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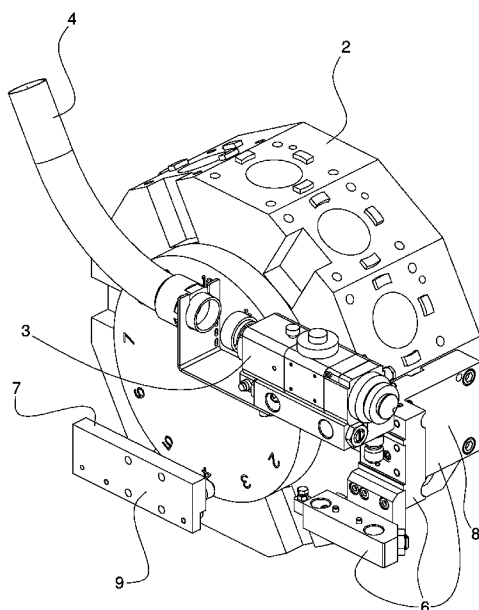


Fig. 2

(57) Abstract: An operating assembly is disclosed that is mounted on a numerically controlled turret lathe, in which the operating assembly comprises a laser cutting head, support means of the laser head mounted on the tool-holding turret of the lathe, and parking means of the laser head mounted on a fixed element separated from the turret; the laser head remains on the parking means in a rest position and, if necessary, the tool-holding turret is moved in such a manner that the support means picks up the laser head from the parking means to take the laser head to a work position.

Operating assembly for turret lathe

Background of the invention

[0001] The invention relates to an operating assembly that is associable with a tool-holding turret of a numerically controlled turret lathe.

5 [0002] Specifically, but not exclusively, the invention can be applied for using an operating module, such as for example a laser cutting head mounted on a tool-holding turret of a turret lathe.

[0003] Integrating a laser cutting head into a high precision CNC machine, in particular a sliding-head lathe is already known. The laser cutting head is provided with a system of cables/pipes that are necessary for carrying the optical fibre, feeding the process gas, supplying electric energy, etc. This entails a certain complication in integrating the laser head into a CNC machine.

10 [0004] It is desirable to extend the possibilities of use of a laser cutting head, or of other types of operating modules that require the use of a more or less complex system of cables/pipes, in CNC machines, in particular in already existing machines.

Summary of the invention

[0005] One object of the invention is to remedy one or more of the aforesaid limits and drawbacks of the prior art.

20 [0006] One object of the invention is to enable an operating module to be used on a CNC machine, in particular on a turret lathe.

[0007] One advantage is to position with precision an operating module with respect to the workpiece.

[0008] One advantage is to enable an operating module to be used that is provided with a relatively complex system of supply cables/pipes.

25 [0009] One advantage is to provide an operating assembly that is constructionally simple and cheap and is further simple and easy to use.

[0010] One advantage is to make available an operating assembly that can be associated with any numerically controlled turret lathe.

30 [0011] One advantage is to make an operating assembly that enables the performance and the versatility to be improved of the numerically controlled machine having the tool-holding turret on which at least one part of the assembly is mounted.

[0012] One advantage is to exploit the ability of a CNC machine to know the position of the workpiece, in particular for performing high precision machining tasks.

[0013] One advantage is to provide an operating assembly that is able to supplement, in a turret lathe, an operating module provided with a system of more or less complex supply cables/pipes, in which the operating module may comprise, in particular, a cutting head (for example of laser, plasma, water, etc type) and/or a pneumatic tool and/or a device for performing a heat treatment (for example induction hardening).

[0014] Such objects and advantages and still others are achieved by the operating assembly according to one or more of the claims set out below.

[0015] In one embodiment, an operating assembly, to be mounted in particular on a numerically controlled turret lathe, comprises an operating module (for example a cutting head, of laser, plasma, or water type, or a pneumatic tool) arranged for machining a workpiece carried by the spindle of the lathe, module support means mounted on the tool-holding turret of the lathe, and module parking means mounted on an element of the lathe separated from the turret, in which the operating module remains on the parking means in a rest position and in which, when required, the support means picks up the operating module from the parking means to take the operating module to a work position.

[0016] The operating module, in particular, may integrate at least one part of the means necessary for performing the machining on the workpiece, such as, for example, the means for conveying a medium that carries the machining energy (for example the optic fibre for laser cutting, a gas pipe for plasma cutting, a water conduit for water jet cutting, a pneumatic circuit for a pneumatic tool, etc) and/or the means for conveying possible process fluid and/or the electric energy supplying means for one or more auxiliary devices, etc.

Brief description of the drawings

[0017] The invention can be better understood and implemented with reference to the attached drawings that illustrate one embodiment thereof by way of non-limiting example.

[0018] Figure 1 shows a partially sectioned turret lathe on which one embodiment of an operating assembly is mounted that is made according to the invention.

[0019] Figure 2 shows a detail of the lathe in figure 1 that includes (in an exploded view) the operating assembly and the tool-holding turret.

[0020] Figure 3 is a vertical raised view of the detail in figure 2.

[0021] Figure 4 is the section IV-IV in figure 3.

[0022] Figure 5 is the section V-V in figure 3.

[0023] Figure 6 is the section VI-VI in figure 3.

[0024] Figure 7 is an exploded view of a component, precisely the parking means, of the operating assembly in figure 1.

[0025] Figure 8 is a side view of the parking means in figure 7.

[0026] Figure 9 is the section IX-IX in figure 8.

5 [0027] Figure 10 is an exploded view of a component, precisely the support means, of the operating assembly in figure 1.

[0028] Figure 11 is a perspective view of the support means in figure 10.

[0029] Figure 12 is an exploded view of a component, precisely the operating module, of the operating assembly in figure 1.

10 [0030] Figures 13 to 15 show three steps, in sequence, of the operation with which the support means picks up the operating module from the rest position, in which the operating module is arranged on the parking means, to then take the operating module to a work position.

Detailed description

15 [0031] With reference to the aforesaid figure 1, overall a CNC machine has been shown that in the specific case comprises a turret lathe 1 having at least one rotating tool-holding turret 2 arranged for receiving a plurality of interchangeable operating modules. The CNC machine may comprise a machine of known type.

[0032] Overall with 3 an operating module has been shown that is intended for
20 mounting on a tool-holding turret of a CNC machine, in particular on the rotating turret 2 of the turret lathe 1.

[0033] The module 3 may comprise, as in this specific case, a laser cutting head that may be in turn provided, as known, with a cable for the optic fibre and/or with a process fluid conveying pipe and/or with an electric energy supply cable for at least one auxiliary
25 use (for example sensor means).

[0034] The operating module 3, in particular, may integrate at least in part the operating means necessary for performing machining on a workpiece. Such operating means may comprise, for example, means for conveying a medium that conveys the machining energy (for example the optic fibre for laser cutting, a gas pipe for plasma
30 cutting, a water conduit for water jet cutting, an air supply for a pneumatic tool, etc). Such operating means may comprise, for example, means for conveying possible process fluid and/or electric energy supplying means for one or more auxiliary devices.

[0035] In the specific case, the operating module 3 (laser cutting head) is provided, in

particular, with supplying means 4 (comprising at least one supply cable/pipe) for supplying energy to the module 3 and which may include, for example, the cable for the optic fibre and/or the pipe for conveying the process fluid and/or at least one electric energy supply cable. The supplying means 4 may comprise, as in this embodiment, at least one tubular element (for containing various supply cables/pipes) provided with a certain flexibility.

[0036] The operating module 3 may be suitable for performing at least one machining on a workpiece carried, in particular, by a spindle 5 of the turret lathe 1. As said, the operating module 3 (laser head) may comprise, in particular, means for conveying a medium that carries the machining energy and/or means for conveying a process fluid and/or means for supplying electric energy.

[0037] With 6 the support means has been indicated that is to be mounted on the tool-holding turret 2 of the lathe 1 and that is arranged for supporting in a removable manner the operating module 3 when the module has to be carried to a work position.

[0038] With 7 the parking means has been indicated that is separated from the tool-holding turret 2 and that is arranged for supporting in a removable manner the operating module 3 when the module has to remain in a rest position.

[0039] In figure 1 the operating module 3 in the work position on the support means 6 has been represented by a continuous line, whereas the operating module 3 in the rest position on the parking means 7 has been represented by a dashed line.

[0040] As shown in figure 2, the support means 6 may comprise, as in this embodiment, a support structure having at least one fixing portion 8 that is fixed (for example by screw connections) to a workstation of the tool-holding turret 2. The parking means 7 may comprise, as in this embodiment, a support structure having at least one fixing portion 9 that is fixed (for example by screw connections) to a fixed element of the lathe 1 separated from the turret 2.

[0041] An operating assembly made according to the present invention may comprise, for example, a combination of elements that may include at least the operating module 3, the support means 6 and the parking means 7.

[0042] The operating assembly may comprise, in particular, first coupling means 10 (see, for example, figures 3, 6, 10-15) arranged for removably coupling the support means 6 to the operating module 3. This removable coupling may be executed through at least one first engaging/disengaging movement executable by the tool-holding turret 2 (as will be

explained better below) for the engaging/disengaging of the first coupling means 10. In figure 13, an engaging movement has been indicated with an arrow F. The disengaging movement may occur in the opposite direction.

[0043] The operating assembly may comprise, in particular, second coupling means 11 (see, for example, figures 3, 5, 7-9, 12-15) arranged for removably coupling the operating module 3 to the parking means 7. This removable coupling between the module 3 and the parking means 7 may be made through at least one second engaging/disengaging movement executable by the tool-holding turret 2 (as will be explained better below) to engage/disengage the second coupling means 11. In figure 15 a disengaging movement has been indicated with an arrow G. The engaging movement may occur in the opposite direction.

[0044] The aforesaid engaging/disengaging movements of the first and second coupling means 10 and 11 may be preceded and followed by movements towards and away from the support means 6 with respect to the parking means 7.

