



- (51) International Patent Classification:
B23Q 11/00 (2006.01)
- (21) International Application Number:
PCT/EP2015/078759
- (22) International Filing Date:
7 December 2015 (07.12.2015)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
1451622-3 19 December 2014 (19.12.2014) SE
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- (81) Designated States (*unless otherwise indicated, for every
kind of national protection available*): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG,
MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM,
PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC,
SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States (*unless otherwise indicated, for every
kind of regional protection available*): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ,
TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU,
TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE,
DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: PNEUMATIC DRILLING TOOL WITH DISPOSAL COLLECTOR

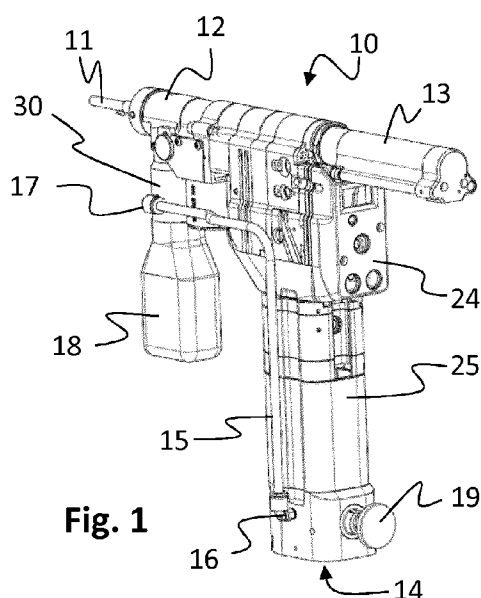


Fig. 1

(57) Abstract: A pneumatic drilling tool (10) comprising a spindle (21), a pneumatic motor for driving said spindle (21), an air inlet portion (14) for supplying pressurised air to drive the motor, a housing (12,13, 25) that at least partly houses the motor and the spindle (21), wherein the spindle (21) is configured to hold a drilling implement (11), which is arranged to extend out from a front housing (12) of said housing during operation. A disposal collector (18) is arranged for collecting drill chips (22) during operation, wherein an air nozzle (23) is arranged in a flow passage (30) adjacent the front housing (12), the nozzle having an outlet (26) that is directed away from the front housing (12) into the disposal collector (18) to thereby create a suction effect from the front housing (12) into the disposal collector (18), which disposal collector (18) has a permeable portion (28) that allows air to pass through it but keeps the drill chips inside, wherein an air conduction conduit (15) is arranged from the air inlet portion (14) to the air nozzle (23) to provide the suction effect.

Pneumatic drilling tool with disposal collector

The invention relates to a pneumatic drilling tool with a disposal collector. Specifically, the invention relates to a pneumatic power tool with a self-supported disposal collector arranged upon it.

5 Background

During operation of machining or material removal power tools such as drilling machines or grinders debris is produced. Most such tools are therefore provided with an arrangement for collecting such debris. Normally, a hose from a separate vacuum unit is arranged and connected
10 to the debris producing end of the power tool.

The arrangement of a separate vacuum unit for removing debris is however cumbersome and it would be beneficial to have the disposal unit arranged as an integrated part of the tool.

In US 3 638 737 a pneumatic drill with a dust removal apparatus. In
15 the dust removal apparatus the exhaust air from the drill is conveyed so as to encapsulate and direct debris into a disposal unit arranged close to the hole being drilled. This is advantageous as it implies that a separate vacuum unit is no longer needed.

Similar arrangements are known from US 1 084 152 and US 1 023 594.

20 A problem in common for these prior art arrangements is that they need to be optimised for a specific operation speed of the motor, such that they will be less functional for any other motor speed. Further, such a prior art arrangement requires that the outlet is located close to the tool implement such that the outlet air may be conveyed to the
25 grinding disc and force the debris towards a collector. A further problem is that all of the exhaust air needs to pass through the collector, which sets high demands on the construction of the collector, such as the permeability of the collector walls.

There is hence a need for a pneumatic drilling tool with an improved arrangement for collecting debris that is self-supported, i.e. not dependent on external driving.

