhere on the floor, and optionally attached thereto. On the basic body 102 is provided a magazine 104 with apparatus panels 106, into which spraying devices 10 are embedded.

25

[0069] In the illustration of Fig. 1 only one spraying device 10 can be seen due to the side view, the spraying device 10 being connected to a line system 80. The conduit system 80 is a circulation line comprising a material supply line 82 and a material return circuit 84. By means of this conduit 82 spray material is directed to the spraying device 10 from a material supply device 34 comprising a material container 30.

30

[0070] The conduit system has a follow-up device 86, which includes a conduit storage 88 and a roller system 89, which is guided on a rail 87. When the spraying device 10 is connected to the quick-change adapter 50, the device 10 is sprayed on the object 8, and the operation is performed there. Above the follow-up device 86 are the material conduits 82 and 84 accordingly followed up.

35

[0071] Fig. 2 shows an enlarged illustration of a storage-and-changing device 100. At the basic body 102 is a magazine 104 attached at the upper end, which magazine has a back wall 114 and a plurality of spaced-apart side walls 112. The side walls 112 divide the magazine into adjoining apparatus panels 106, which are open both upwardly and downwardly.

[0072] On the side walls 112 is provided a recording device 108, which in the shown embodiment consists of guiding rails 112 which form the second guiding means 110. The guiding rails 112 are arranged at an angle and with one side open, so that a spraying device 10 can be inserted and fixed in a predetermined end position. In this case, the first guiding means 40 of the spraying device 10 (see Fig. 4) engage into the second guiding means 110.

[0073] In the magazine of Fig. 2 there are provided four apparatus panels 106, wherein three apparatus panels 106 are occupied with spraying devices 10. To spraying devices 10 are on their housing 12 provided with material connections 17a,b, whereupon the conduits 82 and 84 shown in Fig. 1 can be installed.

[0074] A spraying device 10 has on its housing 12 a material container 30, which is acted upon by means of a compressed-air supply inlet 31 with compressed air for discharging the spray material. This material container 30 is a pressure container. It is also possible to use gravitationally operated material containers 30a, in which case no compressed-air conduit 31 is required (see Fig. 3).

[0075] All spraying devices 10 have a fastening element 20, with which the spraying devices 10 can be attached to the quick-change adapter 50, and locked.

[0076] Moreover, the front spraying device 10 additionally has an extension 32 between the housing 12 and the spray head 14.

[0077] In the illustration shown in Fig. 2, the magazine 104 is fastened to the frame 102. It is also possible to arrange the magazine 104 pivotably mounted on the frame 102. Schematically, a horizontal pivot axis 105a and a vertical pivot axis 105b is shown. In order to realize the possibility of swivelling, corresponding additional devices are required, which are not shown here. It is also possible to pivot the individual apparatus panels 106 independently of one another above a horizontal pivot axis 105a

and/or above a vertical pivot axis 105b in order to change the position of the spraying devices 10 and, if appropriate, to adapt the programmed receiving position of the robot arm 4.

5 [0078] In Fig. 3 is shown a storage-and-changing device 100, which comprises a process device 120, which is attached to the basic body 102. Furthermore, a rail 126 is provided on the basic body 102, on which rail the magazine 104 is slidably arranged. By means of the displacement device 120, which has a drive device 122 and e.g. an angle gear 124, the magazine 104 can be displaced in the horizontal direction. It is
10 thus possible to move the respective required spraying device 10 to a common predetermined position, where the robot arm 4 takes up the spraying devices 10. This simplifies the programming of the robot 2, because all of the spraying devices 10 can be accommodated in one and the same location.

15 [0079] The illustrated material container 30a is a gravity-operated container which does not require compressed-air supply. The container 30 is a pressurized container with compressed air.

[0080] Fig. 4 shows a spraying device 10 and a quick-change adapter 50 in perspective view before assembly. The spraying device 10 has a housing 12 and a spray head 14, which has a material-exit nozzle 15 and air nozzles 16a,b,c,d being arranged around the material-exit nozzle 15, with which the geometry of the material circular jets can be adjusted. In addition, the spray head 14 is equipped with two horns 18a and 18b. Second air nozzles 19a,b are arranged at the horns 18a, which are arranged to form a
25 flat jet from a circular jet.

[0081] The geometry of the material jet can be changed dependent on the type of control of the air nozzles 16a-d and 19a,b. Jet geometries between a circular jet and a flat jet are also possible. The desired jet geometry is pre-set for the operation concerned,
30 so that no adaptation has to be carried out when changing the spraying device 10.

[0082] On the side of the housing 12, a first guiding means 40 is provided in the form of a guiding wedge, which has a tapered portion 42. This guiding wedge 42 engages into the second guiding means 110 of the apparatus panel 106 (see Fig. 2). The
35 tapered section 42 facilitates entry into the second guiding means 110 of the apparatus panel 106. On the opposite side wall of the housing 12 a further second guiding means is arranged, which is however not shown in Fig. 4.

[0083] The housing 12 has on its underside a bearing surface 13 perpendicular to which surface 13 a fastening element 20 is arranged, which has a longitudinal axis L_B . The fastening element 20 is pin-shaped and is described in more detail with reference to the following figures.

5

[0084] The quick-change adapter 50 has a first mounting surface 52, with which the quick-change adapter 50 is attached to the robot arm 4. A locking bolt 51, which is shown only schematically and by way of example, also serves for attachment.

10 [0085] The quick-change adapter 50 has a second mounting surface 54, in which a first drilling 60 is arranged, into which the fastening element 20 of the spraying device 10 engages during assembly. In the mounting surface 54 multiple channels open. These channels are the air spray channels 70a,b, the control air channels 72a,b, and the compressed-air channel 74. These channels correspond with corresponding openings of the
15 spraying device 10 arranged on the bearing surface 13. Sealings may optionally be provide at the openings in question, which sealings are not shown. The compressed air from the air spray channel 70a,b is directed to the first air nozzle 16a-d. The air from the actuating channel 72a,b is led into the second air nozzle 19a,b of the two horns 18a,b. The compressed air of the channel 74 is directed to the compressed-air inlet 31 of the
20 material container 30.

[0086] The fastening element 20 engages in the first hole 60a when the spraying device 10 is placed on the second mounting surface 54. This assembled representation is shown in Fig. 5.