[0045] The support means 6 may be capable, as in the specific embodiment, of picking up the operating module 3 from the parking means 7 through a first engaging movement F (to engage the first coupling means 10 so as to insert the support means 6 into the module 3) followed by a second disengaging movement G (to disengage the second coupling means 11 such as to remove the module 3 from the parking means 7).

[0046] The support means 6 may be capable, as in the specific embodiment, of delivering the operating module 3 to the parking means 7 by a second engaging movement (in the direction opposite the disengaging movement G, to engage the second coupling means 11, in such a manner as to insert the module 3 into the parking means 7) followed by a first disengaging movement (in the direction opposite the engaging movement F, to disengage the first coupling means 10, so as to remove the support means 6 from the module 3).

[0047] The first coupling means 10 may be of the male-female joint type, as in this embodiment. The second coupling means 11 may be of the male-female joint type, as in this embodiment.

[0048] The first coupling means 10 and the second coupling means 11 may be arranged, in particular, with respect to one another in such a manner that the first engaging (or disengaging) movement F is transverse (in the specific case perpendicular) to the second disengaging (or engaging) movement G.

[0049] The first coupling means 10 may comprise, as in this embodiment, at least one first pair of projections (in particular in the form of a, for example cylindrical, pin, as in this embodiment) that are connectable/disconnectable within a respective first pair of recesses (shapingly coupled with the projections). The second coupling means 11 may
5 comprise, as in this embodiment, at least one second pair of projections (in particular in the form of a, for example cylindrical, pin, as in this embodiment) that are connectable/disconnectable within a respective second pair of recesses (shapingly coupled with the projections).

[0050] The first pair of projections may be carried, as in the specific embodiment
10 disclosed here, by the operating module 3. The second pair of projections may be carried, as in the specific embodiment disclosed here, by the parking means 7. The first pair of recesses may be carried, as in the specific embodiment disclosed here, by the support means 6. The second pair of recesses may be carried, as in the specific embodiment disclosed here, by the operating module 3.

[0051] The operating assembly may comprise, in particular, blowing means for
15 cleaning the first coupling means 10 and/or the second coupling means 11. Such blowing means may comprise conduit means (obtained, in the specific embodiment, at least partially inside the projections) for conveying pressurised gas. The conduit means is, for example, communicating with a source of pressurised gas ((not shown) and terminating
20 with one or more outlets 12 (see, for example, figures 5, 8, 9) of a blow of gas that are arranged on one or more projections (as in this case) and/or on one or more recesses.

[0052] The operating assembly may comprise, in particular, first locking means 13
(elastic, see, for example, figures 6, 10) for locking in position the first coupling means 10. In the specific embodiment at least two (elastic) first locking means 13, at least one for
25 each projection-recess coupling, are provided. The two first (securing) locking means 13 may be arranged, as in this embodiment, to exert two respective (elastic) locking forces that are transverse to one another so that the operating module 3 is coupled with precision in a determined position on the support means 6 that carries the module 3 during machining. In the specific case, the directions of the locking forces exerted by the two first
30 locking means 13 form a 45° angle. It is nevertheless possible to provide other tilts.

[0053] The operating assembly may comprise, in particular, second locking means 14
(elastic, see, for example, figure 5) for locking in position the second coupling means 11. In the specific embodiment at least two (elastic) second locking means 14 are provided, at

least one for each projection-recess coupling. The two second (securing) locking means 14 may be arranged, as in this embodiment, to exert two (elastic) respective locking forces that are parallel and/or coaxial to one another, so that the operating module 3 is coupled with a certain freedom of play on the parking means 7 to facilitate the coupling and/or decoupling thereof. In the specific case the directions of the locking forces exerted by the two second locking means 14 are coaxial and opposite.

[0054] The first locking means 13 and/or the second locking means 14 may comprise, in particular, spring pushing members coupled to respective gaps. The pusher members may comprise, as in this embodiment, spherical bodies. The gaps may comprise, as in this embodiment, annular grooves. The pusher members may be arranged on the elements that carry the aforesaid recesses, whereas the recesses may be arranged on the elements that carry the aforesaid projections.

[0055] The operating assembly may comprise, in particular, first sensor means 15 (see, for example, figures 4, 12) arranged for signalling when the operating module 3 is coupled to or decoupled from the support means 6. The operating assembly may comprise, in particular, second sensor means 16 (see, for example, figures 5, 6, 12) arranged for signalling when the operating module 3 is coupled to or decoupled from the parking means 7. The first sensor means 15 may comprise, as in this embodiment, first switch means arranged for contact with the support means 6. The second sensor means 16 may comprise, as in this embodiment, second switch means arranged for contact with the parking means 7. The first switch means may comprise, in particular, at least one first microswitch. The second switch means may comprise, in particular, at least one second microswitch.

[0056] The first (switch) sensor means 15 may be arranged, in particular, on the operating module 3. The second (switch) sensor means 16 may be arranged, in particular, on the operating module 3.

[0057] The operating assembly may comprise, in particular, at least one first safety abutment 17 arranged (see, for example, figures 10, 11) arranged (on the support means 6) for protecting the first sensor means 15 by limiting an engaging movement of the first coupling means 10. In the specific case, the operating assembly comprises two first safety abutments 17.

[0058] The operating assembly may comprise, in particular, at least one second safety abutment 18 (see, for example, figures 5, 7, 8, 9) arranged (on the parking means 7) for protecting the second sensor means 16 by limiting an engaging movement of the second

coupling means 11. In the specific case, the operating assembly comprises two second safety abutments 18.

[0059] The operating assembly may comprise first adjusting means 19 (see, for example, figures 10, 11) of the first (switch) sensor means 15. The first adjusting means 19 may comprise, in particular, at least one first adjusting dowel (arranged on the support means 6) operationally associated with the first switch means.

[0060] The operating assembly may comprise second adjusting means 20 (see, for example, figures 5, 7-9) of the second (switch) sensor means 16. The second adjusting means 20 may comprise, in particular, at least one second adjusting dowel (arranged on the parking means 7) operationally associated with the second switch means.

[0061] The operating assembly may comprise, in particular, programmable electronic control means (not shown, for example the control means of the CNC machine) and program instructions implementable by the aforesaid control means to control the tool-holding turret 2 in such a manner that when the operating module 3 is coupled to the support means 6, a safe operation mode is activated automatically in which one or more functionalities of the turret 2 are prevented or limited, to safeguard the operating module 3, in particular the supplying means 4 of the module. In particular some movements of the turret 2 can be prevented and/or the maximum speeds of some movements of the turret 2 can be limited. When the operating module 3 returns to the rest position (coupled to the parking means 7), the program instructions may provide the automatic return to a normal operating mode in which the aforesaid functionality/functionalities of the turret is/are restored.

[0062] In use, the support means 6 is mounted on the tool-holding turret 2 and the parking means 7 is mounted on a fixed element of the lathe 1 separated by the tool-holding turret 2. The operating module 3 is coupled removably to the parking means 7 (through the second coupling means 11) to remain in rest position. When the operating module 3 has to enter into action, the tool-holding turret 2 is moved in such a manner that the support means 6, carried by the turret 2, picks up the module 3 from the parking means 7.

[0063] Figure 13 shows the operating module 3 coupled to the parking means 7. The turret 2, which carries the support means 6, performs a movement towards the parking means 7, in order that the coupling means 10 (the projections on the operating module 3 and the recesses on the support means 6) are arranged coaxially. After this, the turret 2 can make the support means 6 perform the engaging movement F to engage the first coupling

means 10 (inserting the projections on the module 3 inside the recesses on the support means 6) arriving at the configuration in figure 14. At this point the turret 2 can make the support means 6 perform the disengaging movement G (figure 15) to disengage the second coupling means 11 (removing the recesses on the module 3 from the projections on the parking means 7), to then move away the operating module 3, which is now coupled to the support means 6.

[0064] The turret 2, once the support means 6 has taken the module 3, positions the module 3 in a work position with respect to the workpiece carried by the spindle 5 of the lathe 1. Once the task of the operating module 3 has been completed, the turret 2 is moved to redeliver the module 3 to the parking means 7, with opposite directions to those disclosed previously.

CLAIMS

1. Operating assembly comprising:

- an operating module (3) suitable for performing at least one machining on a workpiece carried by a spindle (5) of a turret lathe (1), said operating module (3) comprising supplying means (4) for supplying energy to said operating module (3);
- support means (6) to be mounted on a tool-holding turret (2) of the lathe (1) and arranged for supporting in a removable manner said operating module (3);
- parking means (7) separated from the tool-holding turret (2) and arranged for supporting in a removable manner said operating module (3);
- first coupling means (10) arranged for removably coupling said support means (6) with said operating module (3) through at least one engaging/disengaging movement (F) executable by the tool-holding turret (2) for engaging/disengaging said first coupling means (10);
- second coupling means (11) arranged for removably coupling said operating module (3) with said parking means (7) through at least one engaging/disengaging movement (G) executable by the tool-holding turret (2) for engaging/disengaging said second coupling means (11);

said support means (6) being arranged for picking up said operating module (3) from said parking means (7) through an engaging movement (F) of said first coupling means (10) and a disengaging movement (G) of said second coupling means (11); said support means (6) being arranged for delivering said operating module (3) to said parking means (7) through an engaging movement of said second coupling means (11) and a disengaging movement of said first coupling means (10).

2. Assembly according to claim 1, wherein said supplying means (4) comprises means for conveying a medium that carries the machining energy.
3. Assembly according to claim 2, wherein said means for conveying a medium that carries the machining energy comprises an optic fibre for laser cutting and/or a gas pipe for plasma cutting and/or a water conduit for water jet cutting and/or a pneumatic circuit for a pneumatic tool.
4. Assembly according to any preceding claim, wherein said supplying means (4) comprises means for transporting a process fluid and/or means for supplying electric energy.