Summary of the invention

5 An object of the invention is to provide self-supporting debris collector for a pneumatic drilling tool that is reliable and independent of motor speed.

This object is achieved by the invention according to claim 1, which relates to a pneumatic drilling tool comprising:

- 10 - a spindle,
- a pneumatic motor for driving said spindle,
- an air inlet portion for supplying pressurised air to drive the motor,
- a housing that at least partly houses the motor and the spindle,
- 15 wherein the spindle is configured to hold a drilling implement, which is arranged to extend out from a front housing of said housing during operation, and
- a disposal collector for collecting drill chips, wherein a flow passage is arranged to connect the disposal collector to the front
- 20 housing. An air nozzle is arranged in the flow passage, the nozzle having an outlet that is directed away from the front housing into the disposal collector to thereby create a suction effect from the front housing towards the disposal collector, which disposal collector has a permeable portion that allows air to pass through it but keeps the
- 25 drill chips inside, wherein an air conduction conduit is arranged from the air inlet portion to the air nozzle to provide the suction effect.

The fact that an air conduction conduit is arranged from the air inlet portion, i.e. upstream of the motor, to the air nozzle makes it possible to customize the suction effect such that it will always have

30 a desired effect, which is independent of the current motor effect.

Instead it is proportional to the input pressure delivered from the pressurised air source to the inlet portion.

In a specific embodiment flow restrictions are arranged in the flow passage that restricts the sectional area of the flow passage around the nozzle, so as to create a venturi effect and increase the suction effect when in operation.

In another embodiment a main valve is arranged in the air inlet portion, which is shiftable between an open and a closed position, and which in the open position allows air to pass from the air inlet portion to the motor, and wherein an outlet conduit is arranged on an output side of the main valve, which connects the air inlet portion with the air nozzle when the main valve is open.

In yet another embodiment a sensor is arranged to monitor the pressure in the disposal collector and to alert if the pressure exceeds a predetermined threshold pressure indicating that the disposal collector needs to emptied or replaced.

Other features and advantages of the invention will be apparent from the figures and from the detailed description of the shown embodiment.

Short description of the drawings

In the following detailed description reference is made to the accompanying drawings, of which:

Fig. 1 is a perspective view of a pneumatic drilling tool in accordance with a specific exemplifying embodiment of the invention;

Fig. 2 is a front view of the pneumatic drilling tool in fig. 1;

Fig. 3 is a sectional view of the pneumatic drilling tool along the line III-III in fig. 2;

Fig. 4 is a side view of the specific embodiment of the pneumatic drilling tool;

Fig. 5 is a sectional view of the pneumatic drilling tool along the line V-V in fig. 4;

5 **Fig. 6** is a perspective view from below of the specific embodiment of the pneumatic drilling tool; and

Fig. 7 is a detailed view of a part of fig. 6.

Detailed description of the shown embodiment of the invention

In fig. 1 a pneumatic drilling tool 10 according to a specific
10 exemplifying embodiment of the invention is shown. The drilling tool 10 has a housing 25 that houses a pneumatic motor and a spindle, which is driven by said motor. A rear part of the spindle is covered by a rear housing part 13. The spindle is configured to hold a drilling implement 11, which is arranged to extend out from a front housing
15 part 12. A disposal collector 18 for collecting drill chips during operation is arranged adjacent the front housing part 13. A control panel 24 is arranged on a rear end of the drilling tool 10. The control panel 24 typically comprises a start button, a release button and a retract button. The retract button interrupts an on-going
20 operation and the release button is utilised when the tool is moved in and out of working position as described below. An air inlet portion 14 is arranged at the lower end of the drilling tool. An emergency stop 19 is arranged at the air inlet portion 14 to rapidly close a main valve arranged inside said air inlet portion 14.

25 An air conduit 15 is arranged to conduct pressurised air from an air conduit inlet 16 at the air inlet portion 14 to an air conduit outlet 17 at a flow passage 30 connecting the front housing part 12 and a disposal collector 18. As an alternative the air conduit 15 may be arranged inside tool housing 25. An advantage of having the conduit on

the outside of the tool is that it may be implemented on existing tool without demanding a very big effort.