25

[0087] In Fig. 6 can be seen a side view of the combination of the spraying device 10 and the quick-change adapter 50. On the quick-change adapter 50 are the air spray inlet 71a,b, the air actuating inlet 73, and the compressed-air inlet 75 as well as the air actuating inlet for the locking device 55, which will be explained in further detail in connection with Figs. 7 and 8.
30

[0088] Fig. 7 is a vertical section through the combination of the spraying device 10 and the quick-change adapter 50. In the housing 12, there is a material needle 15a, with which the material exit nozzle 15 can be opened or closed. The control air is used to

start the material needle. The two horns 18a,b are also shown in a sectional view. Further details in the interior of the housing 12 are not shown, since these are not essential to the invention.

5 [0089] The fastening element 20 is also arranged in the housing 12 and is running vertically downwards and is arranged in the first hole 60 of the quick-change adapter 50. The fastener 20 cooperates with a locking element 56 of the locking device 55, which operates pneumatically in the shown illustration. For this purpose, air actuating inlets 77a,b are provided, via which control air for closing, and control air for releasing, the
10 locking device 55 are provided.

[0090] The locking element 56 is located in a second hole 61 and has a piston 64, which is located in the piston chamber 62. To push the locking element 56 perpendicular to the fastener 50, the piston is acted upon either from one side or from the other
15 side, with compressed air. The locking element 56 cooperates formfitting with the fastening element 20 as shown in Fig. 8. The details are explained in connection with Figs. 10a and 10b.

[0091] A spraying device 10 is shown in side view in Fig. 9. The spraying device
20 10 has from the housing 12 an elongation 32 at the front end of which the spray head 14 is arranged. A spraying device 10 with this equipment is provided in particular for the coating of cavities.

[0092] The fastener is two side views in Fig. 10a. The fastening transmission element 20 has clamping and locking means 21, which are formed as oppositely arranged recesses 22. Other components of the clamping and locking means 21 are the
25 second clamping surface 26 at the lower end of the recesses 22. The second clamping surface 26 are planar surfaces, which are arranged obliquely and form an angle $\alpha > 90^\circ$ with the longitudinal axis L_B of the fastening element.

30

[0093] In Fig. 10a is also shown the locking element 56 in two side views. The locking element 56 has a long hole 59, which has a circular hole section 59a and an elongated hole section 59b. The diameter of the circular hole section 59a is adapted to the diameter of the fastening element 20, so that it can be inserted into the circular
35 hole section 59a. The width of the elongated hole section 59b is adapted to the thick-

ness of the fastening element 20 in the region of the recesses 23. Next to the elongated hole section 59b, the locking element 56 has first clamping surfaces 58, which form an angle $\beta > 90^\circ$ with the longitudinal axis L_R of the locking element 56. The angles α and β are preferably equal to each other.

5

[0094] As shown in the upper part of Fig. 10b, the fastening element 20 is inserted from above into the circular hole section 59a of the long hole 59. The locking element 20 is in its release position. Thereafter the locking element 56 is displaced in the direction of the arrow, so that the two clamping surfaces 26 and 58 abut each other, so that a force F is exerted on the fastening element 20, and this is pulled down. This causes the tightening of the spraying device 10 against the quick-change adapter 50. The locking element 56 is in its locking position.

[0095] Fig. 10c shows a further embodiment of the fastening element 20 in two side views. The fastening element 20 has a hole 23, which is tapered so that a conical second clamping surface 26 is formed.

[0096] The locking element 56 is formed as a mantle and has a conical tip, which forms a first clamping surface 58.

20

[0097] In Fig. 10d a sectional view of the fastening element 20 is shown. The locking element 56 has been displaced in the direction of the arrow, so that the clamping surface 58 contacts the second clamping surface 26 and runs upwards, so that likewise a force F is exerted downwards in the direction of the arrow, whereby a fastening of the spraying device 10 with the quick-change adapter 50 is provided. The locking element 56 is in its locking position in Fig. 10d.

25

REFERENCE NUMERALS

- 1 Injection system
- 2 Robot
- 5 4 Robot arm
- 5 Coating device
- 8 Object

- 10 Spraying device
- 10 12 Housing
- 13 Bearing surface
- 14 Spray head
- 15 Material exit nozzle
- 15a Material needle
- 15 16a-d First air nozzle
- 17a,b Material connection
- 18a,b Horn
- 19a,b Second air nozzle

- 20 20 Fastening element
- 21 Clamping and locking element
- 22 Recess
- 23 Hole
- 26 Second clamping surface
- 25
- 30 Material container
- 30a Gravity-operated material container
- 31 Compressed air inlet
- 32 Spray extending device
- 30 34 Material supply device
- 40 First guiding means
- 42 Tapered section

- 50 Quick-change adapter
- 35 51 Locking bolt
- 52 First mounting surface

- 54 Second mounting surface
- 55 Locking device
- 56 Locking element
- 57 Front end
- 5 58 First clamping surface
- 59 Long hole
- 59a Circular hole section
- 59b Elongated hole section

- 10 60 First hole
- 61 Second hole
- 62 Piston chamber
- 64 Piston

- 15 70a,b Air spray channel
- 71a,b Air spray inlet
- 72a,b Air actuating channel
- 73 Air actuating inlet
- 74 Compressed air channel for the container
- 20 75 Compressed air inlet of the container
- 77a,b Air actuating inlet for the locking device

- 80 Conduit system
- 82 Conduit for the material (forward conduit)
- 25 84 Conduit for the compressed air (return conduit)
- 85 Conduit for the compressed air
- 86 Follow-up device
- 87 Rail
- 88 Conduit storage
- 30 89 Roller system

- 100 Storage and change device
- 102 Basic body of the storage and change device
- 104 Magazine
- 35 105a Horizontal swing axis of the magazine
- 105b Vertical swing axis of the magazine

- 106 Apparatus panel
- 108 Recording device

- 110 Second guiding means
- 5 112 Guiding rails
- 112 Side wall
- 114 Back wall

- 120 Process device
- 10 122 Drive device
- 124 Angle gear
- 126 Rail

- L_B Longitudinal axis of the fastening element
- 15 L_R Longitudinal axis of the locking element

