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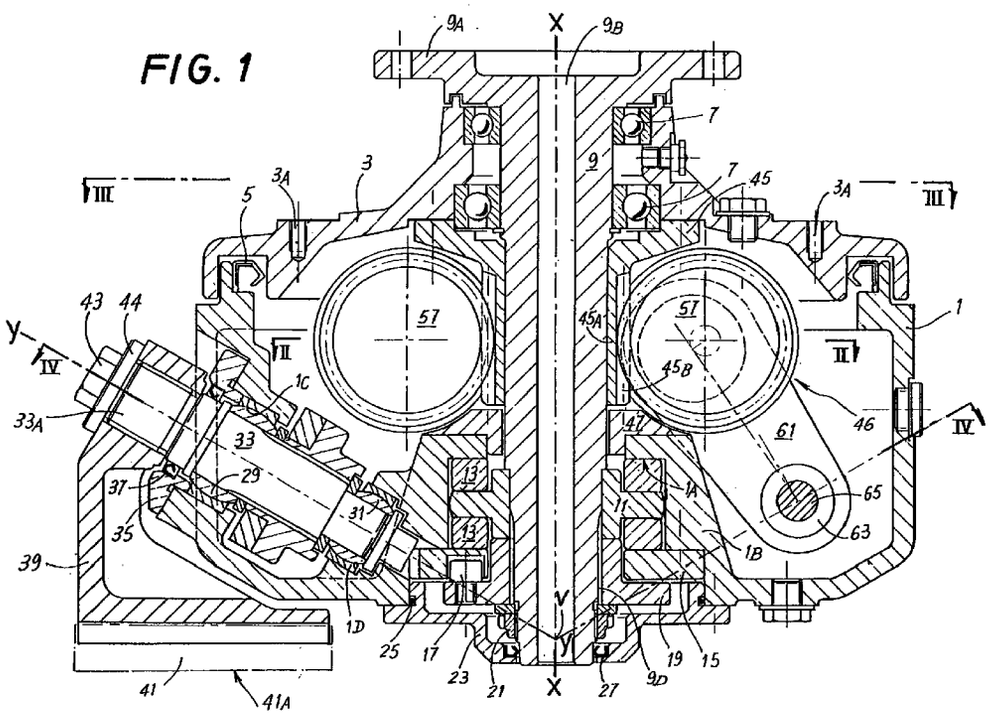
(54) Lapping and polishing head for stone slabs

(57) The head comprises a rotating bowl-shaped casing (1) for driving by a central shaft (9) and closed by a flanged cover (3). Shafts (33) intended to operate in an oscillating manner lapping tools (41) are provided in rotational seats (1C, 1D) of said bowl-shaped casing (1). For operation of said shafts (33) the head comprises an endless screw (45A, 45B) coaxial with said central shaft (9), helical gears (57) supported by said bowl (1) and co-operating with said endless screw (45A, 45B), an articulated drive between each helical gear (57) and one of said shafts (33), and means for transmission from said oscillating shaft to other adjacent oscillating shafts (33).

FIG. 1



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Description

For the lapping and polishing of slabs of stone material lapping machines are used, comprising a rotating head on which there are mounted grinding inserts which are kept in contact with one side of said slabs to be machined, in the presence of a stream of an aqueous suspension of abrasive powder. During rotation of the head, the slab of stone material is moved with respect to the rotating head so that the entire surface of the slab itself is machined.

Generally the rotating head comprises a rotating bowl-shaped casing for driving by a central shaft by which said bowl is supported by means of resiliently yielding spacers. The casing is closed, with the arrangement, in between, of a sealing gasket, by a flanged cover supported by a fixed structure of the machine and defines, together with the cover, a lubricant-tight compartment. Shafts are provided in rotational seats of said bowl-shaped casing and are intended to operate in an oscillating manner lapping tools so that the inserts come into contact with the surface to be machined by means of generatrices of a conical surface thereof which are always new.

These machines have the drawback that complex mechanisms, which are costly to manufacture and to maintain efficiency, in particular owing to the presence of a strongly abrasive environment, are provided for the generation of the oscillating movement of the inserts.