The general function of the drilling tool 10 will now be described with reference to figure 3, which shows a sectional view of the drilling tool along the line III-III in figure 2.

In figure 3 a mantle portion 32 that forms an extension of the front housing part is shown. This mantle portion 32 is not shown in the other figures. The mantle portion 32 serves two main purposes; firstly it may be used to position and fix the drilling tool with respect to a fixture where drilling operations are to be performed. The diameter of the mantle portion 32 may be reduced by pressing the release button on the control panel 24. In the release state the mantle portion 32 may be fitted into a fixture hole and by pressing the release button once again when the mantle portion 32 is in location it will expand so as to fix the mantle portion 32 inside the fixture hole in order to hold the drilling 10 tool still.

The mantle portion 32 encloses the drilling implement 11. As a consequence, when a suction force is created in the flow passage 30, the chips 22 that are removed during the drilling operation will be conveyed from inside of the mantle portion 32 into the front housing part 12 and further into the disposal collector 18, via a suction port 29 and the flow passage 30.

The disposal collector 18 has a permeable portion 28 that allows air to pass through it but keeps the drill chips 22 inside. The permeable portion 28 may extend over the whole envelope surface of the disposal collector 18 or may extend over only a portion of envelope surface depending on the application. Often, a cooling liquid is used. The cooling may be applied through the centre of the drilling implement and will enclose the drill chips 22 and hence be sucked into the disposal collector 18 along with said chips. For such applications the disposal collector 18 needs to be adapted to withheld not only metal

chips, but also a liquid. Since the liquid and the drill chips will end up in the lower portion of the disposal collector 18, it may be a good idea to provide the air permeable portions 28 in the upper portion of the disposal collector 18, i.e. close to the flow passage in which the air nozzle 23 is arranged. The permeable portions may be arranged as net, as pockets, or as any other gas allowing detail or fabric.

The disposal collector 18 may also be arranged at a distance from the power tool 10. The flow passage 30 may in one embodiment be a hose that conveys air, cooling liquid and chips towards a distant disposal collector arranged at a distance from the power tool. The size of the disposal collector may be adapted to different applications and

The function of the suction system will now be described with reference to figure 5. Figure 5 is a sectional view of the disposal collector 18 taken along the line V-V in figure 4.

An air nozzle 23 is arranged inside the flow passage 30 close to the suction port 29 that opens from the front housing 12. The nozzle 23 has an outlet 26 that is directed away from the front housing 12, downwards, into the disposal collector 18 to thereby create a suction effect from the front housing 12 into the disposal collector 18. In the shown embodiment flow restrictions 31 are arranged in the flow passage 30 that restricts the sectional area of the flow passage 30 around the nozzle 23, so as to create an increased venturi effect and increase the suction effect when in operation.

The air flow created by pressurised air exhausted from the outlet 26 of the air nozzle 23 is directed downwards in the figure. Liquid and solid particles that are sucked through the suction port 22 will be trapped in the bottom of the disposal collector and the pressurised air will be exhausted through the air permeable portions 28, which

preferably are located in the upper portion of the disposal collector 18.

In a specific embodiment of the invention a sensor is arranged to monitor the pressure in the disposal collector 18 and to alert if the pressure exceeds a predetermined threshold pressure indicating that the disposal collector 18 needs to be emptied or replaced. The sensor may e.g. be a pressure sensor or a flow meter arranged in connection to the air conduction conduit 15. The threshold may be empirically set so as to allow an on-going operation to be concluded before the disposal collector 18 needs to be emptied or replaced, or it may be set to automatically initiate a termination of an on-going operation.

The function of the air provision system for the suction system will now be described with reference to figure 7. Figure 7 is a detailed view of a part of the drilling tool shown in figure 6.