PATENTKRAV

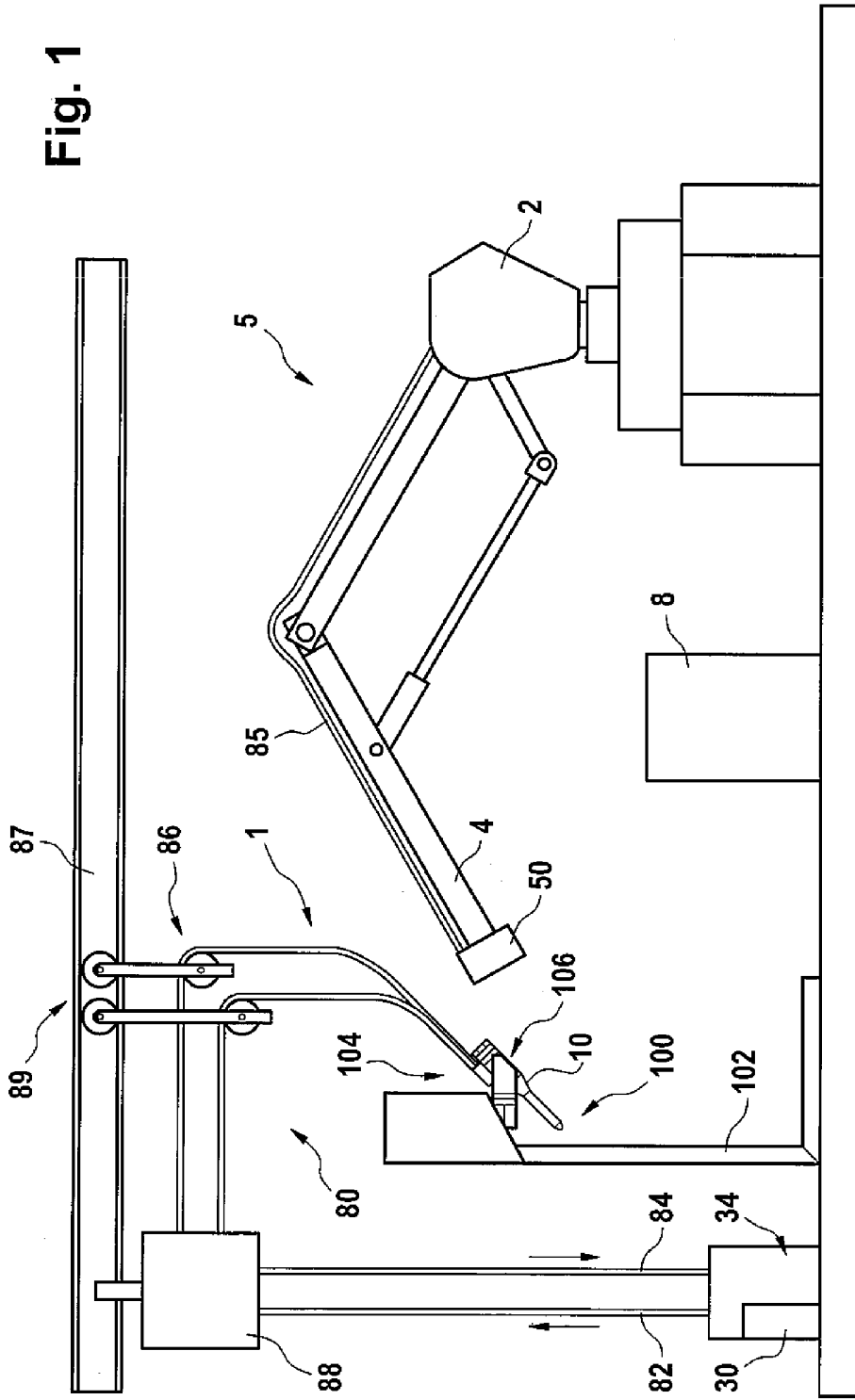
1. Sprøjteindretning (10) med en anlægsflade (13) til montage på en hurtigskifteadapter (50), som omfatter en første og en anden montageflade (52, 54),
- 5
- med et hus (12) og sprøjtehoved (14), hvor anlægsfladen (13) er tilvejebragt på huset (12),
 - med i det mindste ét i forhold til anlægsfladen (13) fremstående fastgørelses-
- 10
- element (20) med en langsgående akse L_B ,
- 15
- hvor sprøjteindretningen (10) omfatter andre organer, som er indrettede til udløselig fastgørelse til den anden montageflade (54) på hurtigskifteadapteren (50), idet disse andre organer omfatter fastgørelseselementet (20), og
- 20
- fastgørelseselementet (20) på sprøjteindretningen (10) omfatter i det mindste ét spænde- og låseorgan (21), **kendetegnet ved, at** de andre organer til automatisk fastgørelse er anbragt på den anden montageflade (54) på hurtigskifteadapteren (50) og spænde- og låseorganerne (21) er udformede således, at i monteret tilstand for sprøjteindretningen (10) udøver i det mindste ét forskydeligt låseelement (56) på hurtigskifteadapteren (50) ved forskydning i aksial retning en fra anlægsfladen (13) bortrettet kraft i retning af
- 25
- den langsgående akse L_B for fastgørelseselementet (20) på fastgørelseselementet (20).
2. Sprøjteindretning (10) ifølge krav 1, **kendetegnet ved, at** fastgørelseselementet (20) er et stiftformet element.
- 25
3. Sprøjteindretning (10) ifølge krav 1 eller 2, **kendetegnet ved, at** spænde- og låseorganerne (21) omfatter i det mindste én på den udvendige side af fastgørelses-
- 30
- elementet (20) tilvejebragt udsparring (22).
4. Sprøjteindretning (10) ifølge krav 3, **kendetegnet ved, at** der på hver af to overfor hinanden liggende sider af fastgørelseselementet (20) er anbragt en udsparring (22).
- 35
5. Sprøjteindretning (10) ifølge ethvert af kravene 1 til 4, **kendetegnet ved, at** spænde- og låseorganerne (21) omfatter i det mindste én boring (23).
6. Sprøjteindretning (10) ifølge ethvert af kravene 1 til 5, **kendetegnet ved, at** spænde- og låseorganerne (21) omfatter i det mindste en anden spændeflade (26).

