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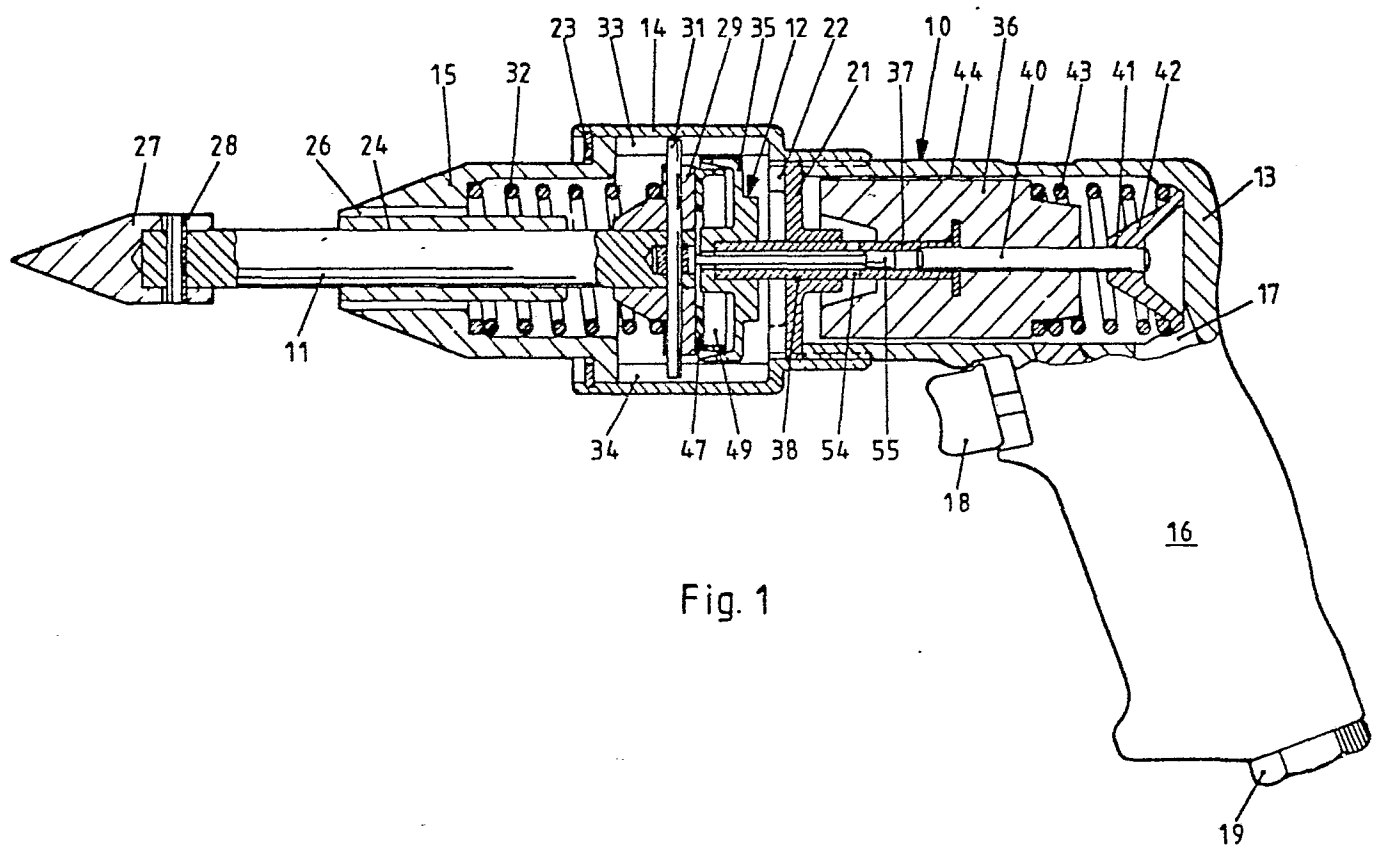
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⑤④ **Pneumatic reciprocating mechanism.**

⑤⑦ A pneumatic reciprocating mechanism comprising a working member (11) reciprocably powered in a housing (10) and forming together with a vibration absorbing reaction support member (12) and an elastic seal element (47) a working chamber (49) which is supplied with pressure via an air feed valve (54,55). The latter is positively coupled to the working member (11) and controls the air flow through openings (54) in the reaction support member (12) in response to the relative positions of the working member (11) and the reaction support member (12).