In order to limit substantially this drawback, the present invention envisages for operation of said shafts: an endless screw coaxial with said central shaft and fixed to said cover; helical gears supported by said bowl and cooperating with said endless screw; an articulated drive between each helical gear and one of said shafts; and means for transmission from said oscillating shaft to other adjacent oscillating shafts. Thus the rotating movement of the head generates, in a simple and easily reproducible manner, a relatively very slow oscillating movement of the grinding inserts about an axis parallel to the line of contact with the surface to be machined. Moreover, with such an arrangement, adjacent inserts oscillate in opposite directions with respect to one another, generating balanced reaction forces and avoiding the occurrence of vibrations.

Said articulated drive comprises preferably an eccentric cam which is integral with the shaft of each helical gear and a connecting rod with articulated bearings which is arranged between said eccentric cam and a pivot of a bush integral with said shaft. Moreover said means for transmission from said oscillating shaft may comprise bevel gear portions or equivalent means arranged between said oscillating shaft actuated by said articulated drive and a shaft adjacent thereto, and between the latter and the following one. The head may also comprise a moving assembly fixed to a hub formed centrally by said bowl and forming the seats for the shafts of said helical gears. In this way the head is extremely compact and easily assembled and maintained.

The invention will be understood better referring to the description and the accompanying drawing, which shows a practical non-limiting embodiment of the invention itself. In the drawing:

Fig. 1 shows a view of a lapping head according to the invention, sectioned along axial planes indicated by I-I in Fig. 3;
Fig. 2 shows a partial plan view of the head sectioned along a plane indicated by II-II in Fig. 1;
Fig. 3 shows a plan view in the direction of the arrows III-III of Fig. 1 of only the rotating bowl-shaped casing of the lapping head;
Fig. 4 shows a partial view of the head sectioned along a conical surface indicated by IV-IV in Fig. 1, a surface which is coaxial with the head itself and hence extends planewise; and
Fig. 5 shows a partial view from the vertex of said conical surface, developed along the broken line V-V of Fig. 4 and partly sectioned.

The lapping head in question for polishing marble or other stone material surfaces comprises a bowl-shaped casing (Fig. 1) which is closed at the top - with the arrangement, in between, of a seal 5 - by a cover 3 in the form of a flange. The cover 3 is fixed to the static structure of a grinding machine, not shown, by means of bolts which are screwed into threaded holes 3A of the cover; by means of bearings 7 said cover 3 supports a vertical shaft 9 with an axis X-X which is moved rotationally by means of a flange 9A, an upper joint and a motor drive system, not shown in the drawing. The shaft 9 has an axial through-hole 9B through which an abrasive liquid, generally an aqueous suspension of abrasive, is supplied to the surface to be lapped.

The bowl-shaped casing 1 is supported by the shaft 9 by means of a disk-shaped flange 11 which is keyed and fixed axially to the shaft 9 in the vicinity of the bottom end thereof. The radially projecting part of the flange 11 is axially clamped - by means of a plate 15, special screws not shown and via two resilient rings 13 - inside a cylindrical recess formed in a bottom central hub 1B of the bowl-shaped casing 1, this recess being delimited at the top by an abutment surface 1A. The flange 11 has a peripheral surface of spherical shape, this surface being combined with a small amount of play with the internal cylindrical surface of said recess; in this way the bowl-shaped casing 1 is centred with respect to the axis X-X and, owing to the presence of the two resilient rings 13, small angular oscillations of the casing itself are permitted. In the plate 15 there are formed blind holes each receiving - with a minimum amount of play - the head of a respective bolt 17 screwed into a hole of an end flange 19. Said flange 19 is keyed onto the shaft 9 by means of a splined section 9D and is axially clamped onto the shaft 9 by means of a screw-type

ring 21. In this way, with the rotation of the shaft 9, the casing 1 is moved rotationally with respect to the cover 3 by means of the heads of the bolts 17.

The bottom recess of the casing 1 is closed by a cover 23 by means of peripheral clamping screws - not shown - with the arrangement, in between, of seals 25, 27 so as to prevent the entry of water and abrasive inside the casing itself.