7. Sprøjteindretning (10) ifølge krav 6, **kendetegnet ved, at** den anden spændeflade (26) er en skråt anbragt flade, som danner en vinkel med den langsgående akse L_B på $\alpha > 90^\circ$.
- 5
8. Sprøjteindretning (10) ifølge ethvert af kravene 1 til 7, **kendetegnet ved, at** der imellem huset (12) og sprøjtehovedet (14) er anbragt en sprøjteforlængelsesindretning (32).
- 10
9. Sprøjteindretning (10) ifølge ethvert af kravene 1 til 8, **kendetegnet ved, at** der på huset (12) er anbragt i det mindste én materialebeholder (30) eller i det mindste én materialetilslutning (17a, 17b).
- 15
10. Sprøjteindretning (10) ifølge ethvert af kravene 1 til 9, **kendetegnet ved, at** huset (12) omfatter i det mindste ét første føringsorgan (40).
11. Sprøjteindretning (10) ifølge krav 10, **kendetegnet ved, at** føringsorganet (40) er en skinne.
- 20
12. Hurtigskifteadapter (50) til montage af en sprøjteindretning (10) ifølge krav 1 omfattende
- et adaptergrundlegeme (58), som omfatter en første montageflade (52) til udløselig anbringelse på en robotarm (4) og en anden montageflade (54) til udløselig anbringelse af en sprøjteindretning (10), hvor der i adaptergrundlegemet (58) vinkelret på den anden montageflade (54) er tilvejebragt i det mindste én første boring (60) til optagelse af i det mindste ét på sprøjteindretningen (10) tilvejebragt fastgørelseselement (20), og
 - med et låseelement (56), som strækker sig i det mindste delvis i den første boring (60), idet låseelementet (56) er anbragt parallelt med montagefladen,
- 25
- 30
- kendetegnet ved, at** første organer er tilvejebragt til automatisk, udløselig fastgørelse af et sprøjteapparat (10), som omfatter en pneumatisk, hydraulisk eller elektrisk betjenbar låseindretning (55), som forskyder låseelementet (56) i aksial retning fra en frigivelsesposition til en låseposition og omvendt.
- 35

13. Hurtigskifteadapter (50) ifølge krav 12, **kendetegnet ved, at** låseelementet (56) er anbragt forskydeligt i retning af sin langsgående akse L_R .

14. Hurtigskifteadapter (50) ifølge krav 12 eller 13, **kendetegnet ved, at** låseelementet (56) omfatter i det mindste én første spændeflade (58).

15. Hurtigskifteadapter (50) ifølge krav 14, **kendetegnet ved, at** den første spændeflade (58) er en skrå flade, som danner en vinkel på $\beta > 90^\circ$ med den langsgående akse L_R for låseelementet.