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Pneumatic reciprocating mechanism

This invention relates to a pneumatic reciprocating mechanism. In particular the invention concerns a reciprocating mechanism of the type having a reciprocable working member which together with a reaction support member defines a pressure air supplied working chamber.

- 5 The working member is balanced by on one hand the pressure in the working chamber and on the other hand the action of a spring.

In US Patent No 2.432.877 there is shown a pneumatic impact tool including an reciprocating mechanism of the above described type. This prior art device comprises a reciprocable working member equipped at
10 its forward end with a chisel bit and is spring biased toward an apertured resilient diaphragm. The pressure from a continuously pressure air supplied working chamber acts upon the working member and moves it forwards. The diaphragm is arranged to control the air outlet from the working chamber in response to the position of the working member.

- 15 The above described prior art impact mechanism suffers from the drawback of having a considerably high air consumption. This is due to the fact that pressure air is continuously supplied to the working chamber, even during the venting sequence of the working cycle, i.e. when the diaphragm has lost its sealing contact with the working member. During
20 that part of the working cycle pressure air may unrestrictedly rush right through the working chamber from the inlet passage to the atmosphere.

The present invention intends to create an improved reciprocating mechanism by which the above mentioned problem is solved. This is ac-

complied by the invention as it is defined in the claims.

An embodiment of the invention is hereinbelow described in detail under reference to the accompanying drawings on which

FIG 1 shows, partly in section, a side elevation of a hand tool including an reciprocating mechanism according to the invention,

FIG 2 shows, on a larger scale, the working member, the reaction support member and the elastic seal element of the device in FIG 1. The working member is illustrated in its rearmost position in which the air feed valve is fully open,

FIG 3 shows the same details as FIG 2 but illustrates the working member during acceleration forwards, and

FIG 4 shows the same details as FIG 2 but illustrates the working member in its forwardmost position in which the air feed valve is fully closed.

The impact tool shown in FIG 1 is a light chisel driving pneumatic tool provided with a pistol grip at its rear end. The tool comprises a housing 10, a reciprocating working member 11 and a reaction support member 12.

The tool housing 10 consists of three main parts, namely a rear section 13, an intermediate section 14 and a front section 15. The rear section 13 is formed in one piece with a pistol grip 16 by which the tool is supported by the operator. The pistol grip 16 includes a pressure air supply passage 17, a throttle valve (not shown) operated by a trigger 18 and a nipple 19 for connection of a pressure air supply conduit.

The intermediate housing section 14 is threaded onto rear section 13, and a transverse wall 21 is clamped between the forward end of the rear section 13 and an inner shoulder 22 on the intermediate section.

The front section 15 is received in the forward end of the intermedi-

ate section 14 and is locked thereto by a lock ring 23. The front section 15 is provided with an axially extending bore 24 for guiding support of working member 11. The front section 15 also comprises a couple of forwardly directed air outlet passages 26.

5 At its forward extremity, the working member 11 is provided with a chisel bit 27. The latter is positively locked thereto by means of a transverse split pin 28. At its rear end, the working member 11 carries an activation head 29. The latter is secured to the working member 11 by a transverse lock pin 31. A compression spring 32, is inserted between the activation head 29 and the front section 15 of the housing 10 so as to apply a rearwardly directed biasing force on the working member 11. The lock pin 31 extends in opposite directions laterally beyond the head 29 to engage two longitudinally extending grooves 33, 34 in the intermediate section 14 of the housing 10, thereby preventing the working member 11 to rotate relative to the housing 10.