5. Assembly according to any preceding claim, wherein said supplying means (4) comprises at least one supply cable/pipe.
6. Assembly according to claim 5, wherein said at least one supply cable/pipe comprises a cable for the optic fibre and/or a pipe for conveying the process fluid and/or at least one electric energy supply cable.
7. Assembly according to claim 5 or 6, wherein said supplying means (4) comprises at least one flexible tubular element for containing said at least one supply cable/pipe.
8. Assembly according to any preceding claim, wherein: said first coupling means (10) is of the male-female joint type; said second coupling means (11) is of the male-female joint type; and said first coupling means (10) and said second coupling means (11) are arranged relative to each other so that the engaging/disengaging movement (F) of said first coupling means (10) is transverse to the engaging/disengaging movement (G) of said second coupling means (11).
9. Assembly according to any preceding claim, wherein said first coupling means (10) comprises at least one first pair of projections connectable/disconnectable within a respective first pair of recesses and wherein said second coupling means (11) comprises at least one second pair of projections connectable/disconnectable within a respective second pair of recesses; said first pair of projections being carried by said operating module (3) and said second pair of projections being carried by said parking means (7).
10. Assembly according to claim 9, comprising blowing means for cleaning said first coupling means (10) and/or said second coupling means (11), said blowing means comprising one or more outlets (12) of a blow of gas arranged on one or more of said projections and/or of said recesses.
11. Assembly according to any preceding claim, comprising first locking means (13) for locking in position said first coupling means (10) and/or second locking means (14) for locking in position said second coupling means (11).
12. Assembly according to claim 11, wherein said first locking means (13) comprises at least two first locking means arranged for exerting two respective locking forces that are transverse to one another on said first coupling means (10) whereby said operating module (3) is coupled with precision in a determined position on said support means (6), and/or wherein said second locking means (14) comprises at least two second locking means arranged for exerting two respective locking forces that

are parallel and/or coaxial to one another on said second coupling means (11) whereby said operating module (3) is coupled with a certain freedom of play on said parking means (7) to facilitate the coupling and/or decoupling thereof.

5 13. Assembly according to claim 11 or 12, wherein said first locking means (13) and/or said second locking means (14) comprises spring pushing members coupled to respective recesses.

10 14. Assembly according to any preceding claim, comprising first sensor means (15) arranged for signalling when said operating module (3) is coupled to or decoupled from said support means (6) and/or comprising second sensor means (16) arranged for signalling when said operating module (3) is coupled to or decoupled from said parking means (7).

15 15. Assembly according to claim 14, wherein said first sensor means (15) and/or said second sensor means (16) comprises proximity or presence sensor means, in particular first switch means and/or second switch means arranged for being opened or closed through the effect of the contact with said support means (6) and/or with said parking means (7).

20 16. Assembly according to claim 14 or 15, comprising at least one first safety abutment (17) arranged for protecting said first sensor means (15) limiting by abutment an engaging movement of said first coupling means (10) and/or comprising at least one second safety abutment (18) arranged for protecting said second sensor means (16) limiting by abutment an engaging movement of said second coupling means (11).

25 17. Assembly according to any preceding claim, comprising programmable electronic control means and program instructions implementable by said control means to control said tool-holding turret (2) so that, when said operating module (3) is coupled to said support means (6), a safe operation mode is activated automatically in which one or more functionalities of the turret (2) are prevented or limited.

30 18. Use of an assembly according to any preceding claim, wherein said support means (6) is mounted on a tool-holding turret (2) of a lathe (1), said parking means (7) is mounted on a fixed element separated from said tool-holding turret (2); said tool-holding turret (2) being moved for taking said operating module (3) from said parking means (7), for positioning said operating module (3) in a work position with respect to a workpiece rotated by a spindle (5) of said lathe (1), and for returning said operating module (3) to said parking means (7); said operating module (3)

comprising a laser cutting head.

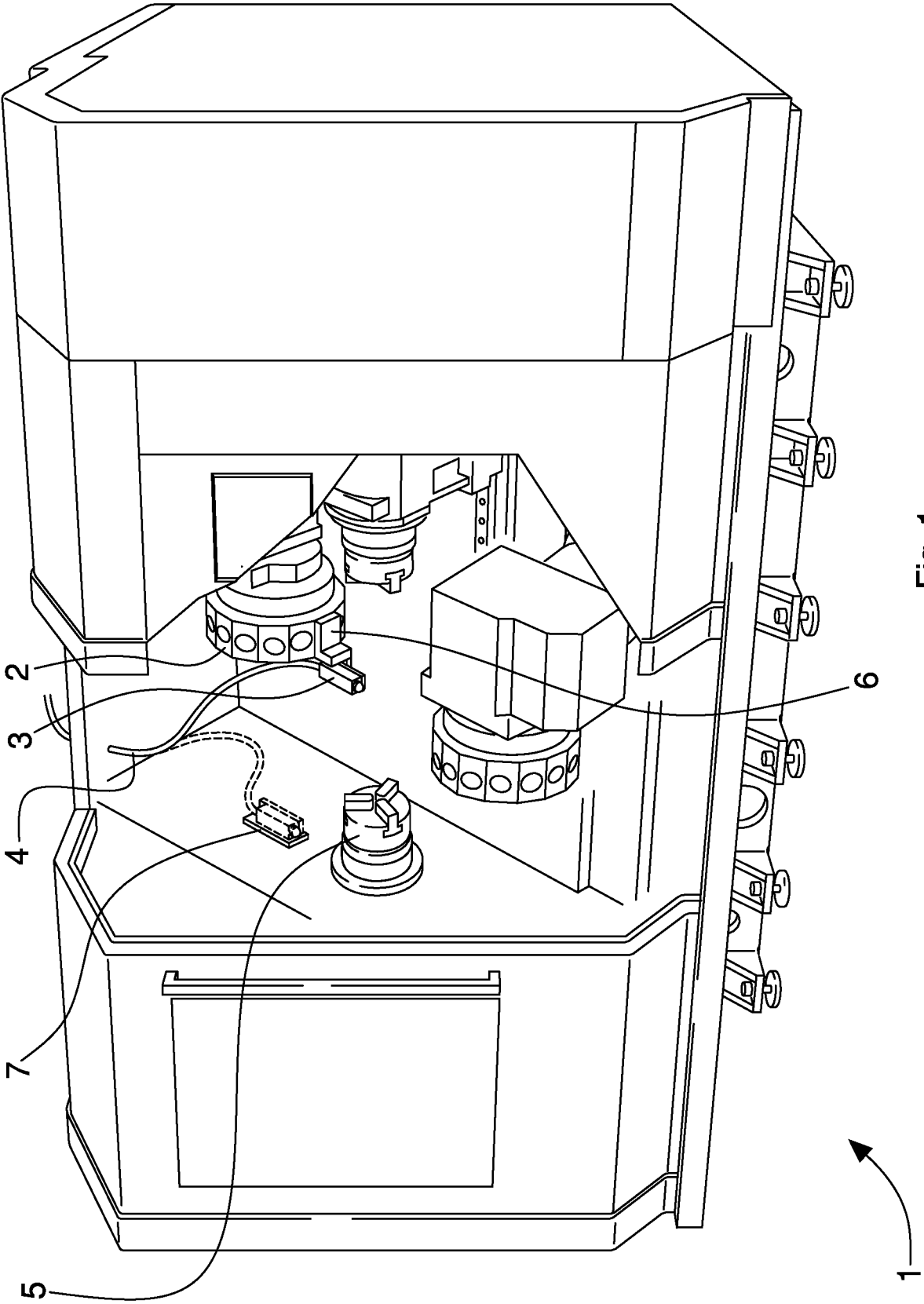


Fig. 1

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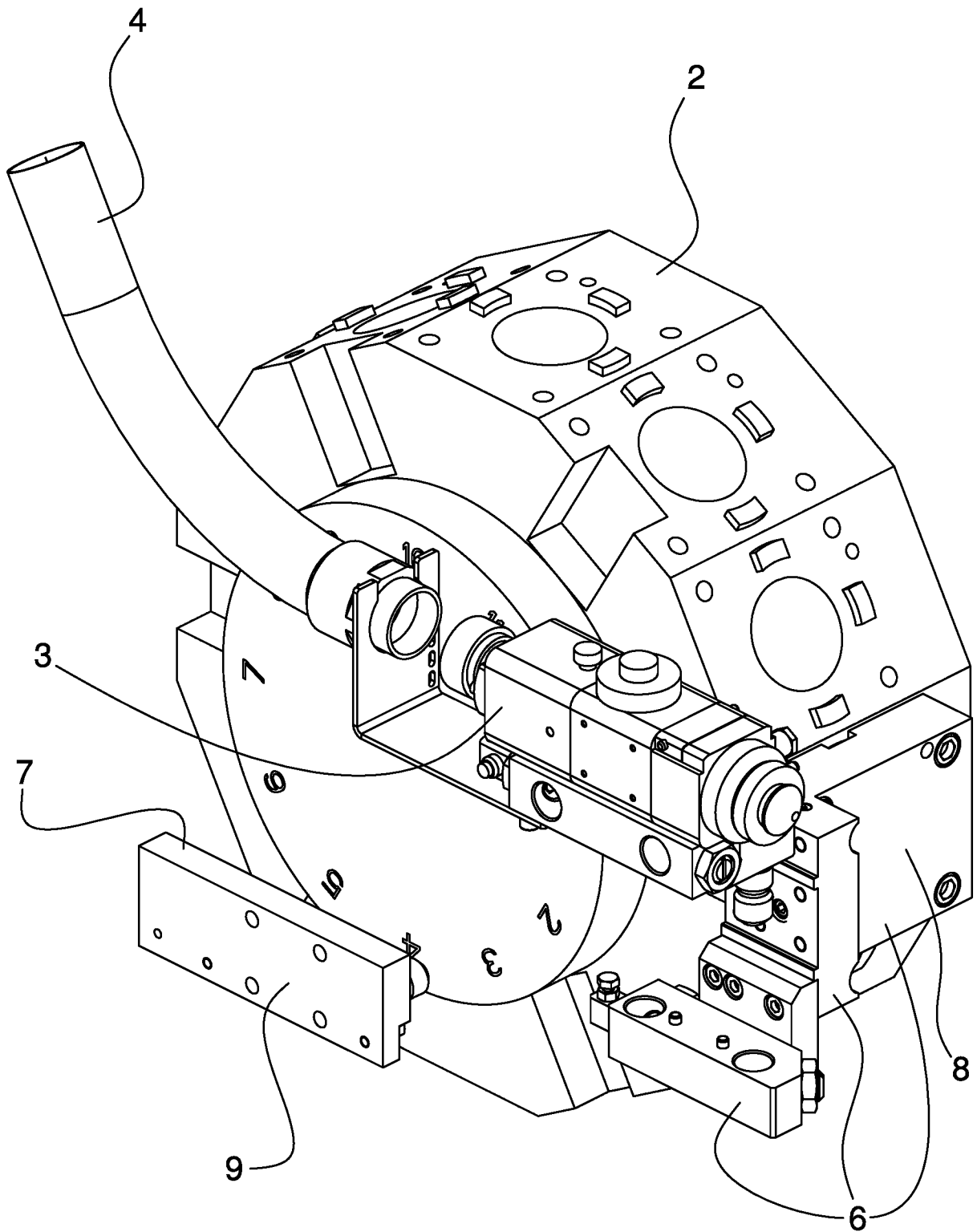