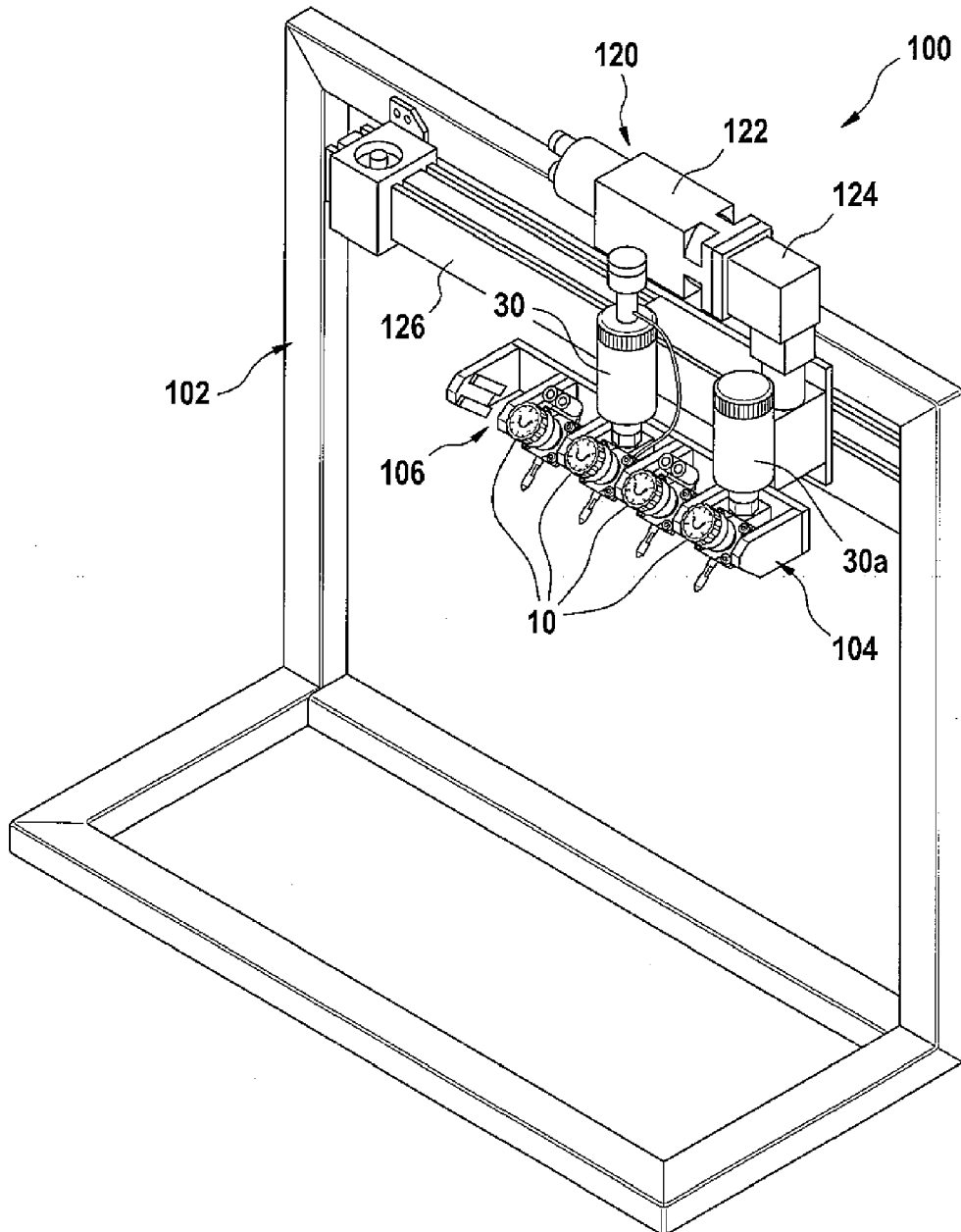


Fig. 3

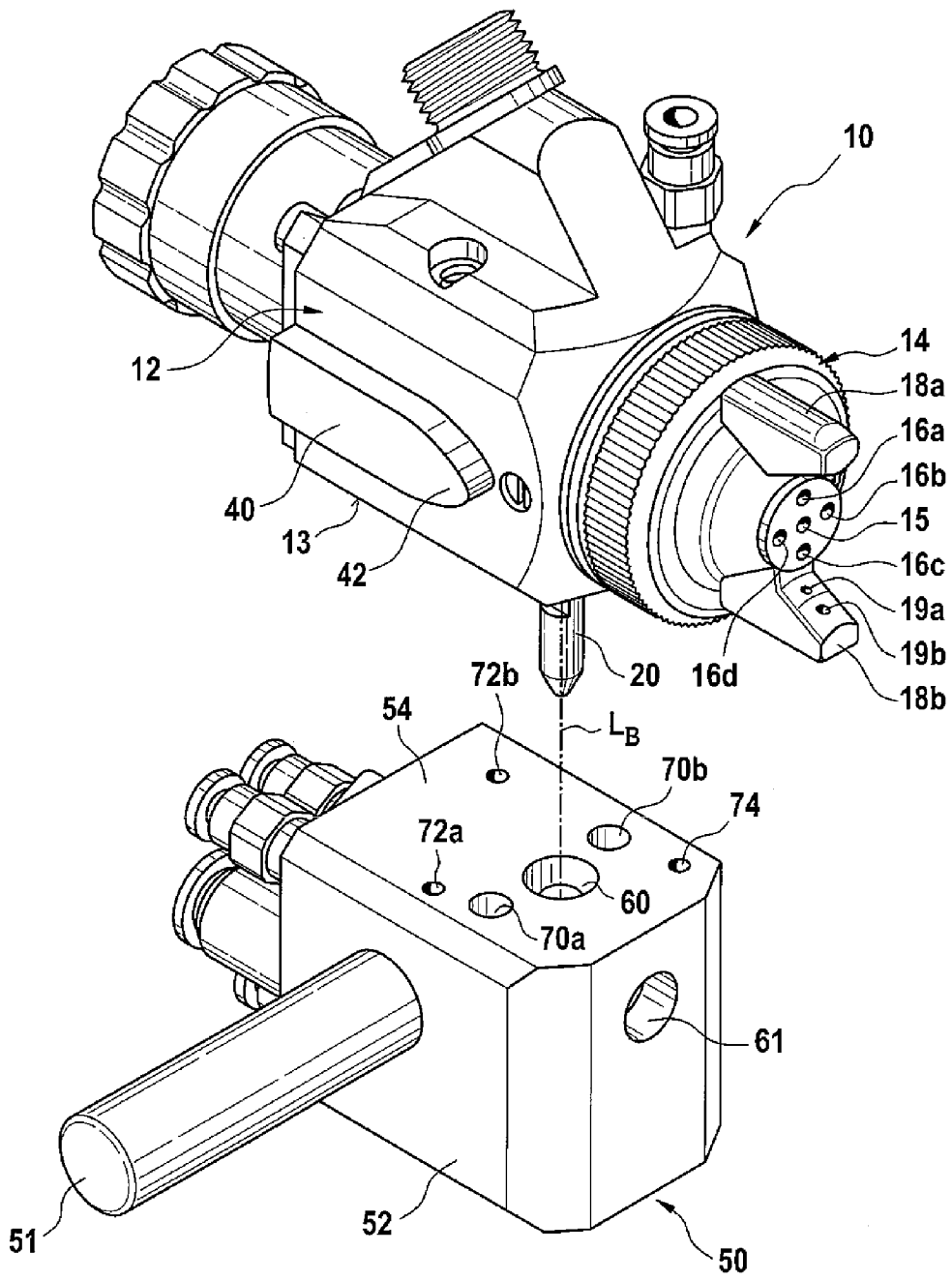


Fig. 4

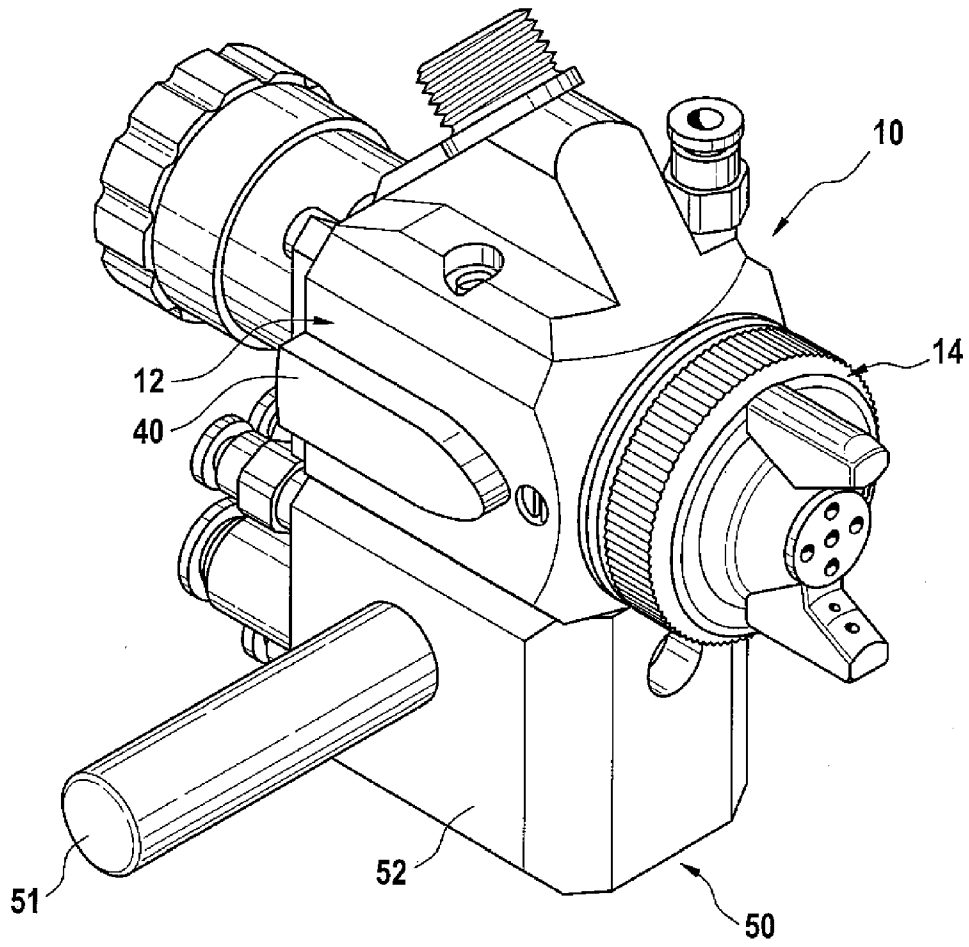