Six pairs of seats 1C, 1D (see also Fig. 3) for bearings 29, 31 are formed in the side wall of the bowl-shaped casing 1 and in the respective hub 1B, the seats being arranged in coaxial pairs so as to support, by means of said bearings, respective shafts 33, 33A with axes Y-Y converging at a point V of the axis X-X and being equally inclined with respect to this axis. Said shafts are distributed in a uniform manner angularly about the axis X-X at six locations A, B, C, D, E, F. Each shaft 33 is retained axially - via screws not shown - by means of a respective flange 35 which is fixed to the side surface of the casing 1; a seal 37 is arranged between the flange 35 and the respective shaft 33. Each shaft 33 projects externally from said casing 1 with a splined shank 33A on which one end of a right-angled arm 39 carrying a lapping tool 41 is mounted; each tool is provided with a frusto-conical working surface 41A with an axis Y-Y, so as to act on a plane perpendicular to the axis X-X of rotation of the lapping head. A bolt 43, which is screwed into an axial end hole of the shaft 33, is tightened against the arm 39 with the arrangement, in between, of a washer 44 and ensures that there is no loosening of the right-angled arm 39 with the associated shaft 33.

A disk 45 extending at the bottom into a coaxial sleeve 45A is fixed - by means of screws not shown - underneath the cover 3 of the lapping head. The sleeve is fitted rotatably with a minimum amount of play onto the shaft 9 and has externally an endless screw 45B.

The upper surface of the hub 1B has, fixed to it, a moving assembly 46 comprising a plate 47 (see Figs. 1 and 2) on which two supports 49 are formed on opposite sides of the axis X-X; each of said supports 49 carries, by means of rolling bearings 51, 53, a respective rotating shaft 55; the axes of the two shafts 55 are parallel and lie in a plane perpendicular to the axis X-X. A respective helical gear wheel 57 meshing with said endless screw 45B is keyed onto each shaft 55. On the opposite side to the bearings 51, 53, each shaft 55 has a seat 55A which is eccentric with respect to said bearings and to which one end of a respective connecting rod 61 is rotatably coupled via a spherical bearing 59. At the other end each of these two connecting rods 61 is rotatably coupled, by means of another spherical bearing 63 (see also Fig. 4), with a pivot 65 radially integral with a bush 67 keyed by means of a splined profile 67A onto one 33A of said inclined shafts 33 associated with the locations A, D.

In this way, with the rotation of the lapping head about the axis X-X, the moving assembly 46 rotates integrally therewith and the gear wheels 57, meshing with the endless screw 45B of the sleeve 45A fixed to the structure of the machine, rotate slowly with respect to the rotating movement of the head in accordance with the transmission ratio of the endless screw 45B and the two wheels 57 themselves; the latter in turn cause the respective lapping tool 41 to oscillate about the respective axis Y-Y, by means of the crank mechanism 55A, 59, 61, 63, 65, 67.

The moving assembly 46 thus actuates directly the tools 41 associated with the diametrically opposite locations A, D, causing them to oscillate. The tools 41 corresponding to the other shafts 33 of the following stations B, C; E, F, in the direction of the arrow F of Fig. 3, receive a similar oscillating movement from the shafts 33 of the locations A; D by means of bevel gear portions 69, 71, 75, 77 (see Figs. 4, 5) fixed to respective bushes 67, 73, 79 each keyed to the respective shaft 33, the bush 67 being integral with the pivot 65. In this way each tool 41, during rotation of the lapping head, oscillates about the respective axis Y-Y, constantly offering a different and always new line of contact with the surface to be machined. Moreover, adjacent tools oscillate in opposite directions transmitting to the lapping head balanced forces so as to avoid the generation of vibrations which could damage the head and result in poor quality lapping.

It is understood that the drawing shows only one example provided merely by way of a practical demonstration of the invention, the forms and arrangements thereof being able to vary without thereby departing from the scope of the idea underlying the invention itself. The presence of any reference numbers in the accompanying claims has the purpose of facilitating reading of the claims with reference to the description and the drawing and does not limit the scope of protection represented by the claims.