Fig. 2

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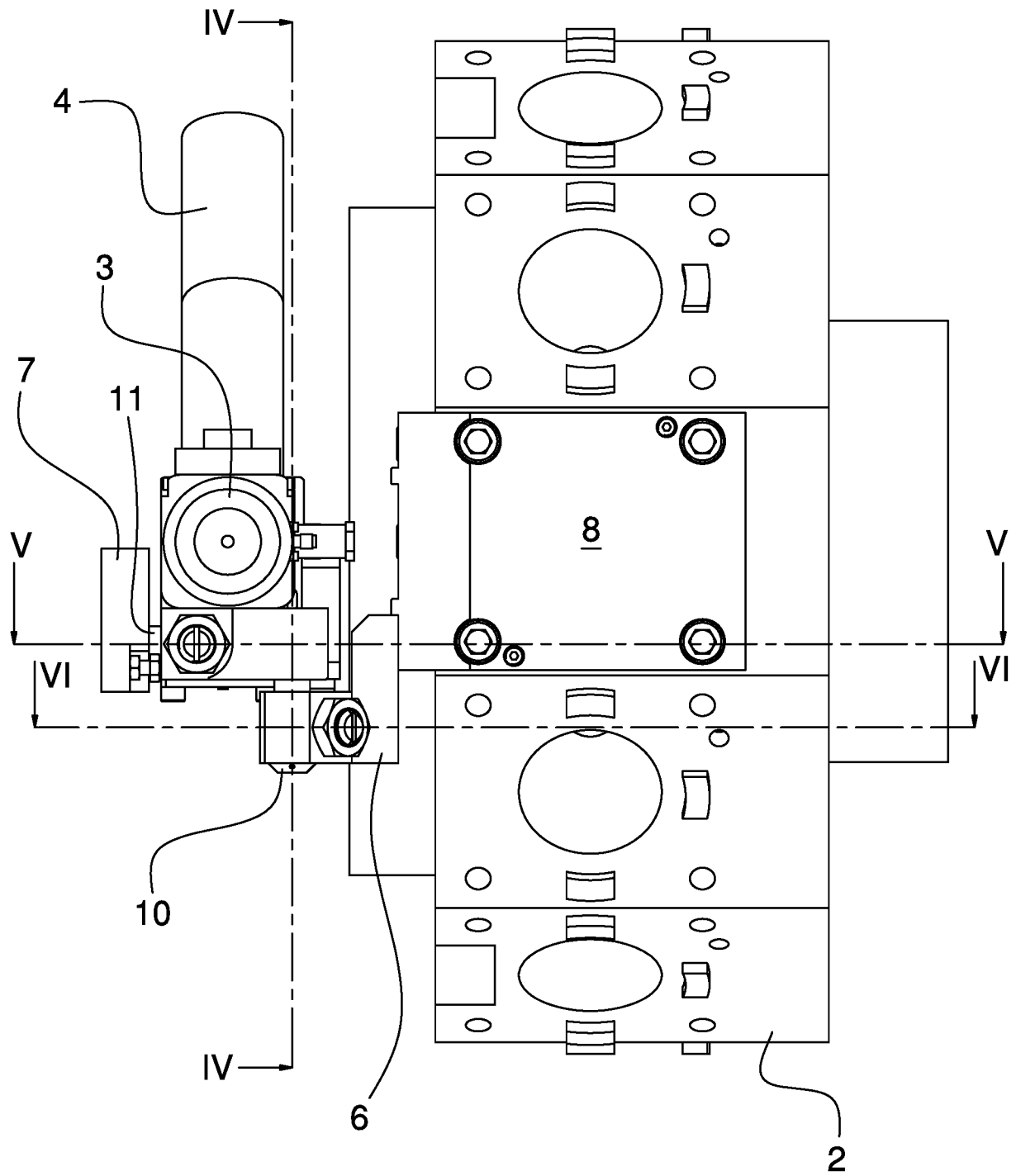