The air inlet portion 14 is adapted for connection to a supply unit of pressurised air, such as an air hose. A main valve 20 is arranged in the conduit that connects the air inlet portion 14 with the pneumatic motor (not shown). The main valve 20 may be positioned in an open or a closed position. A separate regulator (not shown) is arranged between the main valve 20 and the motor for providing a correct pressure or flow to the motor. Hence the pressure will be the same on both sides of the main valve 20 when positioned in the open state.

An outlet conduit 27 is arranged on the output side of the main valve 20. The outlet conduit 27 connects the air inlet portion 14 with the air nozzle 23 when the main valve is open. Given that no pressure is lost over the main valve 20 the pressure will be held constant, typically about 6.3 bars at the inlet of the outlet conduit 27. The outlet conduit 27 and the air conduction conduit 15 will however imply a certain controlled choking effect such that the pressure acting at the air nozzle 23 is only a fraction of the full pressure. It is obvious for a skilled person to try out a pressure that is suitable

for a specific type of disposal collector 18 and for a specific construction of a suction port 29, front housing 12 etc.

An advantage of having the outlet conduit 27 for supply of pressurised air to the air suction system located at the output side of the main valve 20 is that the suction system will automatically be initiated when the machine is turned on, i.e. when the main valve is opened, and automatically shut-off when the machine is turned off, i.e. when the main valve is closed. It may however also be possible to have a separate valve for controlling the air supply to the suction system such that it may be individually controlled.

Above, the invention has been described with reference to a specific embodiment. The invention is however not limited to this embodiment. It is obvious to a person skilled in the art that the invention comprises further embodiments within its scope of protection, which is defined by the following claims.

