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(54) Centreless grinder.

(57) An engine valve (3) which comprises a head (3b) and a stem (3a) is put and ground between the grinding (4) and adjusting (5) wheels in a centerless grinder. The head (3b) is projected at one end of the engine valve (3) from the grinding wheel (4). Thrust force is given towards the projected end of the engine valve by inclining the adjusting wheel (5), and the projected end of the engine valve (3) is supported by an engaged portion of a stopper device (13). The stem (3a) of the engine valve (3) is accurately ground by the width of the grinding wheel (4) from the projected end of the engine valve (3).

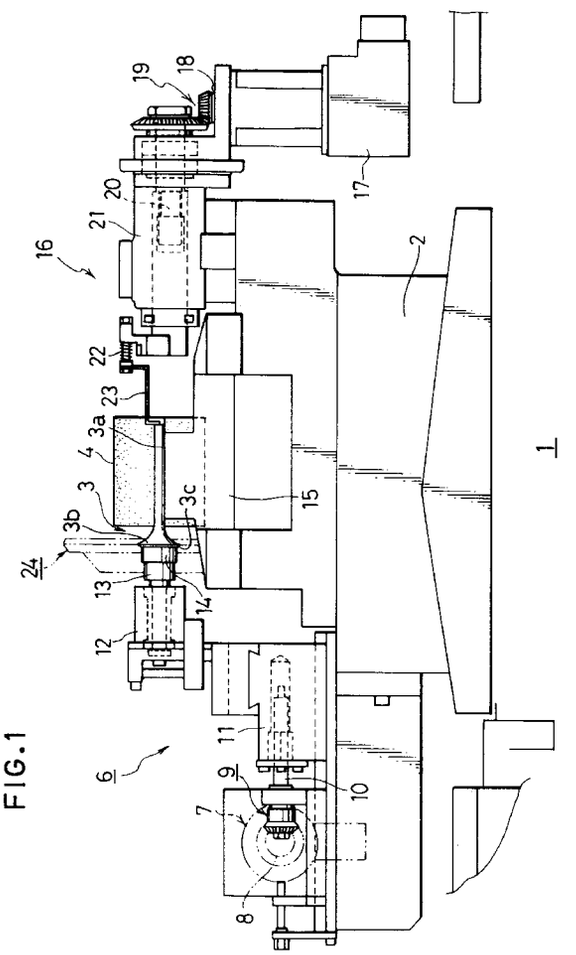

FIG.1

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BACKGROUND OF THE INVENTION

The present invention relates to a centerless grinder for grinding a head or a stem of a workpiece such as an engine valve in which the head is provided at the end of the stem.

A poppet valve is used as an engine valve in an internal combustion engine, comprises a head and a stem, and is finished through various kinds of mechanical steps which includes processing the stem by a centerless grinder.

Fig. 5 shows a main portion of a conventional centerless grinder in which a grinding wheel 104 for grinding a stem 103a of an engine valve 103 is mounted to a shaft 102 of a first motor 101, and an adjusting wheel 108 is mounted to a shaft 107 of a second motor 106, the stem 103a of the engine valve 103 being put between the grinding and adjusting wheels 104 and 108.

The axis of the shaft 107 of the adjusting wheel 108 is inclined such that the head 103b of the engine valve 103 is slightly higher, thereby providing the engine valve 103 with thrust force towards the end. The end 103c of the stem 103a is engaged with a positioning stopper 109 which is axially movable. The motors 101 and 106 are rotated in the same direction, so that the engine valve 103 is engaged with the positioning stopper 109 and positioned, in which the stem 103a is ground.

However, there are disadvantages when thrust force is given in a direction of the end to engage the end of the stem 103 with the stopper 109 to grind the engine valve 103 from the end. The engine valve 103 is generally molded by hot squeeze forging, but it is liable to cause variations in the full length of the engine valves 103 thus molded. To grind the stem 103a of the engine valve accurately by a fixed ground length, the outer circumferential surface of the grinding wheel 104 is engaged on a predetermined position of the stem and it is necessary to grind a portion corresponding to the width of the grinding wheel. If the engine valve 103 is positioned from the end of the stem 103a, engagement position of the grinding wheel to the stem is variable depending on the length of the engine valve 103 as shown in two-dotted lines in Fig. 5. Each time, it is necessary to adjust the positions of the grinding and adjusting wheels 104 and 105 or the stopper 109, so that it involves low productivity to process a number of engine valves.