Fig. 3

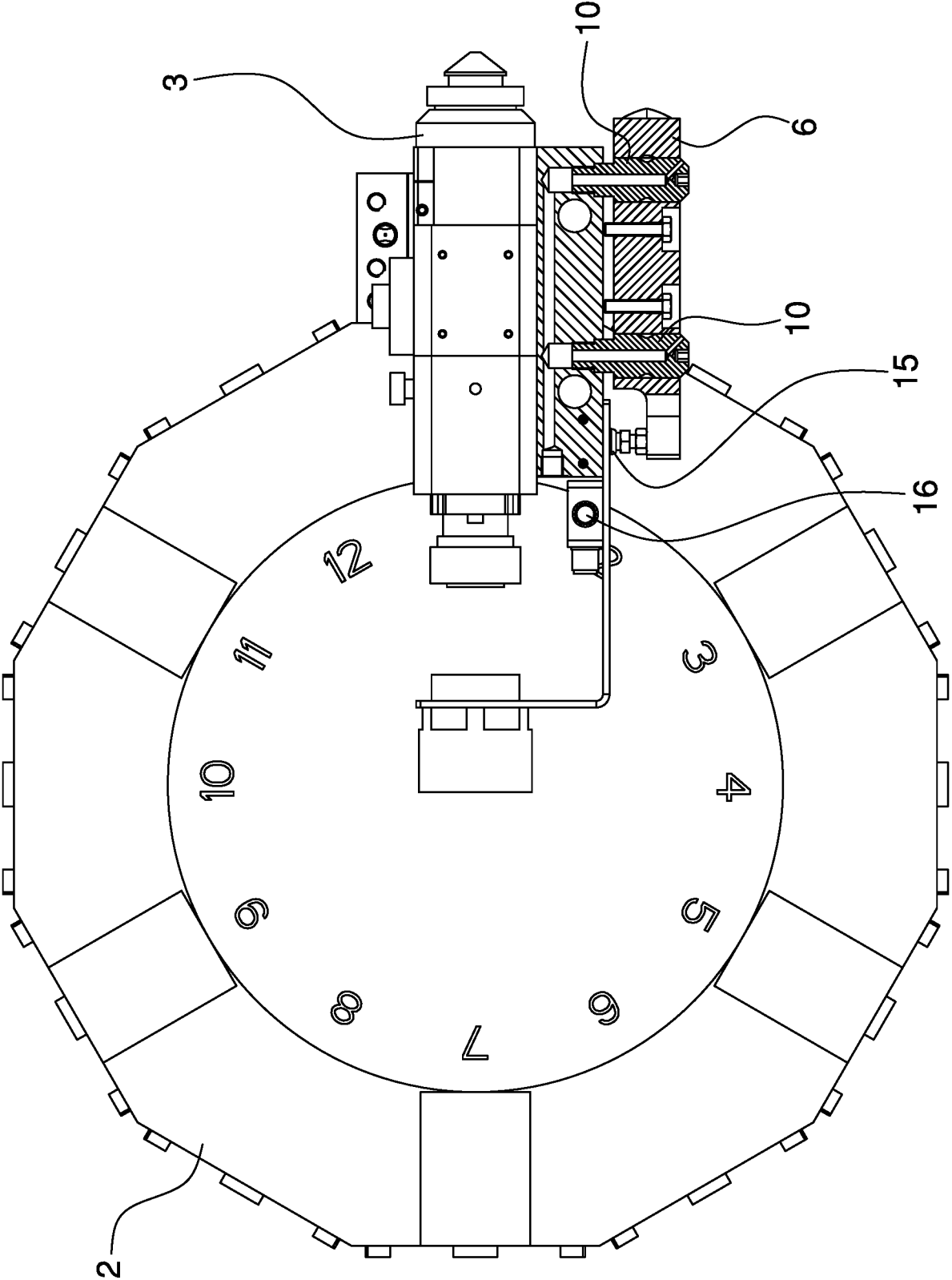


Fig. 4

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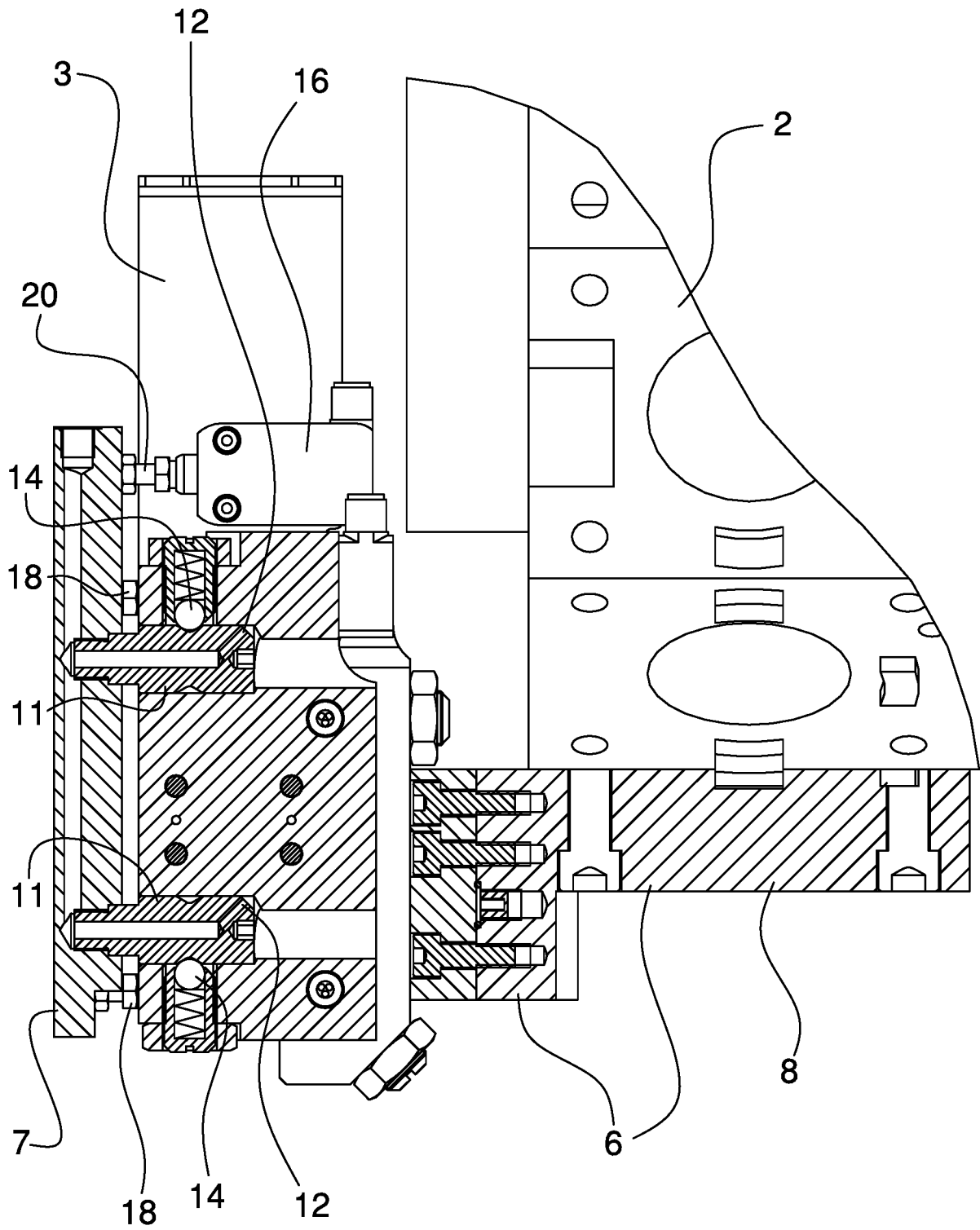


Fig. 5

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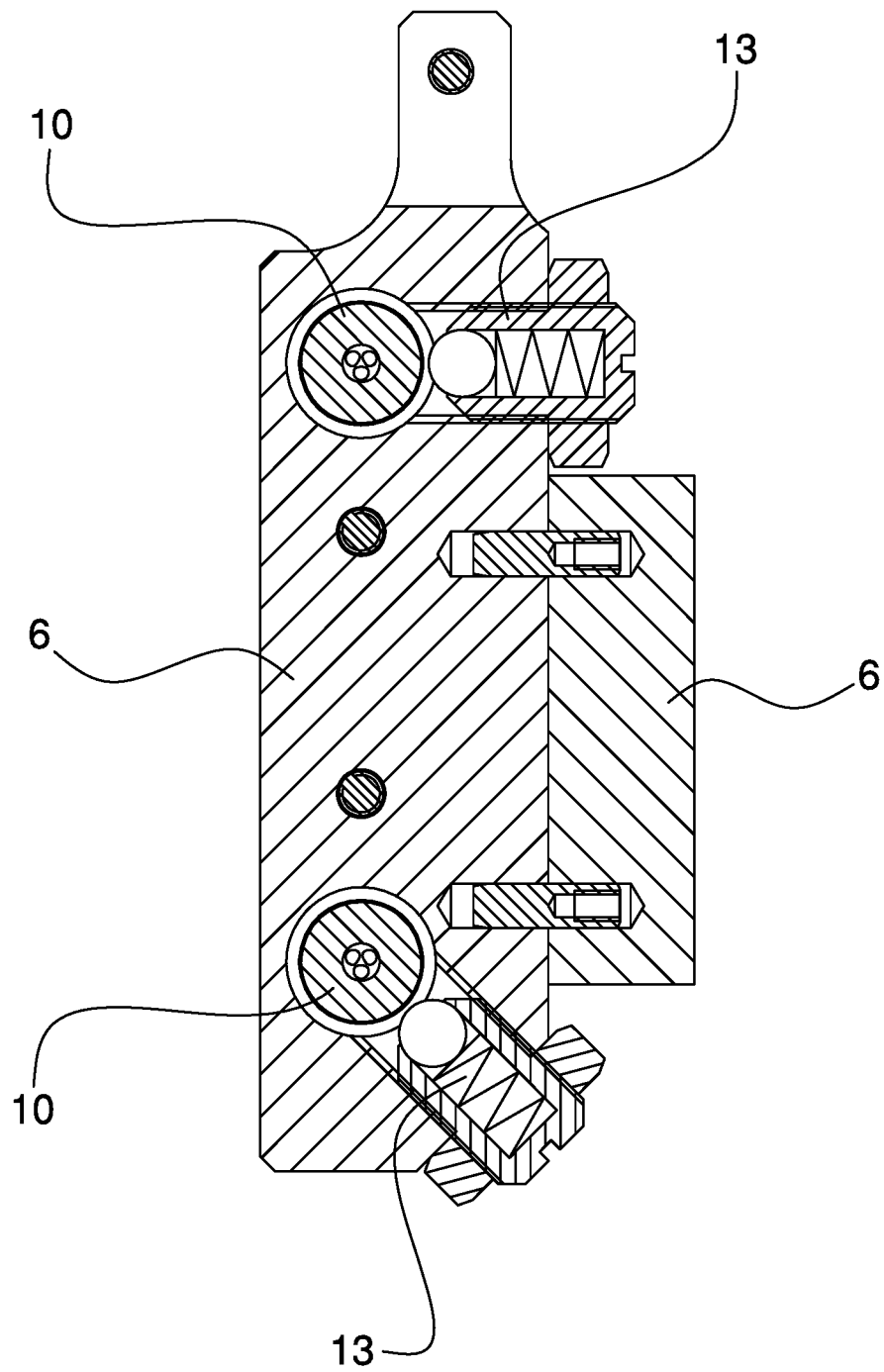