In the illustrated tool, the reaction support member 12 is reciprocally guided relative to the housing 10. The reaction support member 12 comprises a reaction head 35, a high inertia balancing weight 36, and a hollow stem 37 rigidly interconnecting the reaction head 35 and the balancing weight 36. Preferably, the balancing weight 36 is made of lead in order to obtain a high as possible inertia. The stem 37 is longitudinally guided in a central opening 38 of the transverse wall 21 and forms an axial air passage 39. A guide pin 40 is rigidly secured relative to the balancing weight 36 and extends rearwardly therefrom to be guidedly received in a central bore 41 of a conical support element 42. The latter is located at the bottom of the rear housing section 13 and forms a reaction support for a compression spring 43 the opposite end of which takes support against the rear end of the balancing weight 36.

30 The reaction support member 12 is displaceably guided relative to the housing 10 by its hollow stem 37 cooperating with the central opening 38 of the transverse wall 21 and by its guide pin 40 cooperating with the central bore 41 of the support element 42. This means that the balancing weight 36 is kept out of any contact with the inside wall 35 of the housing section 13. Instead, there is left an annular space 44 between the balancing weight 36 and section 13 for communicating pres-

sure air from passage 17 in the handle 16 to the forward end of weight 36.

The activation head 29 of the working member 11 is formed with a flat rear end surface 46 for axially supporting an elastic seal element 47.
5 (See FIG 2-4). The latter has a flat back surface which is kept in continuous contact with surface 46 of the activation head 29 just by the action of pressure air. The seal element 47 is formed with an annular rearwardly extending valve collar 48 for sealing cooperation with the reaction head 35 of the reaction support member 12, as described below.

10 Between the activation head 29, the reaction head 35 of the reaction support member 12 and the seal element 47 there is formed a working chamber 49. In order to give the latter a suitable volume and to match the shape of the seal element 47, the reaction head 35 is provided with an annular depression 51 which is coaxial with the seal element 47 and
15 defined by an inwardly facing, peripheral wall 52. The latter diverge by a small angle toward the seal element 47 and has a minimum diameter slightly exceeding the nominal outer diameter of the valve collar 48. In its central part, the reaction head 35 is provided with an axial opening 53 communicating with the longitudinal passage 39 of stem 37,
20 and, via a couple of lateral openings 54 in stem 37, the working chamber 49 is able to communicate with the annular space 44 and the air supply passage 17.

In order to control the pressure air supply to the working chamber 49, there is provided a feed valve operating within the longitudinal passage
25 39 of the stem 37 to control the air flow through the lateral openings 54. The feed valve comprises a cylindrical element 55 sealingly guided in passage 39 and coupled to the working member 11 by means of a rod 56 extending through passage 39. Rod 56 is of a considerably less diameter than passage 39 and is secured relative to the working member 11
30 by the transverse lock pin 31.

The operation order of the shown chisel driving tool will hereinafter be described with reference to the drawings.

As a pressure air conduit is connected to nipple 19 and trigger 18 is

pulled, pressure air enters the rear end of section 13 of the housing 10 via air supply passage 17. The pressure air passes the annular space 44 between the balancing weight 36 and the housing section 13 and reaches the lateral openings 54 of stem 37.

5 Under the assumption the impact mechanism from start occupies its rest position as illustrated in FIG 1, i.e. the working member 11 and the reaction support member 12 occupy there closest positions under the action of springs 32 and 43, a full operation cycle will be described. In this position, the feed valve element 55 does not at all restrict the
10 openings 54 which means that pressure air unrestrictedly enters and follows passage 39 and reaches the working chamber 49 through opening 53 in reaction head 35.

As the working chamber 49 is pressurized, the valve collar 48 of the elastic seal element 47 is urged outwardly into sealing contact with
15 the peripheral wall 52 of the reaction head 35. The pressure within the working chamber 49 now increases rapidly and a driving force upon activation head 29 is obtained and a work stroke of the working member 11 is commenced.