Claims

1. A lapping and polishing head for marbles and other types of stone, comprising a rotating bowl-shaped casing (1) for driving by a central shaft (9), by which said bowl is supported by means of resiliently yielding spacers (13), a flanged cover (3) which is supported by a fixed structure of the machine and which by means of a sealing gasket (5) defines with said casing a lubricant-tight compartment, and in rotational seats (1C, 1D) of said bowl-shaped casing (1) shafts (33) intended to operate in an oscillating manner lapping tools (41), said head being characterized in that it comprises also, for operation of said shafts (33): an endless screw (45A, 45B) coaxial with said central shaft (9) and fixed to said cover (3); helical gears (57) supported by said bowl (1) and cooperating with said endless screw (45A, 45B) and therefore rotating at a very slow speed of rotation; an articulated drive between each helical

gear (57) and one of said shafts (33); and means for transmission from said oscillating shaft to other adjacent oscillating shafts (33).

2. Lapping and polishing head according to claim 1, characterized in that said articulated drive comprises an eccentric cam (55A) which is integral with the shaft (55) of each helical gear (57), a connecting rod (51) with articulated bearings (59, 63) between said eccentric cam (55A) and a pivot (66) of a bush (67) integral with said shaft (33).

3. Lapping and polishing head according to claim 1, characterized in that said means for transmission from said oscillating shaft (33) comprise bevel gear portions (69, 71; 75, 77) or equivalent means arranged between said oscillating shaft (33) actuated by said articulated drive and a shaft (33) adjacent thereto, and between the latter and the following one.

4. Lapping and polishing head according to at least claim 1, characterized in that it comprises an assembly (46) fixed to a hub (1B) formed centrally by said bowl (1) and forming the seats for the shafts (55) of said helical gears (57).

5. Lapping and polishing head for stone slabs; all of which as described and illustrated by way of example in the accompanying drawing.

