(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 607 763 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93830462.3**

(51) Int. Cl.[5]: **B24B 9/06**

(22) Date of filing: **18.11.93**

(30) Priority: **20.11.92 IT VR920100**

(43) Date of publication of application:
27.07.94 Bulletin 94/30

(84) Designated Contracting States:
DE GB

(71) Applicant: **MONTRESOR & C. S.r.l.**
Via 1 Maggio, 23
I-37069 Villafranca (Verona)(IT)

(72) Inventor: **Montresor, Gabriele**
Via 1 Maggio, 27
I-37069 Villafranca (Verona)(IT)

(74) Representative: **Sarpi, Maurizio**
Studio FERRARIO
Via Collina, 36
I-00187 Roma (IT)

(54) A system for shifting on three axes a mills holder bar in a machine for polishing the edges of slabs in stone, marble or similar materials.

(57) The present patent of invention provides the utilization of particular shifting assemblies which permit to enhance the capacity of intervention and the possibilities of adjusting and moving the milling assemblies in "edge polishing" machines.

In fact, a horizontal mills holder bar (6) in an edge polishing machine on which the said assemblies are mounted is fixed in horizontal shafts (8) which are pivoted on plates which slide vertically on side uprights (9).

Other plates (10) are fixed on the shafts (8) supporting the bar (6). Such plates (10) support movers which are provided with pinions (12) which make the mills holder bar itself pivot on the shafts (8) on which the bar is pivoted.

Finally, the same uprights (9) are arranged on horizontal guides (21) which are placed in the upper part of a fixed framework (5).

All the shiftings of the mills holder bar along the respective vertical and horizontal guides and around its own axis are accomplished through a chain and/or gear system which is actuated by motors, recirculating ball screws, racks, hydraulic cylinders or other similar moving means.

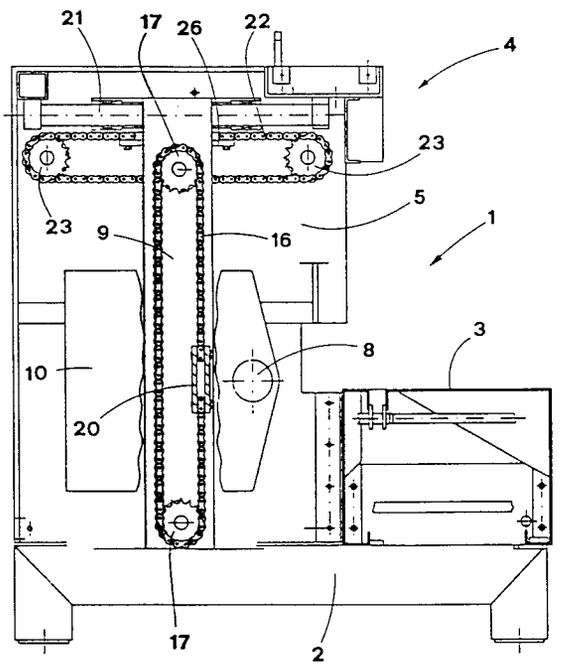

fig. 2

EP 0 607 763 A1

The present patent for industrial invention refers to a system which permits a programmable automatic movement on three axes of a mills holder bar such as the bar which is provided on a machine for polishing the edges or profiles of slabs in stone, marble or similar materials.

From the presently used art, automatic or semi-automatic machines are known in which a series of parallel tools are placed side by side and mounted on respective spindles.

The specific functions of these tools consist in milling and polishing the edges of slabs in stone, marble or similar materials.

To this end, such machines are usually provided with a moving system which moves both the whole tools-spindles assembly and the bar on which such tools are mounted. This moving system permits the milling assemblies to be displaced according to both a rectilinear movement and an angular rotation in order that each mill may follow the outline of the edge of the slab to be milled.

Although such known machines and their general principle of functioning are valid, there are inconveniences when it is necessary to work slabs showing a particular edge shape such as, for instance, the edges showing the Gothic chamfer or the edges showing a larger thickness than the common edges.

Such inconveniences are due to the fact that the angular displacement of the mills depends on the vertical movement of the bar on which the mills are mounted and therefore the adjustment of the range of intervention, for instance in case of different thicknesses, is accomplished in a limited manner by shifting all the mills onwards and backwards or by simply applying a damper on each mill, such dampers being able to absorb any profile differences in the various slabs to be worked.