When the stem 103a and the valve face 103d are ground simultaneously by two grinding wheels, the stem 103a of the engine valve 103 is supported by the grinding and adjusting wheels 103a and 104 like a cantilever, so that the engine valve 103 involves large deviation in centering when the head 103b is ground, thereby decreasing accuracy of the stem 103a as well as the valve face 103d.

SUMMARY OF THE INVENTION

To overcome the disadvantages, according to the present invention, it is an object to provide a centerless grinder in which a desired length can be accurately ground without moving a grinding wheel etc. even if the full length of a workpiece is variable, centering deviation of the workpiece to be processed being prevented.

To achieve the object, according to the present invention, there is a centerless grinder for grinding a workpiece which comprises a head and a stem, the grinder comprising a base; a grinding wheel which rotates at high speed on the base to grind the stem; an adjusting wheel which rotates at speed lower than that of the grinding wheel on the base and is movable with respect to the grinding wheel, the workpiece being ground between opposing outer circumferential surfaces of the grinding and adjusting wheels; thrust means for thrusting the workpiece towards an end which is projected from the grinding wheel; and stopper means which has an engaged portion which rotates depending on rotation of the workpiece, the workpiece being supported by the engaged portion which is movable in an axial direction of the workpiece.

The workpiece is positioned with respect to the projected end of the workpiece, so that the stem can be ground accurately by the width of the grinding wheel even if the length of the workpiece is variable, thereby avoiding necessity for adjusting the position of the grinding or adjusting wheel each time. The workpiece is supported by each end, so that it is not liable to cause deviation of center when the projected end is ground.

BRIEF DESCRIPTION OF THE DRAWINGS:

The features and advantages of the present invention will become more apparent on the basis of the following description with respect to appended drawings wherein:

Fig. 1 is a side elevational view which shows one embodiment of a centerless grinder according to the present invention;

Fig. 2 is an enlarged top plan view of a main part of the same;

Fig. 3 is an enlarged sectional view of a main portion of a stopper device;

Fig. 4 is an enlarged sectional view of an engaged portion in the stopper device; and

Fig. 5 is a top plan view of a conventional centerless grinder.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Figs. 1 and 2, a centerless grinder

of the present invention comprises a grinding wheel 4; an adjusting wheel 5, a stem 3a of an engine valve 3 as a workpiece being put between the grinding and adjusting wheels 4 and 5 which rotate; a stopper device 6 which contacts the end of a head 3b of the engine valve 3; and a pressing device 16 which contacts the end of the stem 3a to press the engine valve 3 towards the stopper device 6. The grinding wheel 4 is rotated at high speed in a clockwise direction seen from the direction X in Fig. 2, and the adjusting wheel 5 is rotated by a motor (not shown) in the same direction at speed lower than that of the grinding wheel 4. The adjusting wheel 5 is movable with respect to the grinding wheel 4.

The axis of the adjusting wheel 5 is slightly inclined towards a left downwards of a horizontal line in Fig. 2. During rotation of the grinding and adjusting wheels 4 and 5, the stem 3a is ground, giving thrust force to the engine valve in an axial direction towards the stopper device 6. In grinding, the lower surface of the stem 3a of the engine valve 3 is supported by a tapered blade 15 and the upper surface is supported by a workpiece holder (not shown) to prevent the engine valve 3 from jumping.

As shown in detail in Fig. 3, the stopper device 6 comprises a motor 7 mounted on a support 2 which is provided on a base 1; a bevel gear mechanism 9 connected to an output shaft 8 of the motor 7; a block 11 which is moved in an X- or axial direction of the valve on the support 2 by rotation of the output shaft 10 of the bevel gear mechanism 9; a bearing block 12 fixed on the block 11; a stopper 13 (loader head) which is rotatably mounted to the bearing block 12; and an engaged portion 14 which is spherically borne at the end of the stopper 13.