Fig. 5

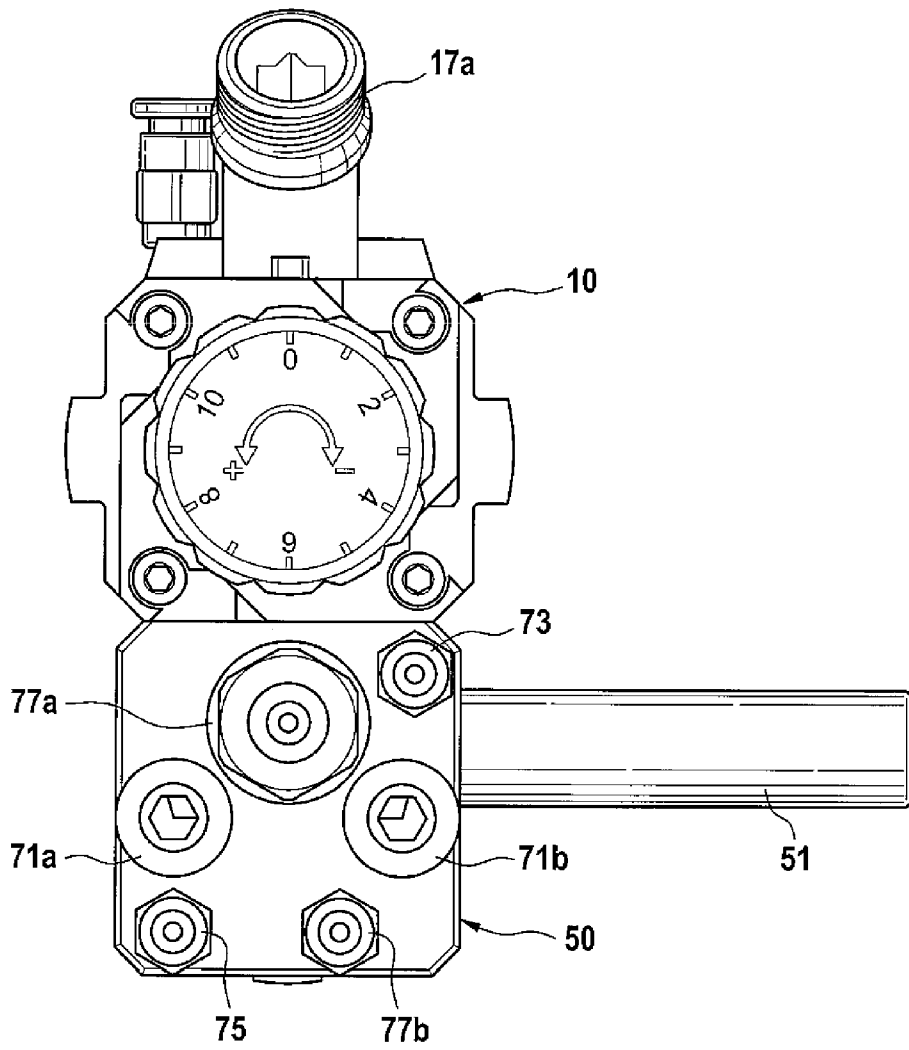


Fig. 6

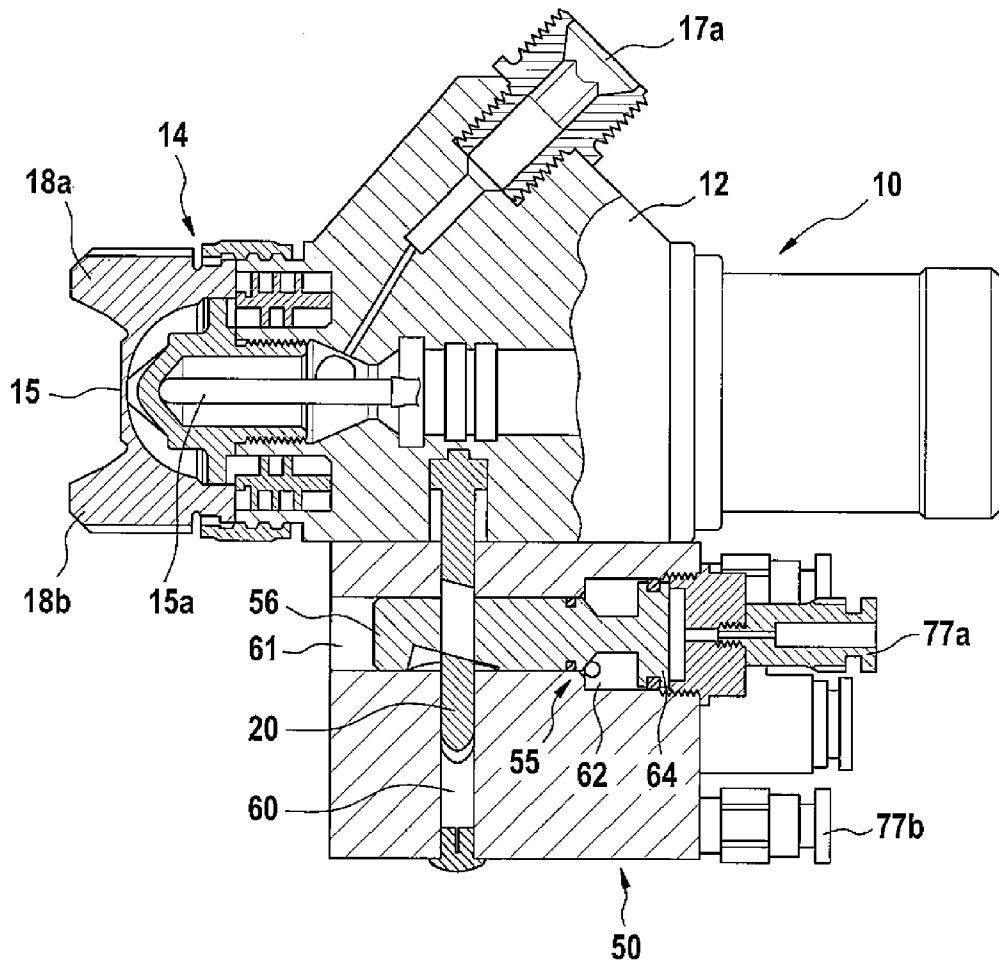


Fig. 7

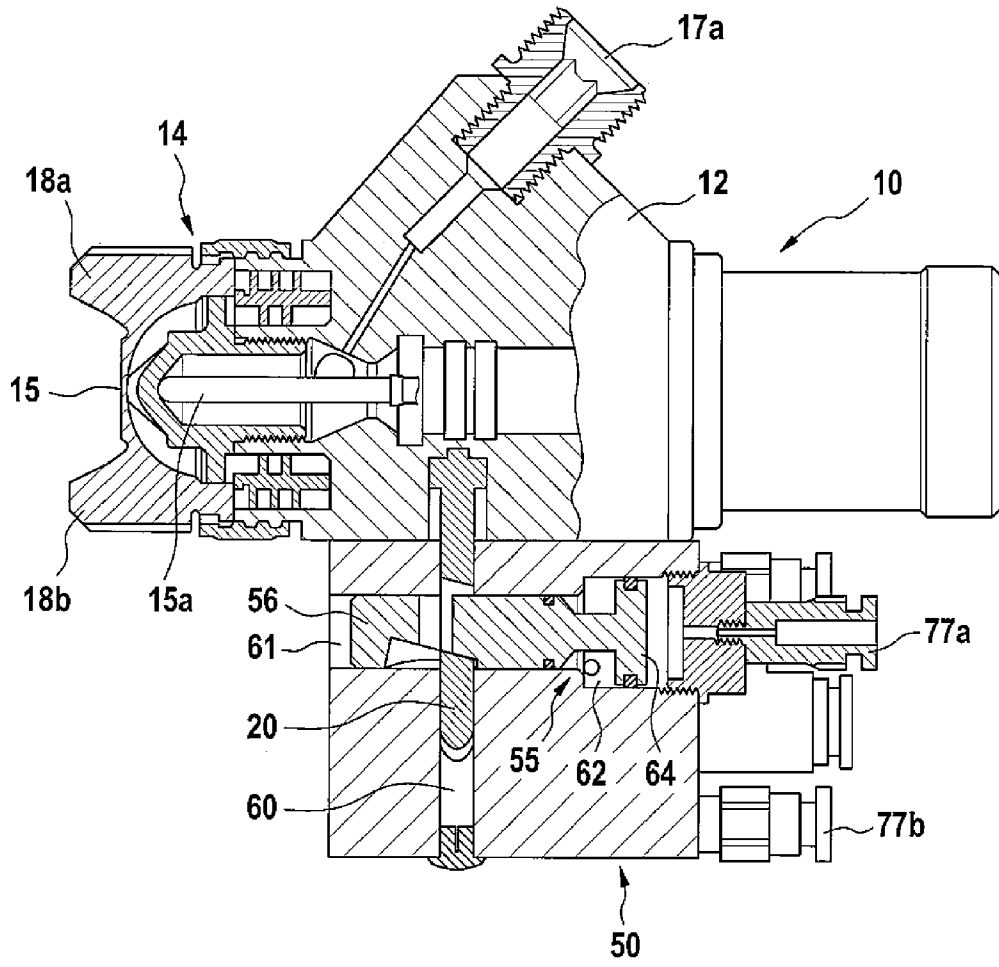