Due to the pressure in the working chamber 49, the working member 11 is
20 moved forwards against the action of spring 32, and since the pressure acts upon the reaction head 35 as well, the reaction support member 12 starts to move backwards against the action of spring 43. Since the mass of the working member 11 is much less than that of the reaction support member 12 (weight 36), the acceleration of the working member 11 is much
25 higher.

During the separation movement of the working member 11 and the reaction support member 12, the valve collar 48 of the seal element 47 maintains its sealing contact with the peripheral wall 52, and as the latter is conically diverging, the valve collar 48 is expanded successively by the
30 air pressure to a diameter exceeding its normal outer diameter (see FIG 3).

When the working and reaction support members 11 and 12, respectively, have reached as far as to the position illustrated in FIG 3, the sealing

contact between the valve collar 48 and the peripheral wall 52 cannot be maintained any longer, and a sudden pressure drop occurs as the pressure air is able to rush out through the large area gap formed between the parting members.

- 5 In order to prevent pressure air from just rushing through the working chamber 49 during this venting sequence of the working cycle, the feed valve 55 has already cut off the air supply path by covering the openings 54. In this way, the feed valve is able to effectively reduce the air consumption of the tool.
- 10 In the position shown in FIG 4, the sealing contact between valve collar 48 and the peripheral wall 52 is broken, the pressure air supply to the working chamber 49 is cut off by valve 55 and the valve collar 48 of the seal element 47 has reassumed its nominal diameter. In this position, the work stroke is over and the working member 11 and the reaction
15 support member 12 start moving towards each other under the action of springs 32 and 43.

When the working member 11 and the reaction support member 12 come close together, the pressure within the working chamber 49 rapidly increases. This is due partly to compression of the air being left between the two
20 parts and partly to the fact that feed valve 55 is reopened allowing pressure air to enter the working chamber 49. When the pressure drop across the rim of the valve collar 48 reaches a certain magnitude, the valve collar 48 is expanded to reassume its sealing contact with the peripheral wall 52 of the reaction head 35. A full working cycle is
25 thereby completed.

The exhaust air leaving the working chamber 49 during operation of the mechanism is collected in the intermediate section 14 of the housing 10 and leaves the tool via the outlet openings 26 in the front housing section 15.

- 30 The characteristic feature of the reciprocating mechanism according to the invention is the feed valve being employed in the pressure air supply passage so as to obtain a reduction of the air consumption in relation to previous devices without affecting the output power of the device.

During tests, we have observed a reduction of as much as 30% of the pressure air consumption when utilizing a reciprocating mechanism according to the invention instead of a prior art device.

It is to be understood that the embodiments are not limited to the
5 shown and described example. For instance, a mechanism designed in accordance with the invention is not limited to vibration damped embodiments including reciprocating support members. Neither is the invention limited to the seal element design of the disclosed embodiment.

CLAIMS

1. Reciprocating mechanism comprising a displaceable working member (11) a reaction support member (12), and a pressure air supplied working chamber (49), arranged between the working member (11) and the reaction support member (12), characterized by a pressure air feed valve (54,55) which is positively coupled to the working member (11) and the reaction support member (12) for controlling the pressure air supply to the working chamber (49) in response to the relative position of the working member (11) and the reaction support member (12).
2. Mechanism according to claim 1, wherein the reaction support member (12) comprises an air supply passage (39,53,54) and the pressure air feed valve comprises a valve element (55) associated with the working member (11), and that said valve element (55) is arranged to control the pressure air flow through said passage (39,53,54).
3. Mechanism according to claim 2, wherein said air supply passage (39, 53,54) comprises a longitudinal bore (39) extending in the reciprocating direction of the working member (11) and one or more lateral openings (54) communicating with said bore (39), and that said valve element (55) is sealingly guided in said bore (39) and movable therein between a closed position in which said lateral opening or openings (54) are covered and an open position in which said lateral opening or openings (54) are uncovered.
4. Mechanism according to claim 3, wherein said longitudinal bore (39) communicates directly with the working chamber (49) and said lateral opening or openings (54) communicate with the pressure air source, said feed valve element (55) being connected to the working member (11) by means of a rod (56) extending through said longitudinal bore (39) and having a cross section that is considerably less than that of said bore (39)
5. Mechanism according to claim 4, the reaction support member (12) of which is displaceably guided and comprises a reaction head (35) partly defining the working chamber (49) and receiving the reactive force arising therein, a high inertia balancing weight (36) and a stem portion (37)