The output shaft 10 is engaged in the block 11. The output shaft 10 is rotated by the motor 7, so that the block 11 and the engaged portion 14 are moved to a position suitable to grind the valve and engaged on the end face of the head 3b of the engine valve 3 which is thrusted leftward. As shown in Fig. 4, the engaged portion 14 is spherically borne by the stopper 13, and the end face of the engaged portion 14 is nearly perpendicular to the axis of the workpiece and is inclinable within a certain range of angle with respect to the axis of the valve.

A valve pressing device 16 for giving auxiliary thrust force to the engine valve 3 is provided on the opposite side to the stopper device 6. The valve pressing device 16 comprises a motor 17 mounted on the support 2 of the base 1; a bevel gear mechanism 19 connected to the motor output shaft 18; a fine adjustment block 21 engaged with the output shaft 20 of the bevel gear mechanism 19; and an elongate thrust member 23 which is mounted to a shaft at the end of the fine adjustment block 21 and usually pressed by a spring 22. By rotation of the motor 17, the fine adjustment block 21 or the pressing member 23 is moved in an axial direction of the valve to contact the end face of the stem 3a of the valve, thereby always pressing the engine valve 3 towards the stopper device 6 by load of the spring 22.

It will be described how to grind the stem 3a of the engine valve 3 by the centerless grinder in the embodiment having the foregoing structure, as below.

The distance between the grinding and adjusting wheels 4 and 5 being set to be slightly larger than the diameter of the engine valve 3, the stem 3a of the engine valve 3 is placed on the tapered blade 15, and, then, the grinding and adjusting wheels 4 and 5 which are both rotating are engaged on the outer circumferential surface of the stem 3a. The engine valve 3 moves towards the stopper device 6 by thrusting force, so that the end face of the head 3b is engaged with the engaged portion 14 with pressure. Meanwhile, the pressing member 23 of the valve pressing device 16 also contacts the end face of the stem 3a. The engine valve 3 is finally positioned, in which the stem 3a is ground by the grinding wheel 4. The engine valve 3 finally ground slightly expands the distance between the grinding and adjusting wheels 4 and 5, and is discharged by a work supply-discharge device(not shown).

When the engine valve 3 is ground, the end face of the head 3b is engaged with the engaged portion 14 and the engine valve 3 is positioned on the basis of the end face of the head 3b, so that regardless of the length of the engine valve 3, the end of the grinding wheel 4 adjacent to the stopper device 6 is always engaged with the head 3b of the engine valve 3, and the stem 3a is ground by the width of the grinding wheel 4. It becomes unnecessary to correct the positions of the grinding and adjusting wheels 4 and 5 or the stopper 5 depending on the length of the engine valve 3 as in the prior art.

If the engine valve 3 is larger than fixed length, the portion of the stem 3a is not ground, but is cut off in the following step, which does not cause any problems.

An embodiment will be described in which not only the stem 3a but also valve face 3a of the head of the engine valve 3 is ground at the same time. In this case, as illustrated by two dotted lines in Figs. 1 and 2, an additional grinding wheel 24 for grinding the valve face 3c may be added to the foregoing embodiment. The grinding wheel 24 is rotatable by a motor(not shown), and is movable in X- and Y-directions on the base 1.

In a conventional centerless grinder, the engine valve 3 is supported as a cantilever, in which the valve face 3c does not become an exact circle and is not accurately ground since the engine valve 3 is deviated in centering owing to load which acts in grinding if the valve face is ground by the additional grinding wheel 24. In this embodiment of the present invention, the valve face 3c is ground by the additional grinding

wheel 24 while the end of the head 3b of the engine valve 3 is held by the stopper device 6, so that the valve face 3c is accurately ground in the engine valve 3 each end of which is supported.

The additional grinding wheel 34 may be mounted to the shaft of the grinding wheel 4, so that both are rotated by one motor.