Fig. 8

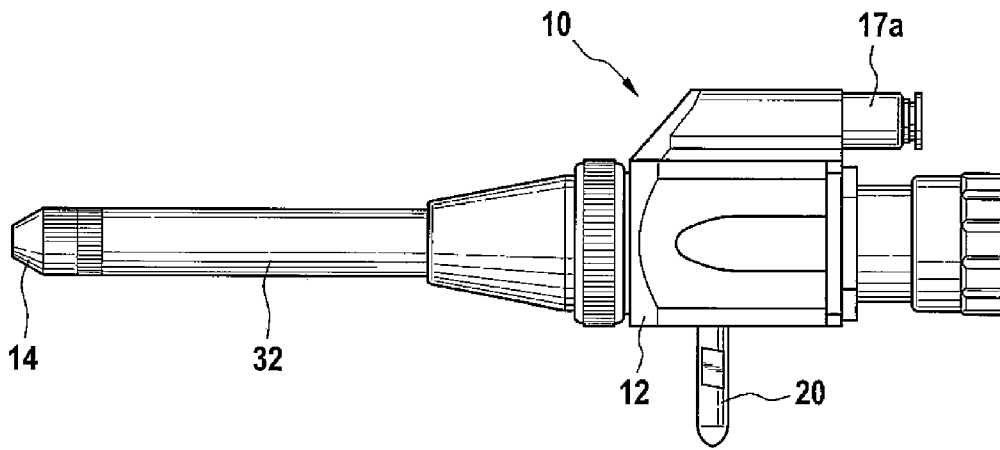


Fig. 9

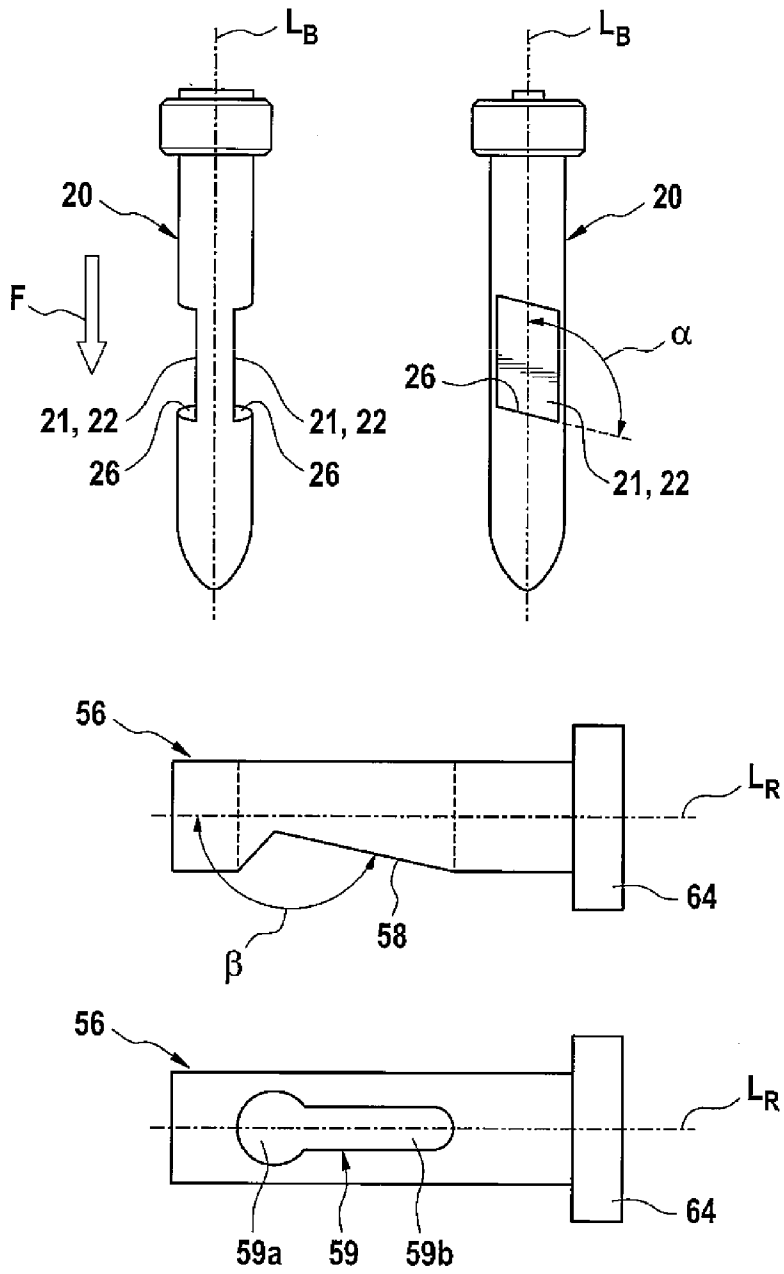


Fig. 10a