rigidly interconnecting said reaction head (35) and said balancing weight (36), wherein said longitudinal bore (39) extends coaxially through said reaction head (35) and said stem portion (37).

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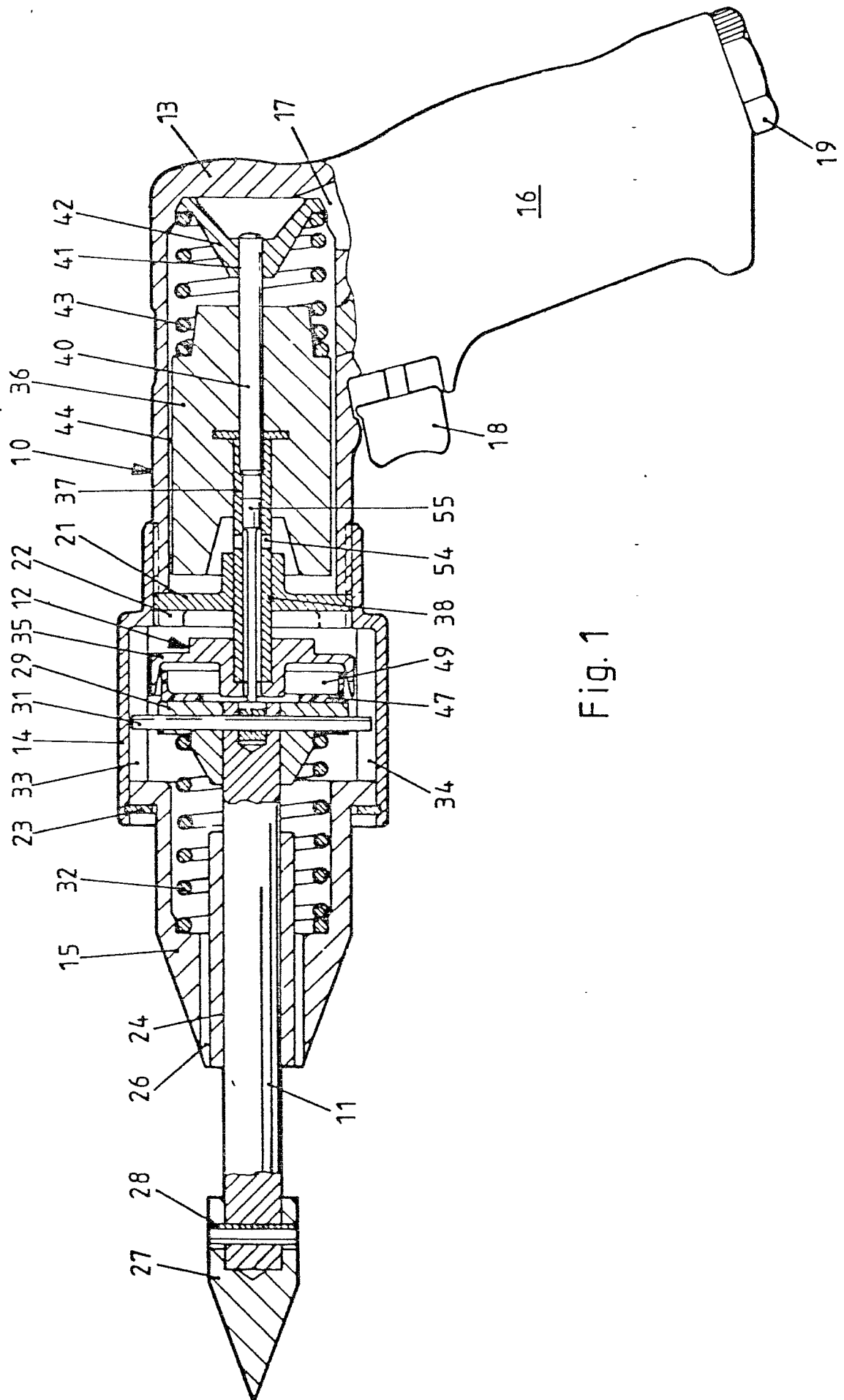