The present invention may be applied to a centerless grinder in which thrust force is applied to the engine valve in a direction opposite to the stopper device 6. In this case, force by the spring 22 in the valve pressing device 16 may be larger than the above thrust force. The head 3b of the engine valve 3 is engaged with the engaged portion 14 , so that thrust force is finally given towards the stopper device to achieve similar advantages.

The foregoings merely relate to embodiments of the invention. Various modifications and changes may be made by person skilled in the art without departing from the scope of claims wherein:

Claims

1. A centerless grinder for grinding a workpiece which comprises a head and a stem, the grinder comprising:

   a base;

   a grinding wheel which rotates at high speed on the base to grind the stem;

   an adjusting wheel which rotates at speed lower than that of the grinding wheel on the base and is movable with respect to the grinding wheel, the workpiece being put and ground between opposing outer circumferential surfaces of the grinding and adjusting wheels, an end of the workpiece being projected from the grinding and adjusting wheels;

   thrust means for thrusting the workpiece towards the projected end in an axial direction of the workpiece; and

   stopper means which has an engaged portion which rotates depending on rotation of the workpiece, the projected end of the workpiece being supported by the engaged portion which is movable in an axial direction of the workpiece.

2. A centerless grinder as defined in claim 1 wherein the workpiece comprises a poppet valve.

3. A centerless grinder as defined in claim 1 wherein the thrust means is that an axis of the adjusting wheel is inclined downwards towards the projected end of the workpiece.

4. A centerless grinder as defined in claim 1 wherein the thrust means comprises a pressing member and a spring, the pressing member being engaged with an end opposite to the projected end of the workpiece, the pressing member being thrusted by the spring to push the workpiece forward.

5. A centerless grinder as defined in claim 1 further comprising an additional grinding wheel for grinding the head of the workpiece.

6. A centerless grinder as defined in claim 1 wherein the engaged portion of the stopper device is spherically supported by a body of the stopper device.