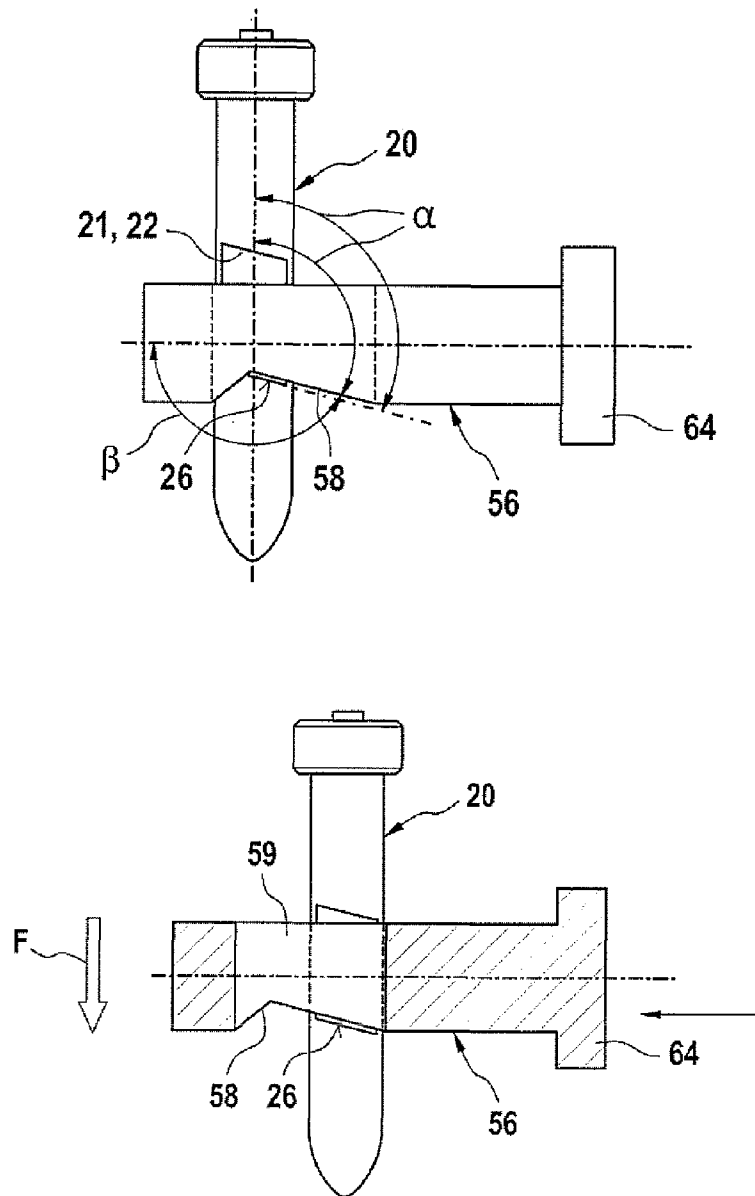


Fig. 10b

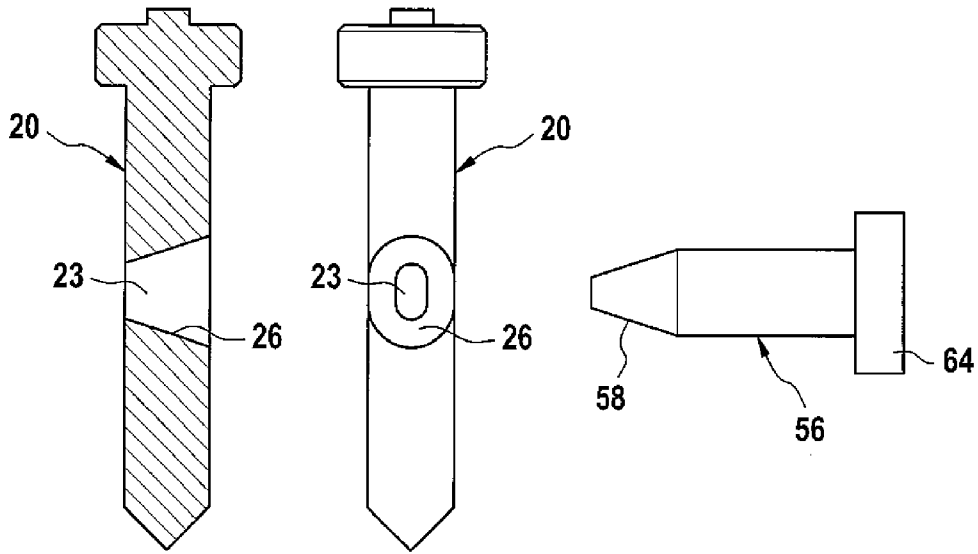


Fig. 10c

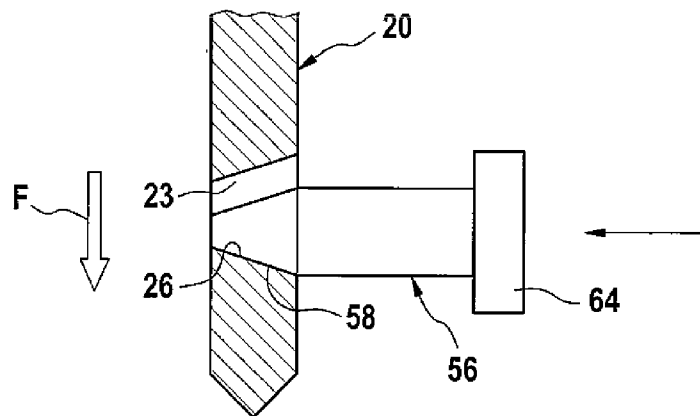


Fig. 10d