Fig. 1

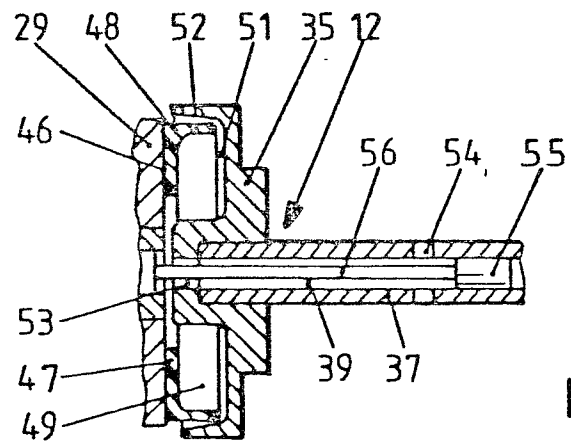


Fig. 2

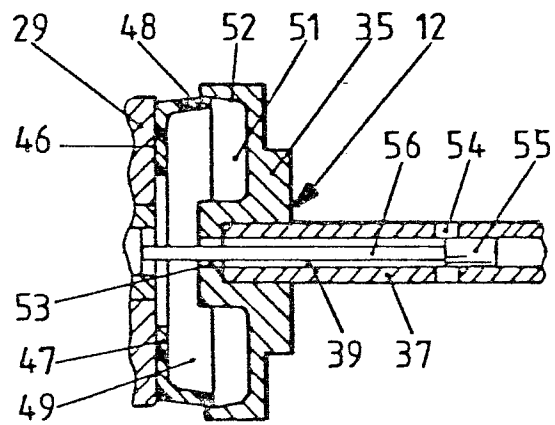


Fig. 3

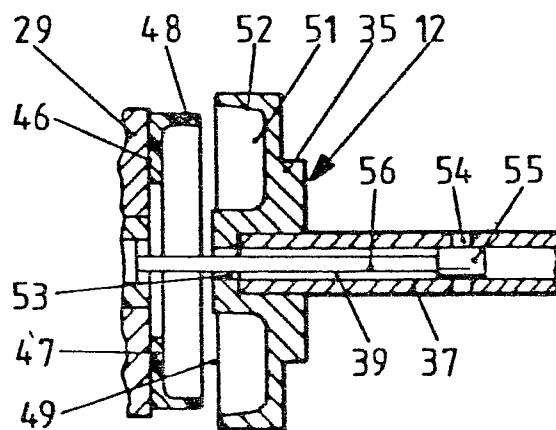


Fig. 4



European Patent
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EUROPEAN SEARCH REPORT

0022428

Application number

EP 80 85 0034.2

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. CL ³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
	DE - A1 - 2 710 920 (NILSSON et al.) * page 6, line 1 to page 9, line 9; fig. 1 * -- FR - A1 - 2 306 796 (NILSSON et al.) * claims 1 to 5; fig. 10 to 12 * -- DE - A - 2 235 817 (CHICAGO PNEUMATIC TOOL CO.) * claims 1 to 3; fig. 1, 6 * ----	1 : 1 1,2	B 25 D 9/16
			TECHNICAL FIELDS SEARCHED (Int. CL ³)
			B 25 D 9/00 B 25 D 17/24
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
X The present search report has been drawn up for all claims			&: member of the same patent family, corresponding document
Place of search		Date of completion of the search	Examiner
Berlin		15-10-1980	HOFFMANN