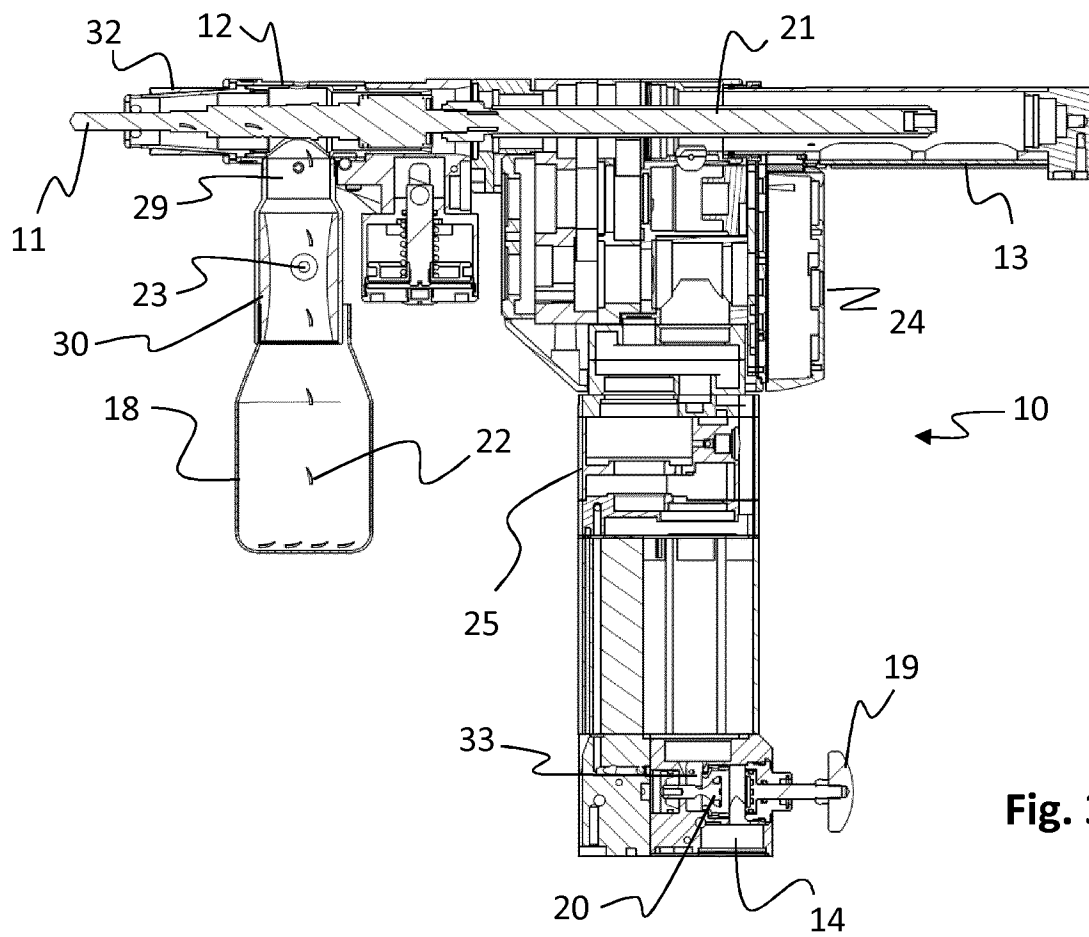
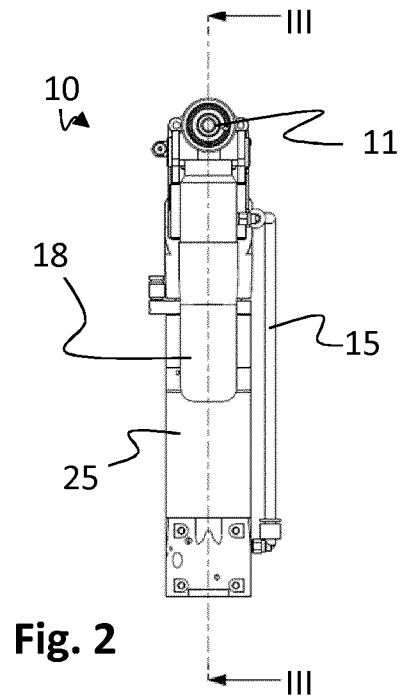
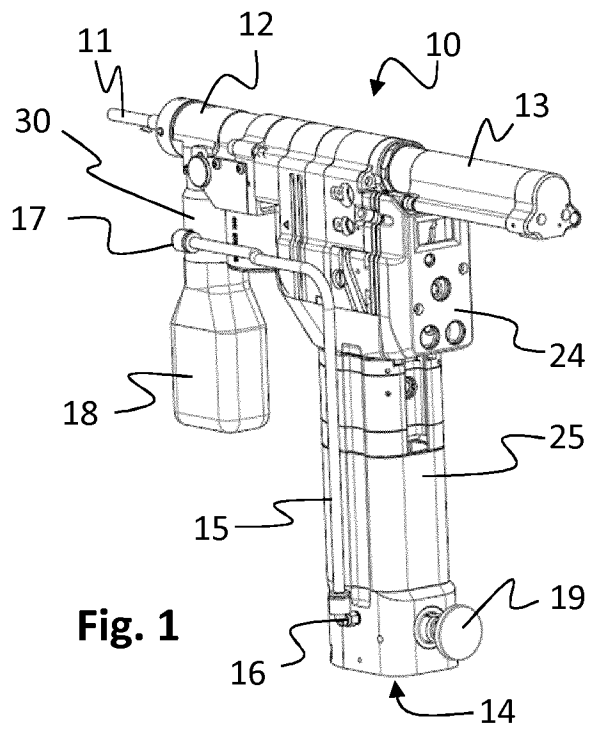
Claims