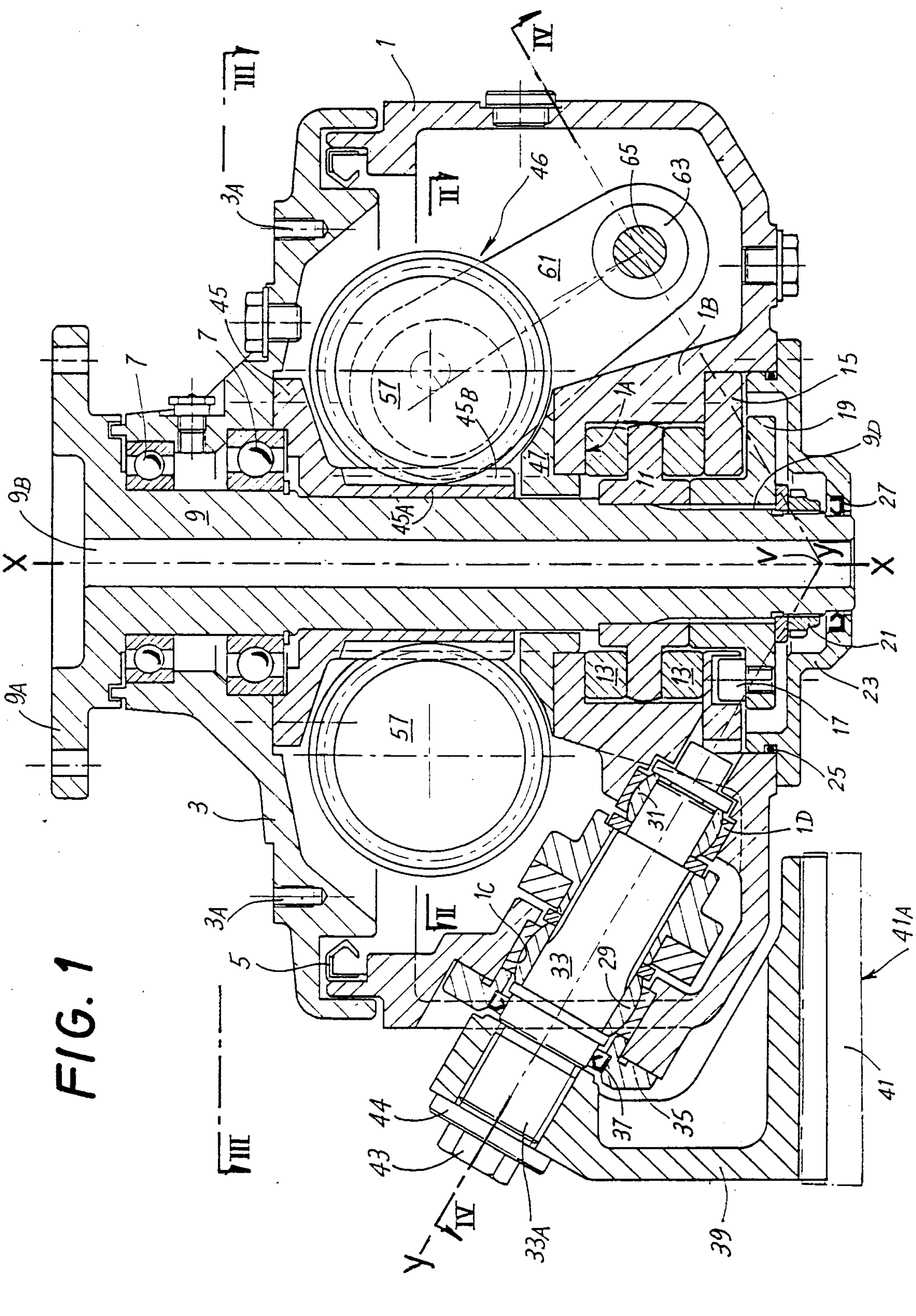


FIG. 1

FIG. 2

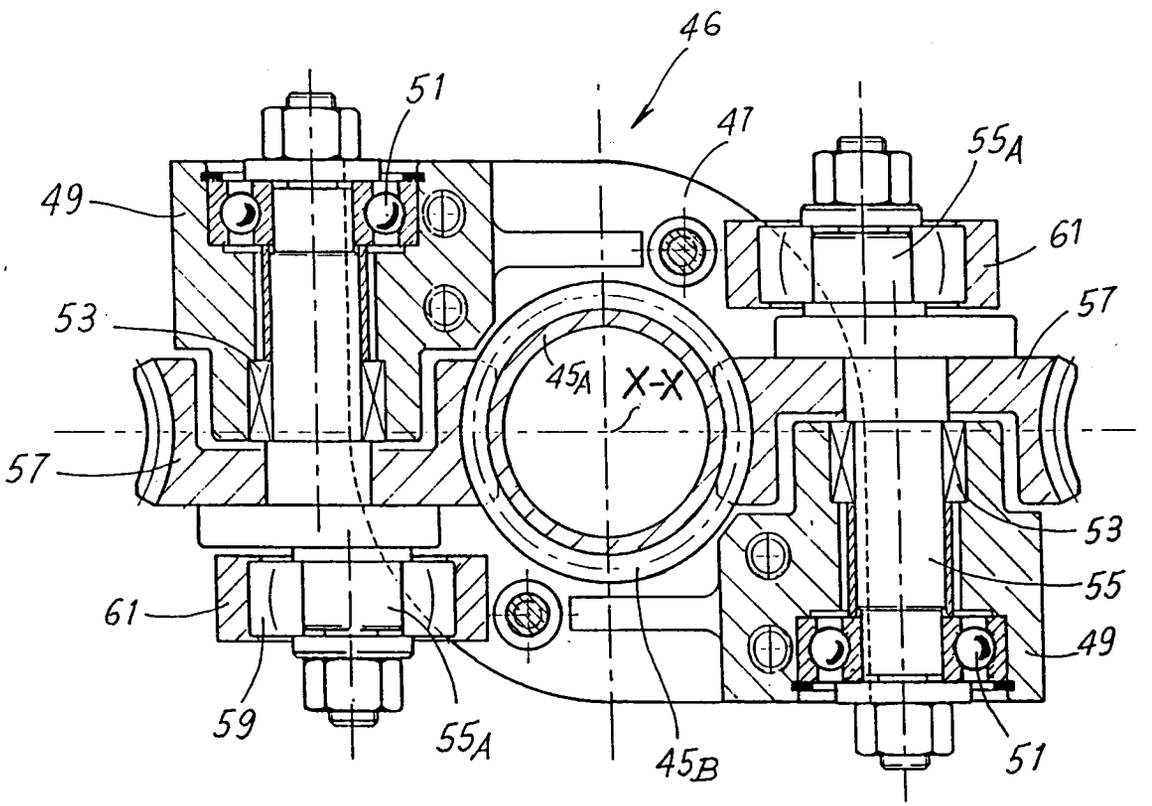


FIG. 3

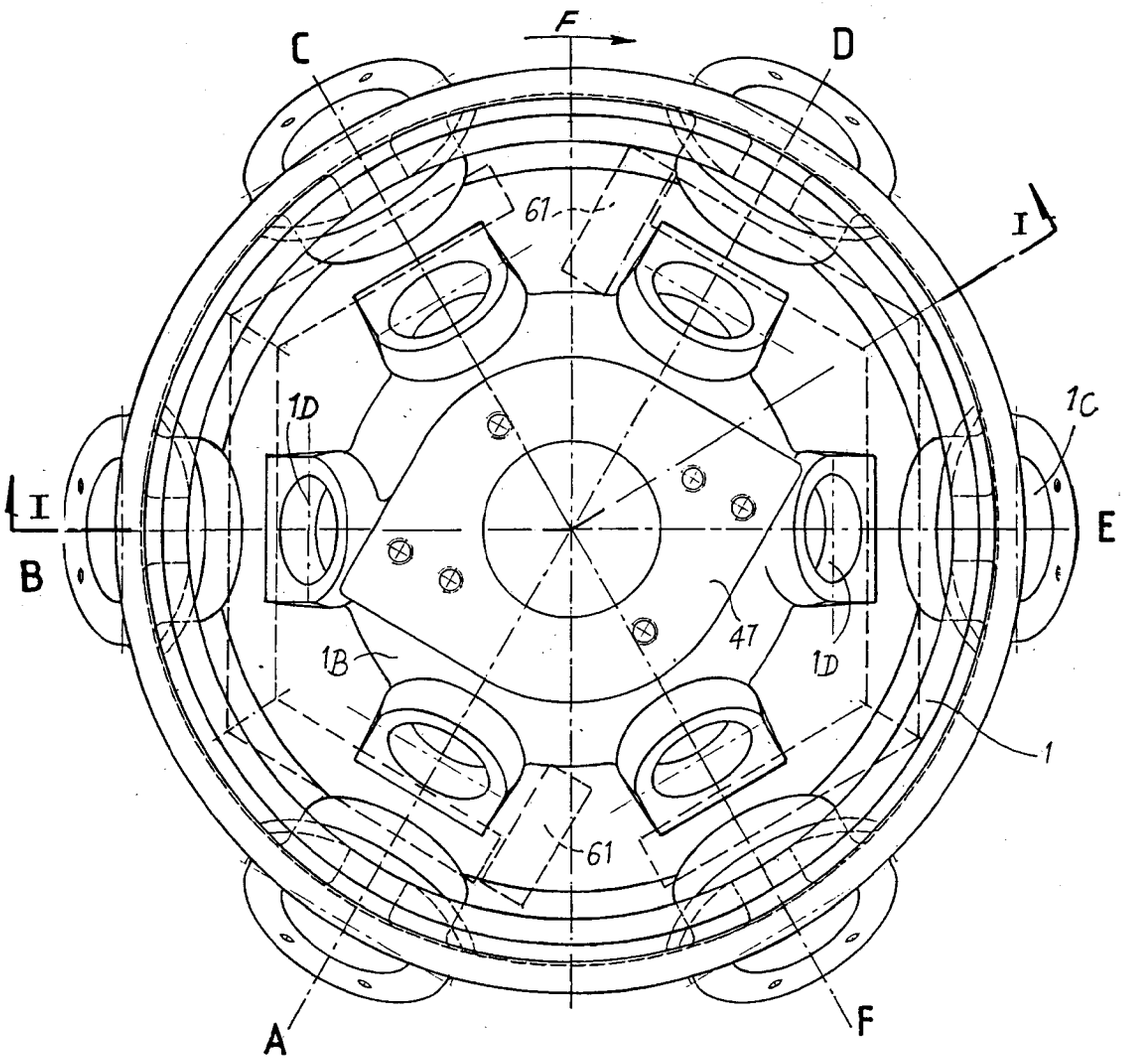


FIG. 4

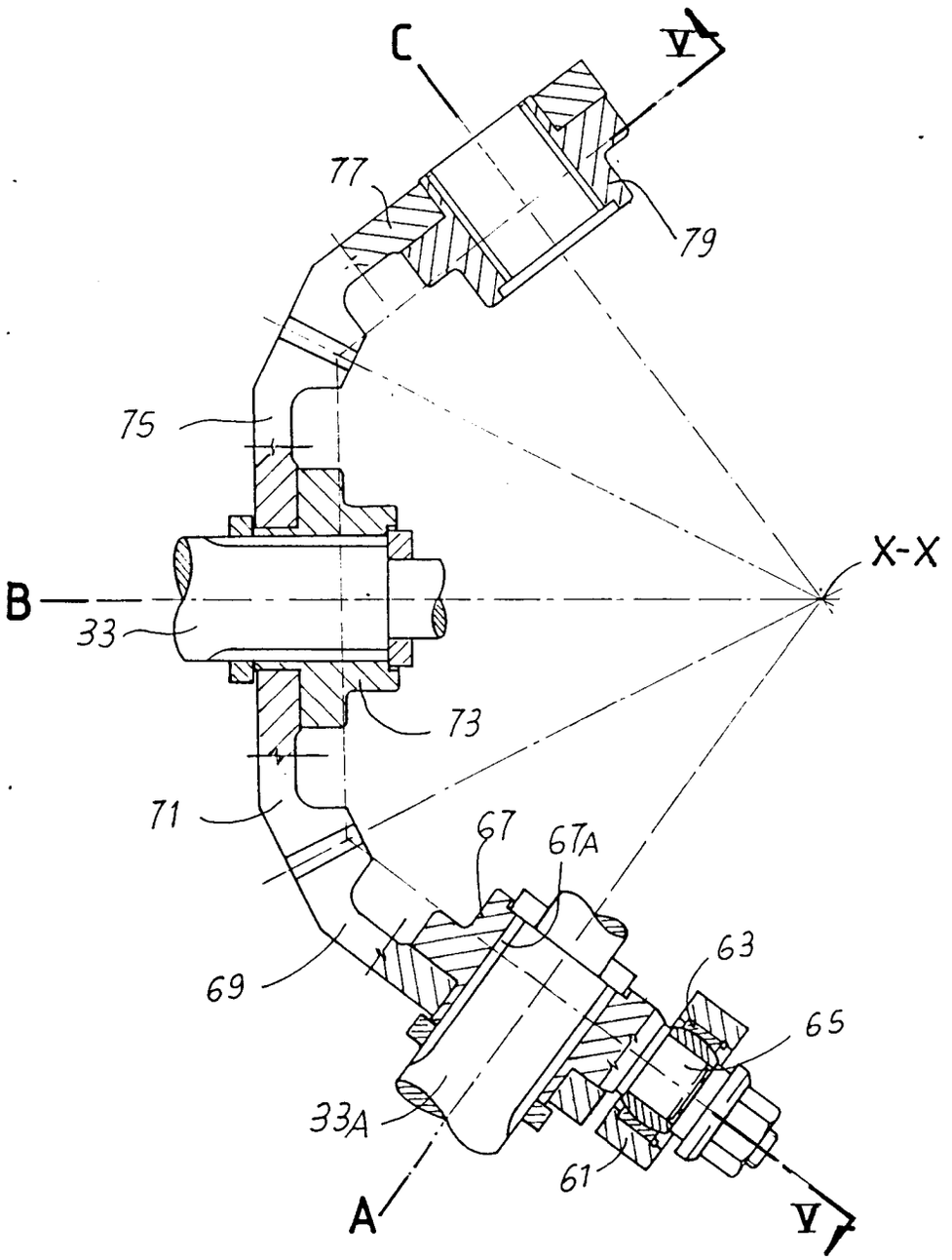
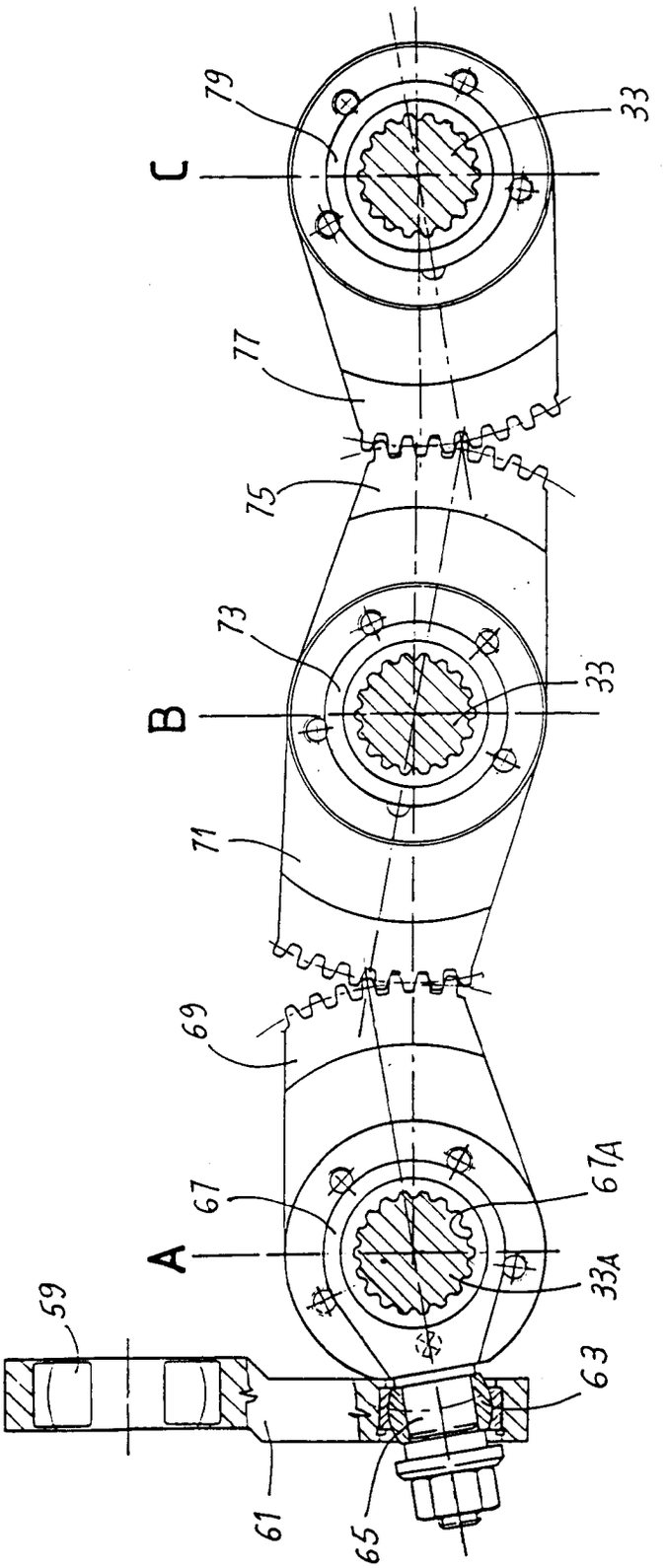


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 98 83 0366

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)
Y	EP 0 448 847 A (ZAMBON S N C OFF MEC FLLI) 2 October 1991 * the whole document *	1,2,4	B24B41/047
Y	DE 44 08 560 A (SCHANKWEILER RALF) 21 September 1995 * column 2, line 41 - line 45; figures *	1,2,4	
A	EP 0 649 706 A (TONCELLI LUCA) 26 April 1995 * column 10, line 1 - line 25; figure 8 *	3	
A	EP 0 510 603 A (SIMEC SPA) 28 October 1992 * column 1, line 55 - column 2, line 26; figures 1-3 *	3	

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	31 August 1998	Garella, M

CATEGORY OF CITED DOCUMENTS

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