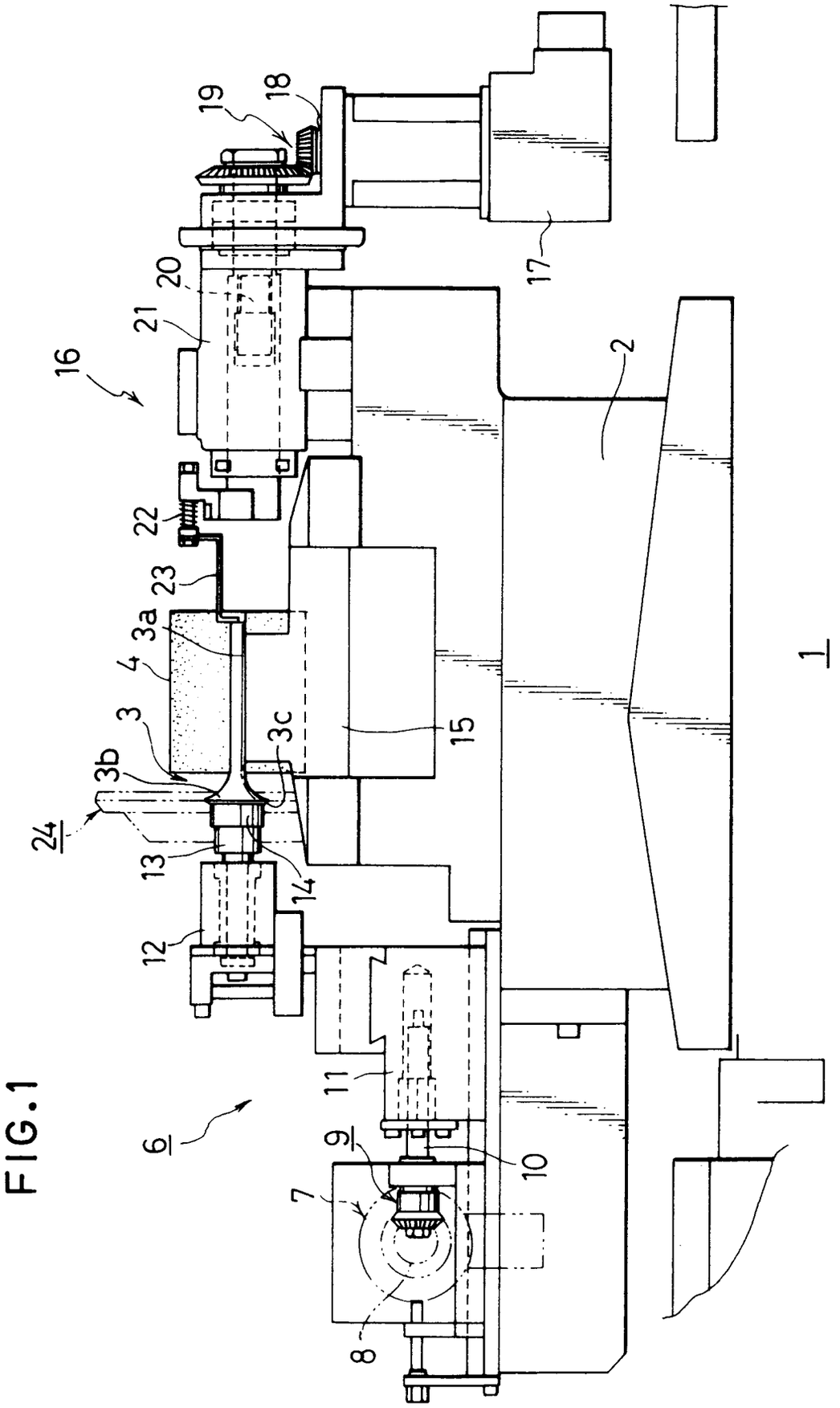


FIG.1

FIG.2

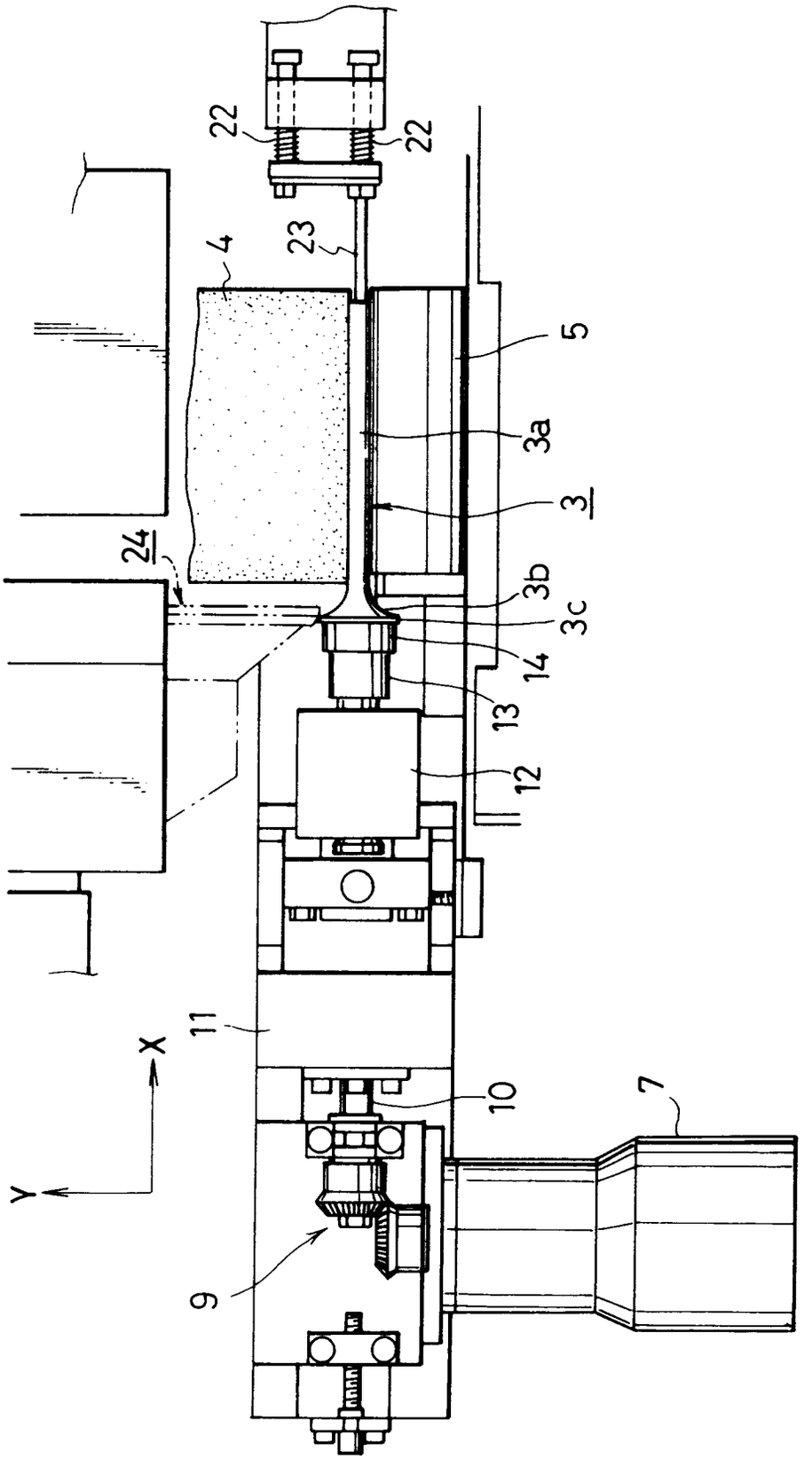


FIG.3

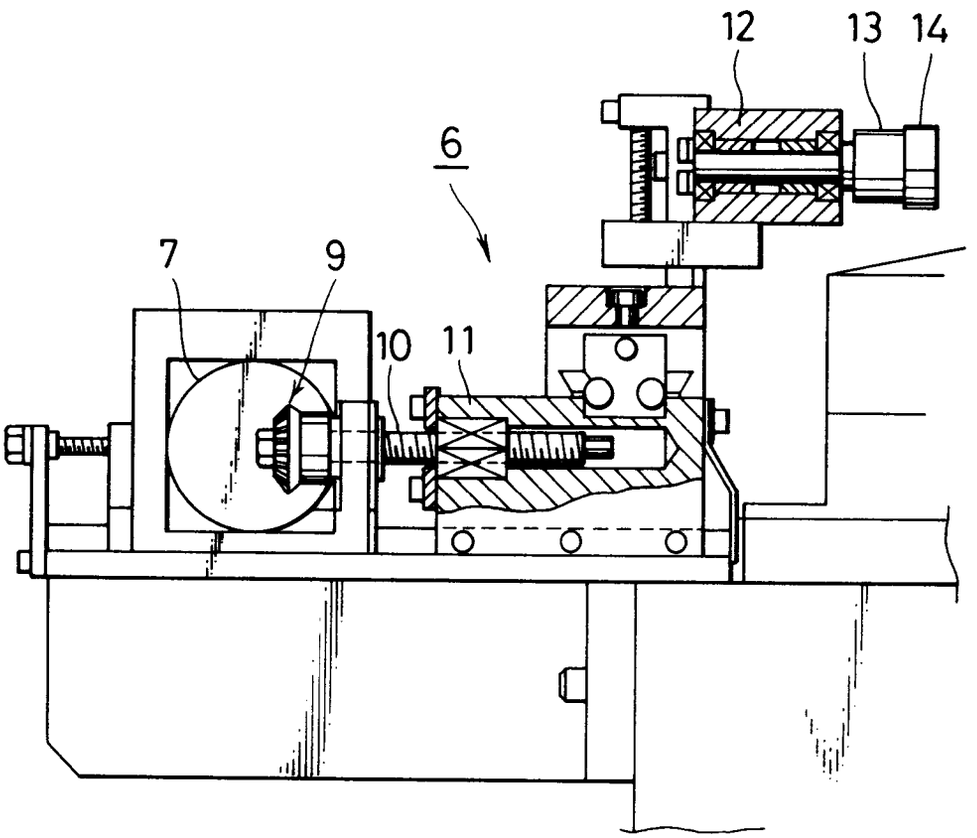


FIG.4

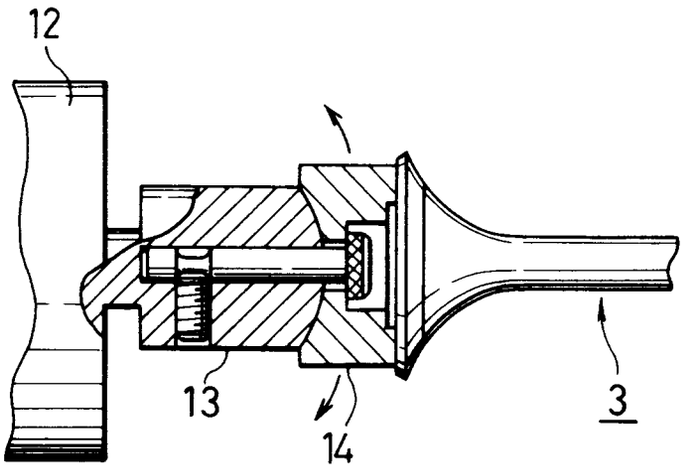
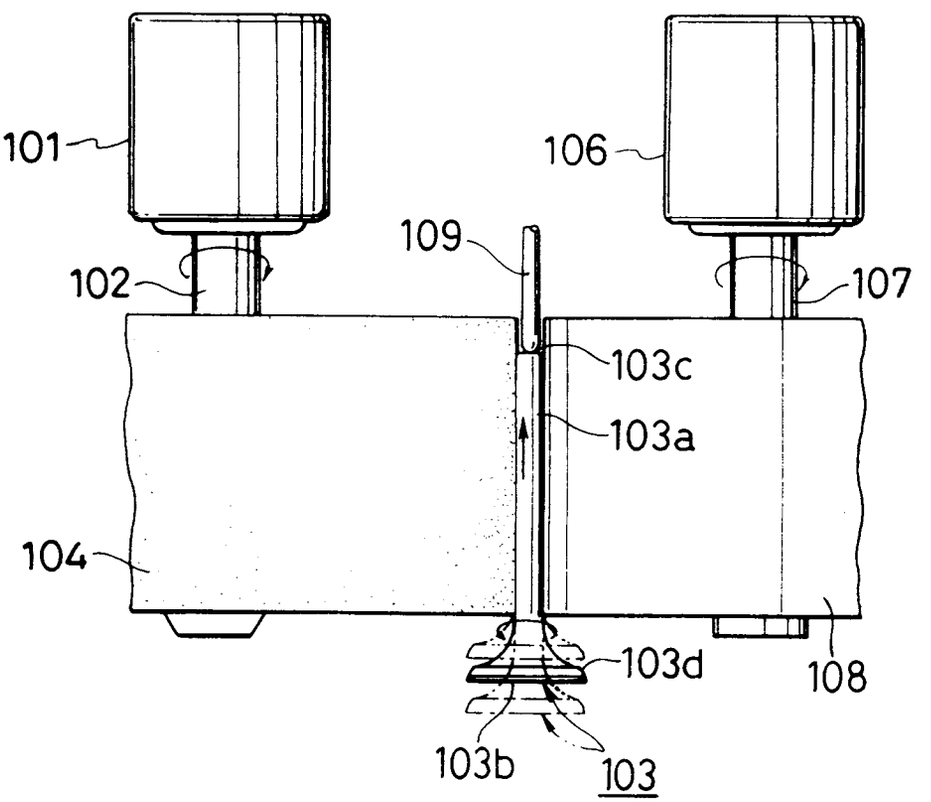


FIG.5



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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 1796

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US-A-1 938 764 (HAAS ET AL.) * page 1, line 101 - page 3, line 128; figures *	1-5	B24B15/04 B24B5/307
Y		6	
Y	EP-A-0 456 590 (REALISATION ET DE DIFFUSION SE) 13 November 1991 * figure 3 *	6	
A	DE-A-41 17 494 (NOMOCO MASCHINENBAU GEBRUEDER) 24 October 1991 * column 2, line 3 - line 52; figures *	1	
A	US-A-3 903 655 (SOMMER PETER J) 9 September 1975 * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19 May 1995	Garella, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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