1. A pneumatic drilling tool (10) comprising:
 - a spindle (21),
 - a pneumatic motor for driving said spindle (21),
 - 5 - an air inlet portion (14) for supplying pressurised air to drive the motor,
 - a housing (12,13,25) that at least partly houses the motor and the spindle (21), wherein the spindle (21) is configured to hold a drilling implement (11), which is arranged to extend out
 - 10 from a front housing (12) of said housing during operation, and
 - a disposal collector (18) for collecting drill chips (22), wherein a flow passage (30) is arranged to connect the disposal collector (18) to the front housing (12), **characterised in** that an air nozzle (23) is arranged in the flow passage (30) the
 - 15 nozzle having an outlet (26) that is directed away from the front housing (12) into the disposal collector (18) to thereby create a suction effect from the front housing (12) into the disposal collector (18), which disposal collector (18) has a permeable portion (28) that allows air to pass through it but keeps the
 - 20 drill chips inside, wherein an air conduction conduit (15) is arranged from the air inlet portion (14) to the air nozzle (23) to provide the suction effect.
2. The pneumatic drilling tool (10) according to claim 1, wherein flow restrictions (31) are arranged in the flow passage (30) that
- 25 restricts the sectional area of the flow passage around the nozzle, so as to create a venturi effect and increase the suction effect when in operation.
3. The pneumatic drilling tool (10) according to claim 1 or 2, wherein a main valve (20) is arranged in the air inlet portion
- 30 (14), which is shiftable between an open and a closed position, and which in the open position allows air to pass from the air inlet portion (14) to the motor, and wherein an outlet conduit

(27) is arranged on an output side of the main valve (20), which connects the air inlet portion (14) with the air nozzle (23) when the main valve is open.

4. The pneumatic drilling tool (10) according to claim 1 or 2,
5 wherein a sensor is arranged to monitor the pressure in the disposal collector (18) and to alert if the pressure exceeds a predetermined threshold pressure indicating that the disposal collector (18) needs to be emptied or replaced.

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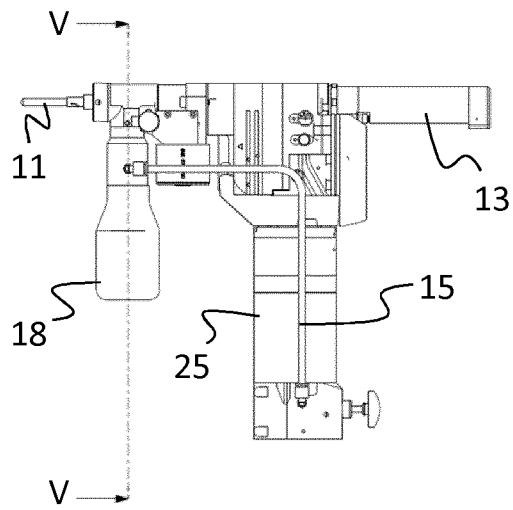