Fig. 6

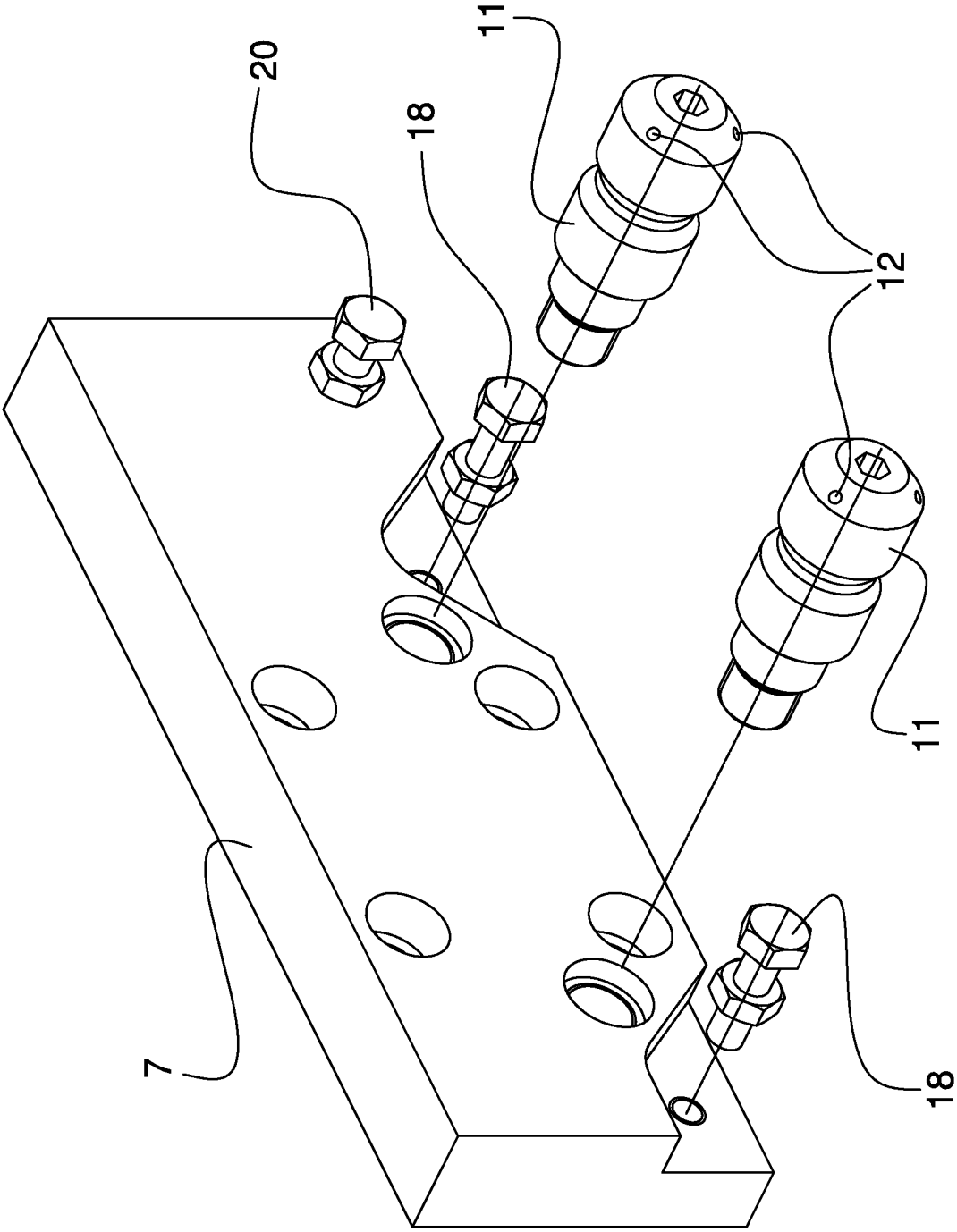


Fig. 7

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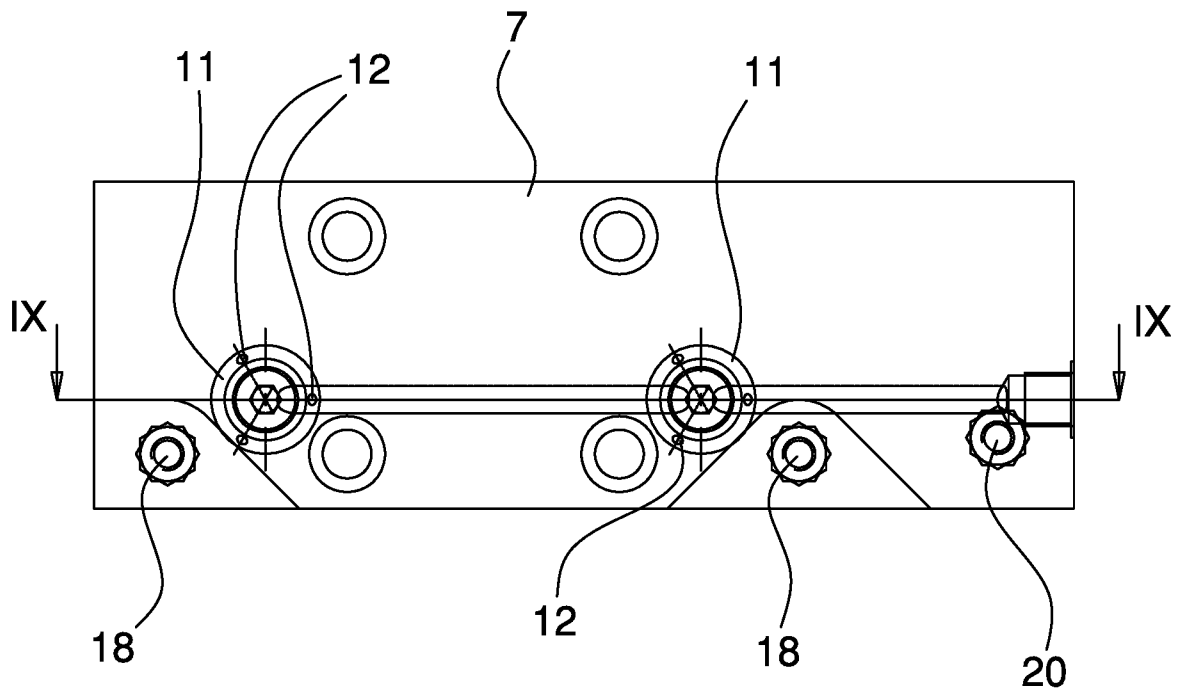


Fig. 8

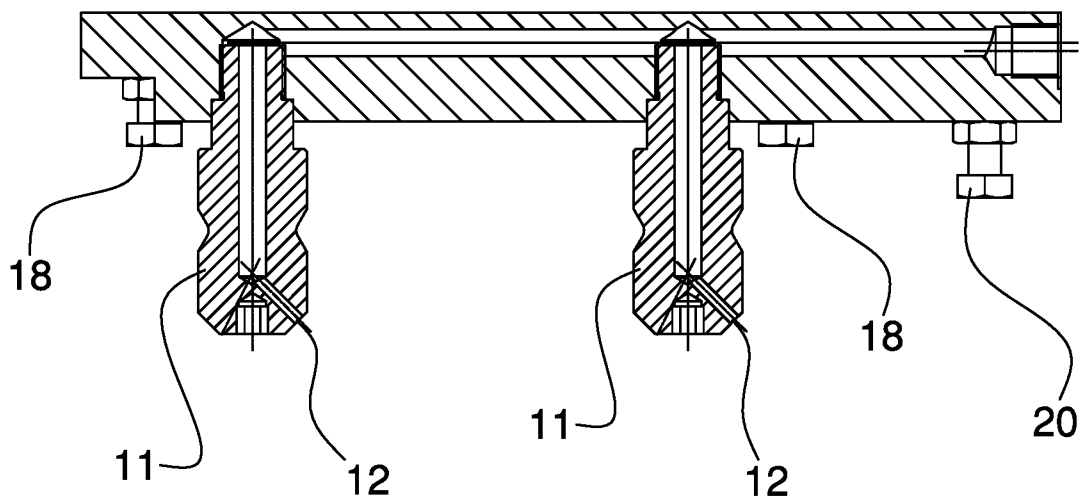


Fig. 9

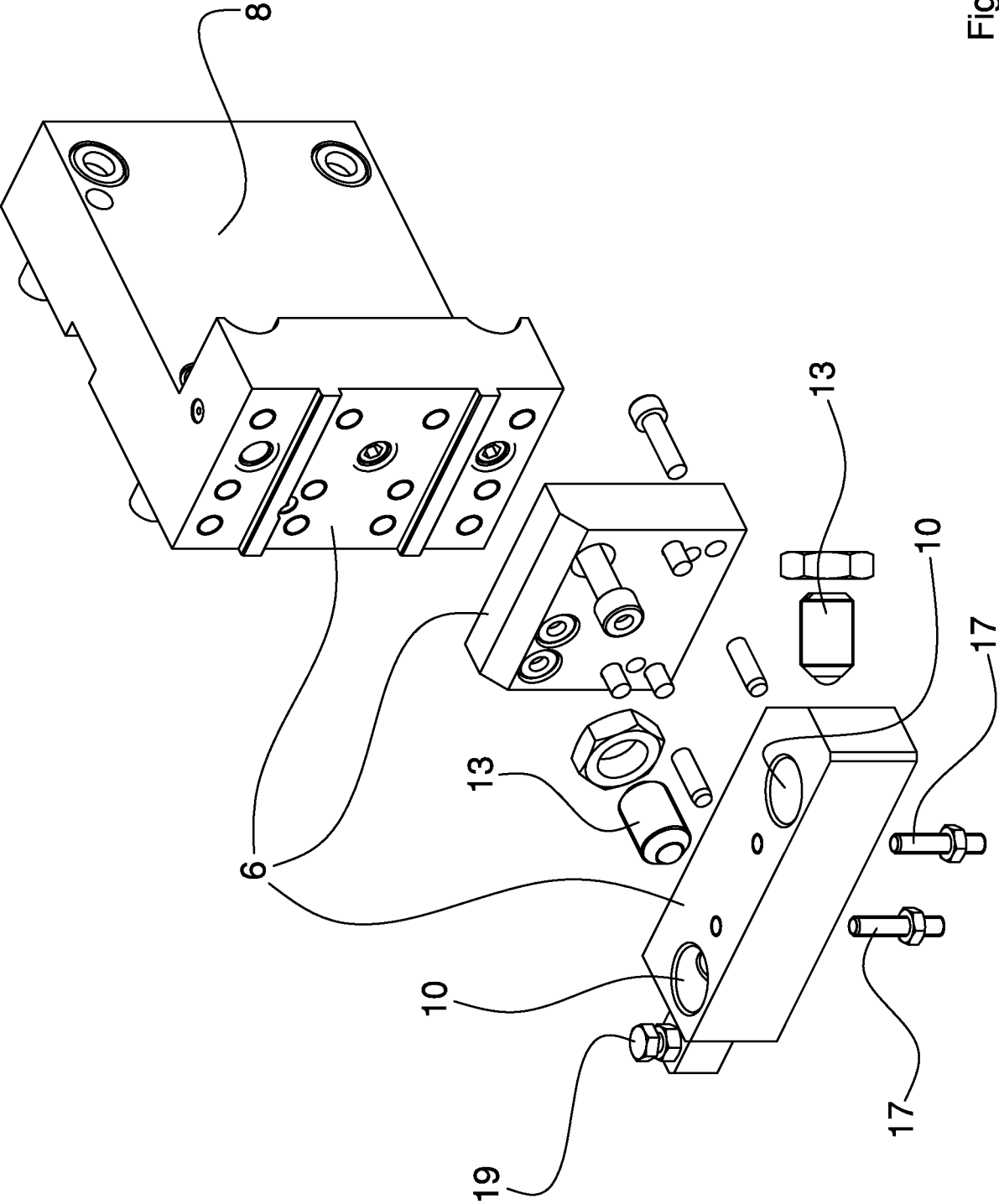


Fig. 10

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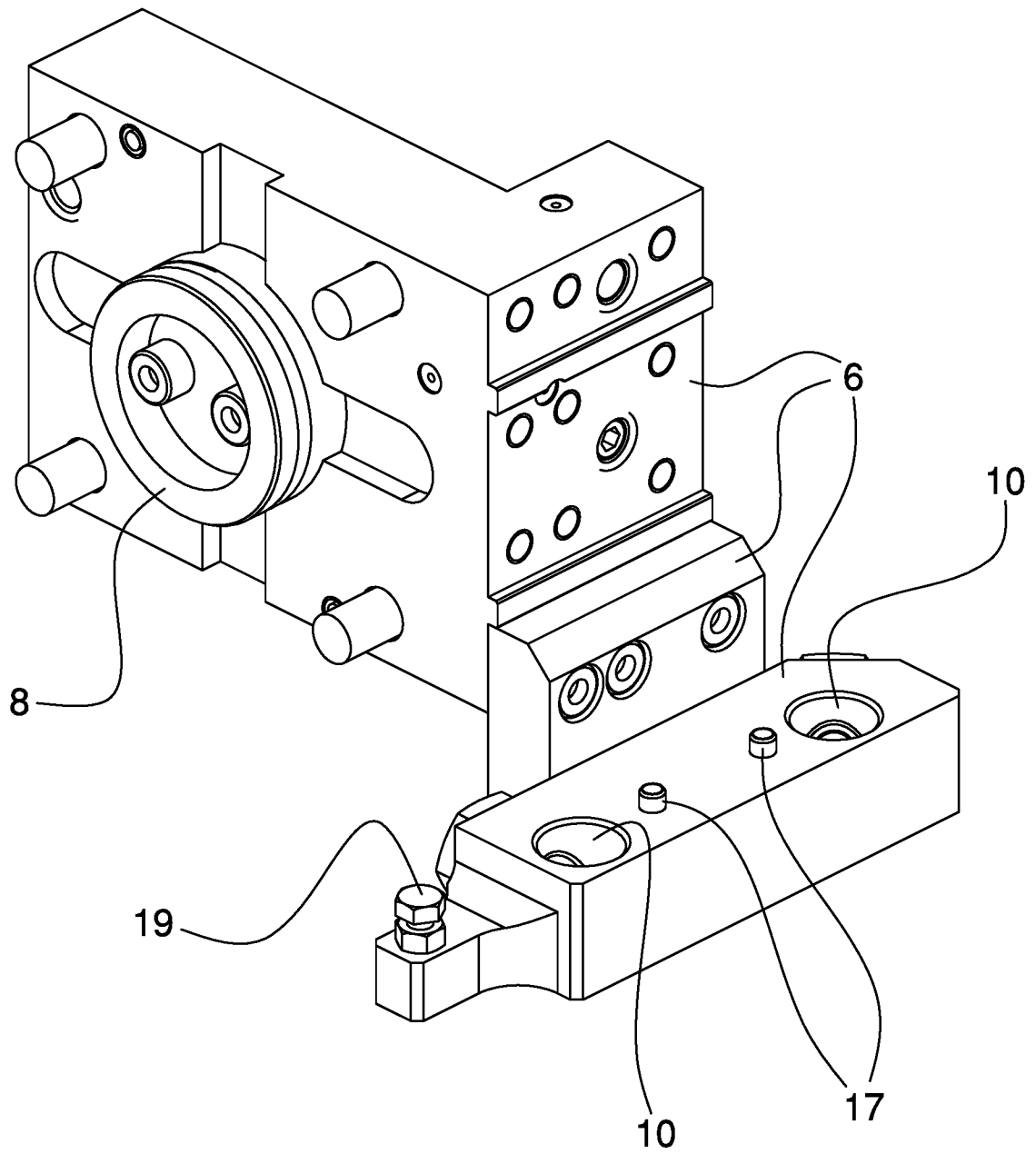


Fig. 11

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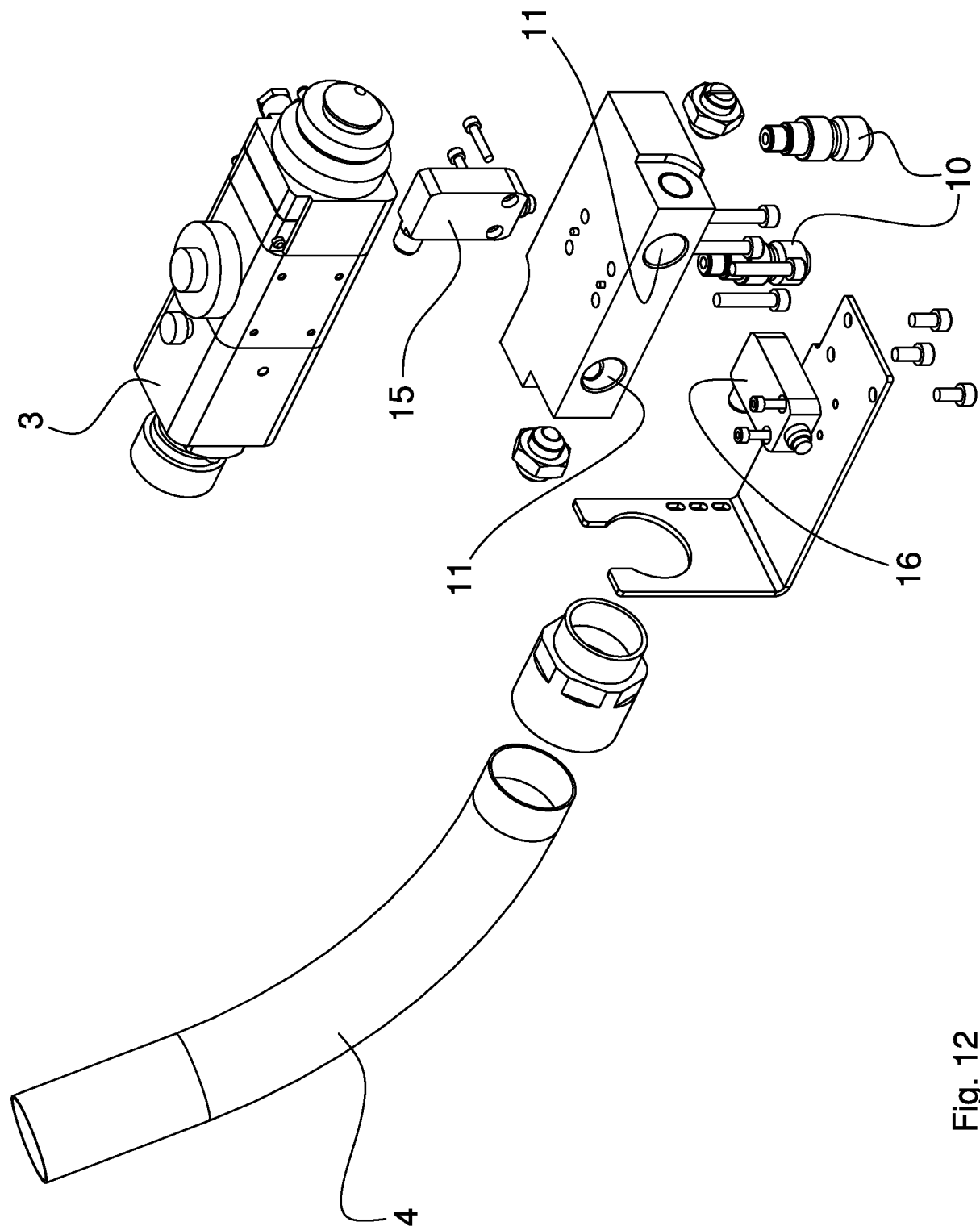


Fig. 12

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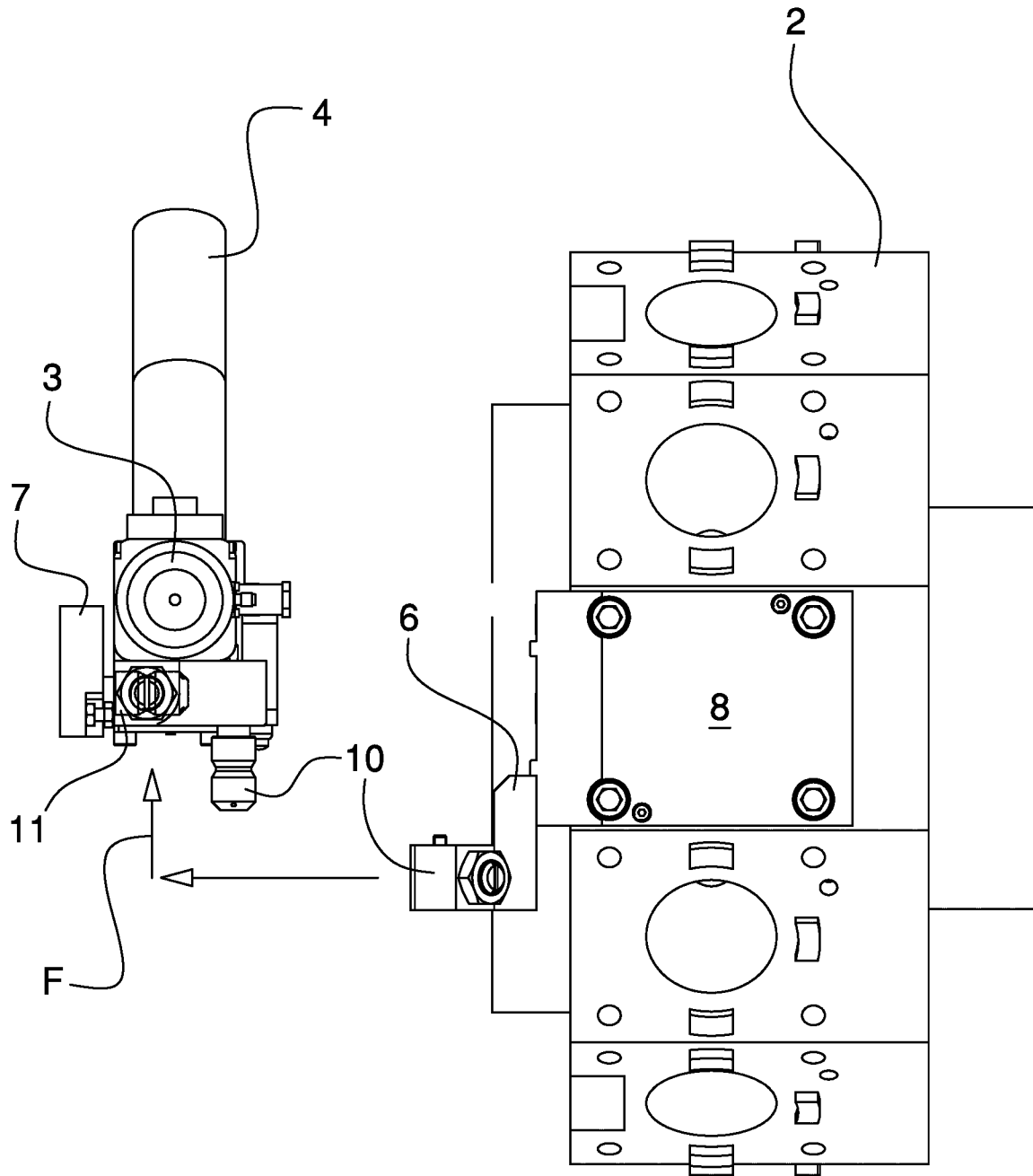