Fig. 4

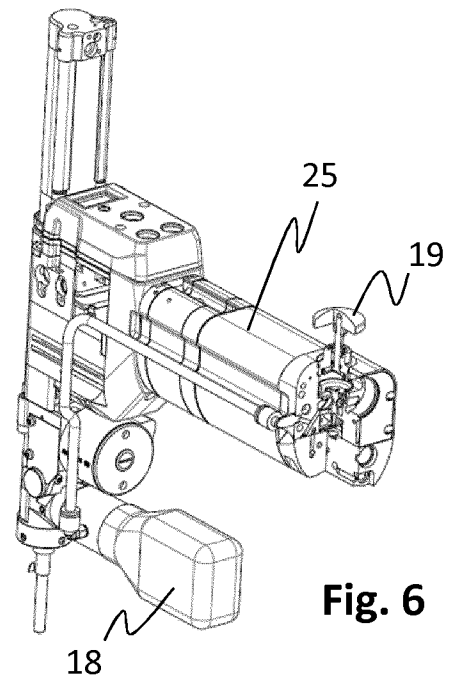


Fig. 6

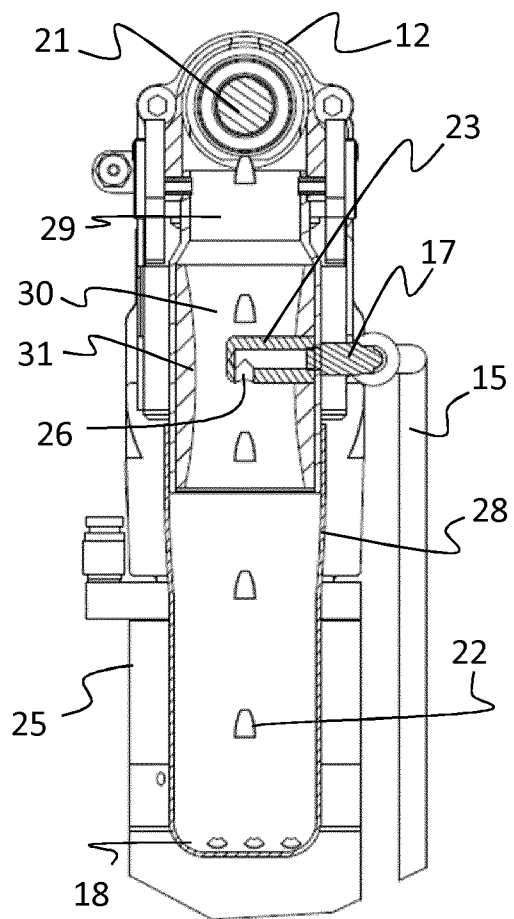


Fig. 5

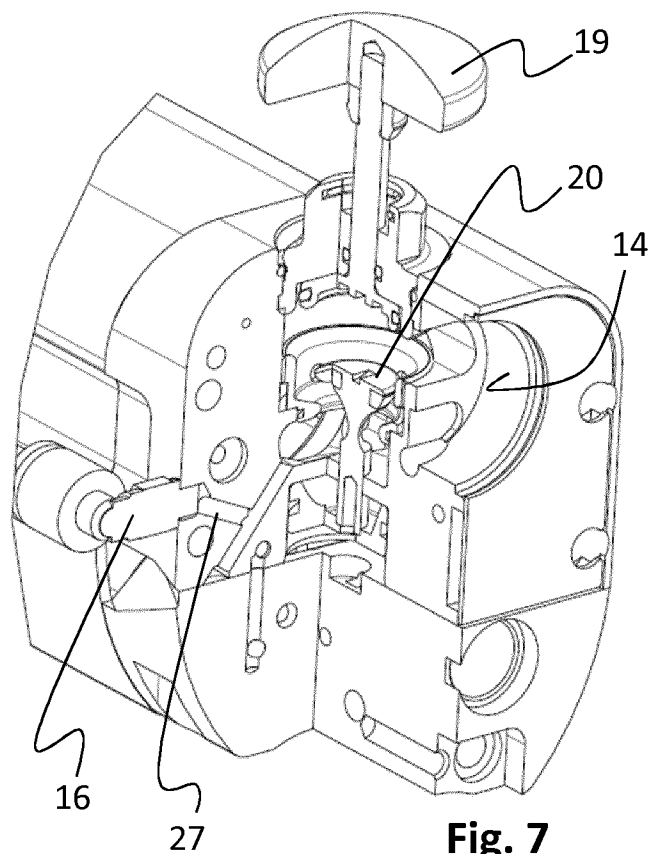


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/078759

A. CLASSIFICATION OF SUBJECT MATTER
INV. B23Q11/00
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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 1 301 137 A (FERDINAND SPITZNAS MASCHINENFA) 10 August 1962 (1962-08-10) the whole document -----	1-4
X	GB 1 593 279 A (COMPAIR IND LTD) 15 July 1981 (1981-07-15) figures 1-5 -----	1,2
X	US 2009/214307 A1 (NGUYEN PETER D [US]) 27 August 2009 (2009-08-27) paragraph [0054]; figures 4,8 -----	1
X	US 1 223 027 A (BRACKETT GEORGE C [US]) 17 April 1917 (1917-04-17) figures 1,5 ----- -/-	1-3



Further documents are listed in the continuation of Box C.



See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 February 2016

Date of mailing of the international search report

03/03/2016

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2015/078759

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 950 550 A1 (A M D P [FR]) 1 April 2011 (2011-04-01) page 6, lines 1-7; figure 1b -----	1-3
A	US 2004/060719 A1 (WIBORG LANCE W [US]) 1 April 2004 (2004-04-01) paragraphs [0002], [0015], [0027]; figure 5 -----	1
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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GB 1593279	A	15-07-1981	NONE	
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