Fig. 13

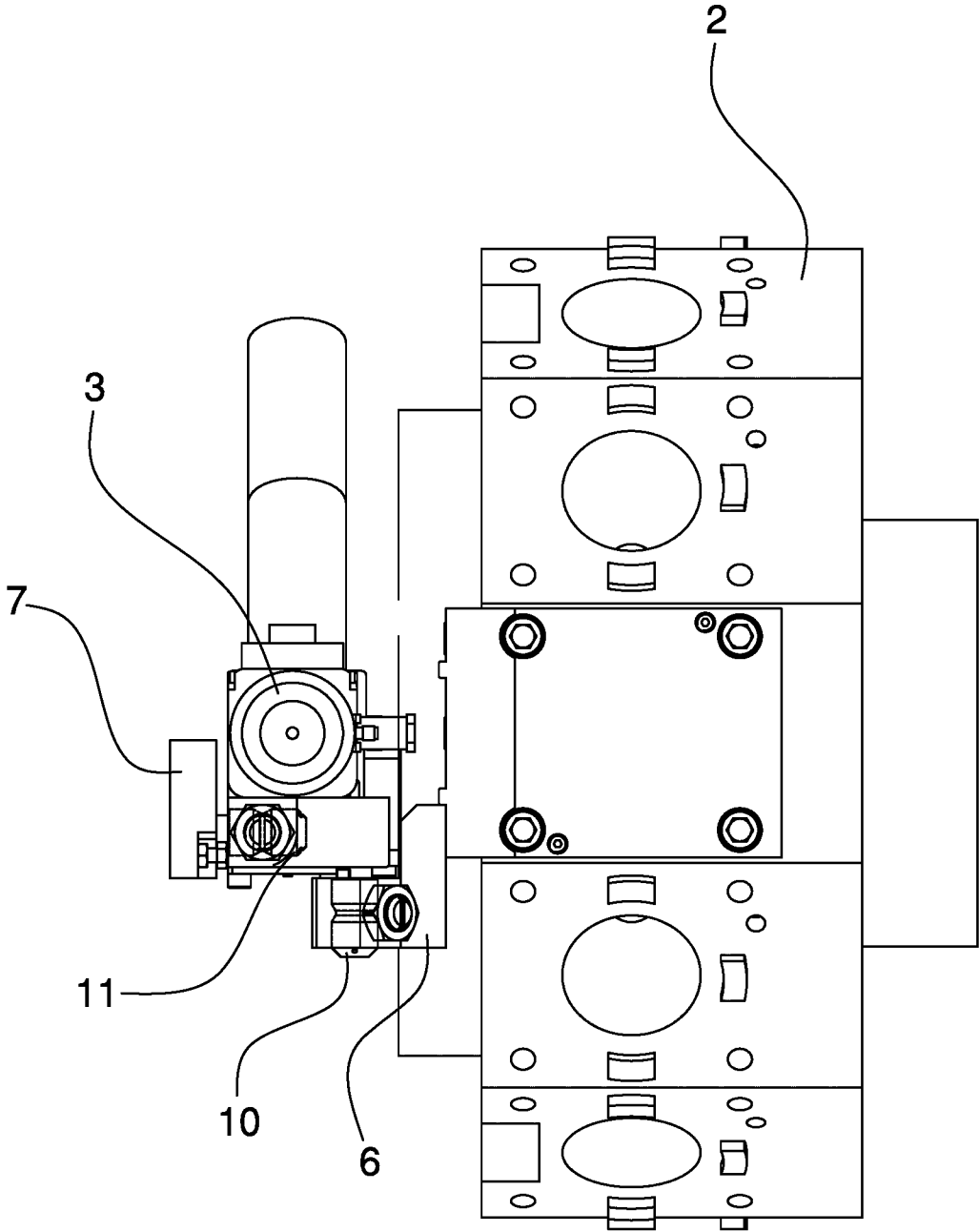


Fig. 14

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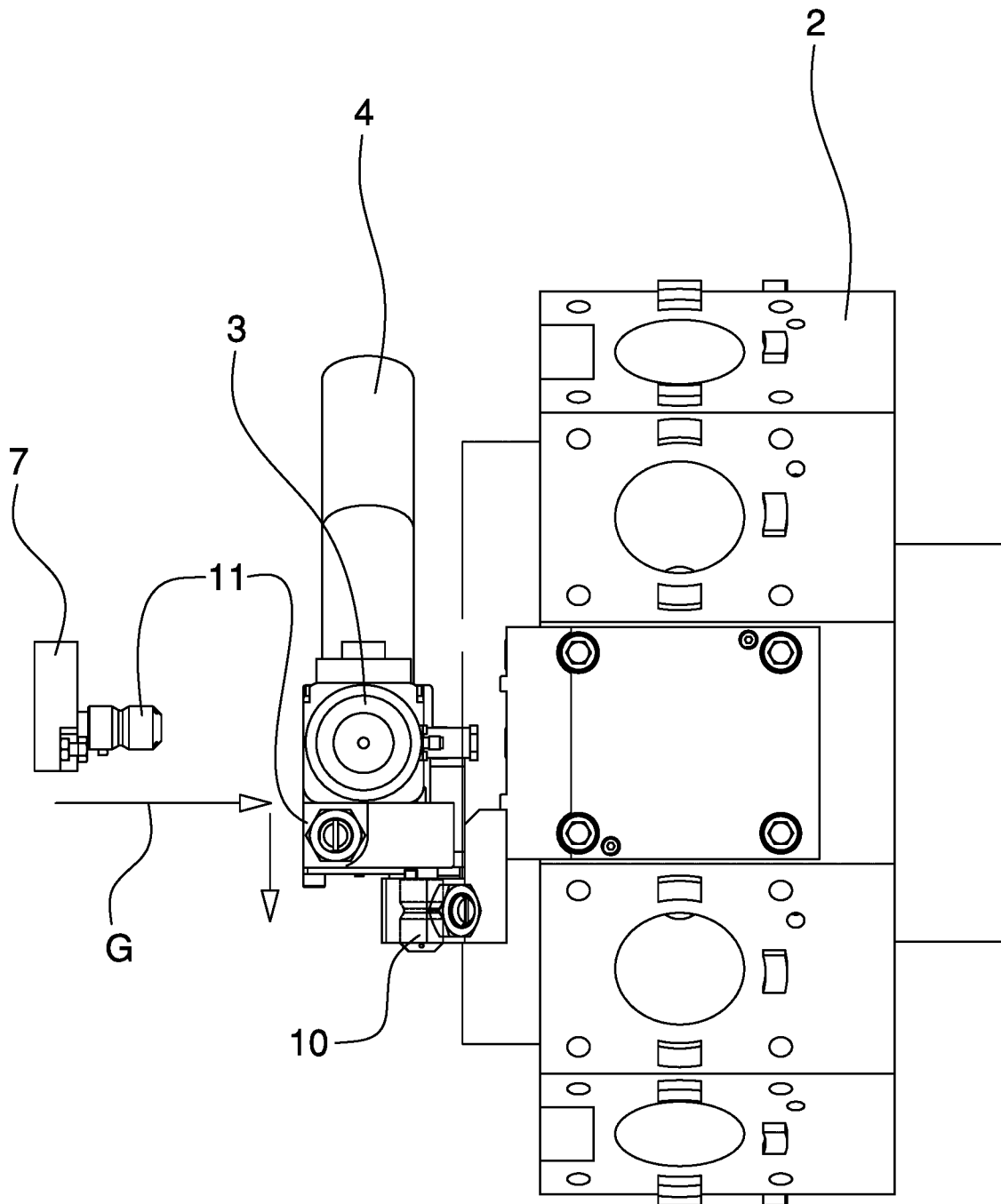


Fig. 15

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2016/054065

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23Q3/155 B23B3/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B23Q B23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2014/157559 A1 (HESSBRUEGGEN MARKUS [DE]) 12 June 2014 (2014-06-12) the whole document	1-18
X	DE 195 21 846 A1 (GILDEMEISTER AG [DE]) 19 December 1996 (1996-12-19) the whole document	1-18



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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Date of the actual completion of the international search

24 October 2016

Date of mailing of the international search report

03/11/2016

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/054065

Patent document cited in search report	Publication date	Patent family member(s)	Publication date	
US 2014157559	A1	12-06-2014	CN 103862317 A	18-06-2014
			DE 102012023973 A1	12-06-2014
			US 2014157559 A1	12-06-2014

DE 19521846	A1	19-12-1996	NONE	