Moreover, there are other known edge polishing machines, the capacity of intervention being better. However, these machines have the inconvenience that their working assemblies are excessively complicate as well as the inconvenience that such machine are consequently too difficult and onerous as regards the working.

The main object of the present invention consists in enhancing the capacity of intervention and the adjusting and moving possibilities of the milling assemblies of the "edge polishing" machines, the necessary simplicity of the operative means being maintained, in order to eliminate the inconveniences which are due on one hand to the limitation in the versatility, and on the other to the complexity of the known machines and all the subsequent consequences.

In the range of the aforecited general object, the present invention proposes in particular that the adjustment and the displacements of the bar supporting the milling assemblies may be accomplished on three axes, that is along a horizontal and vertical displacement directions and around an axis of angular rotation.

According to the present invention, these three kinds of displacement and adjustment for the tool-holder bar may be all synchronized with one another through a central control device with which it is possible to coordinate and measure the single movements in respect to any shape and dimension of the edge to be milled.

The aforesaid objects and functions are all reached by the present system for displacing the mills holder bar on three axes, preferably in a machine for polishing edges of slabs in stone, marble or similar material, characterized mainly in that the ends of the mills holder bar are mounted on pairs of vertical uprights so as to slide and rotate angularly, the vertical uprights being in turn mounted on horizontal guides which are arranged in the upper part of a fixed support; the angular rotation and the vertical sliding of the bar on the respective uprights as well as the sliding of the uprights on the horizontal guides being provoked by corresponding chain gearings, such chains being driven by motors, or by re-circulating ball screws and/or racks, hydraulic cylinders or other similar moving means.

The above-mentioned and further characteristics will be better comprised from the following description of a preferred type of embodiment which is set forth as an example not limiting the invention as well as from the accompanying drawings wherein:

Figure 1 shows a schematic plan view of an edge polishing machine which is provided with the moving system for the mills assemblies according to the present invention;

Figure 2 shows a schematic view of the same in side section according to the line A-A of Fig. 1;

Figure 3 shows a schematic view in side section of the machine according to the line B-B of Fig. 1;

Figures 4 and 5 show schematic side views of an edge polishing machine according to a possible variant of the moving means for the milling assemblies;

Figure 6 shows a schematic side view of a variant of the moving system for the vertical uprights.

With reference to the accompanying drawings, number 1 indicates a machine for polishing the edges of slabs, preferably in stone, marble or similar material, such machine being provided according to the present invention with a particular moving system for the milling assemblies.

In general, the machine 1 comprises a base 2 which is provided on the one hand with an assem-

bly which permits the slabs to be supported and to horizontally slide, this assembly comprehending a conveyor belt 3. On the other hand, the base 2 is provided with a milling assembly, designated on the whole with the number 4.

The milling assembly 4 is included in a fixed framework 5 and comprises a horizontal bar 6 which supports a series of spindles 7 with the respective milling tools thereof, the bar 6 being arranged on moving assemblies which permit the bar itself to axially rotate and to be translated according to orthogonal axes.

In fact, the bar 6 is fixed on horizontal shafts 8 which are pivoted upon plates which slide vertically on side uprights 9.

Other plates 10 are fixed on the shafts 8 which support the bar 6. These plates 10 supports in turn motors 11 and the respective pinions 12 thereof which permit the tool-holder bar 6 to be rotated around shafts 8 on which the bar is pivoted.

In fact, as it can be seen from Fig. 3, the pinions 12 act in opposition to chains 13 the ends 14 of which are fastened upon a fixed semi-circular rim 15.

The bar 6, which supports the milling spindles 7, is moved angularly and may slide vertically on the vertical uprights 9 since the plates that hold the bar 6 itself are moved along vertical guides which are arranged on the vertical uprights 9 and are driven by a trailing system which consists in the present case of chains 16 which are moved on return pulleys 17 through the intervention of a motor 18.

A shaft 19 connects the movement which is imparted by the motor 18 to the upper return pulleys of both trailing assemblies which are arranged on each upright.

The chain 16 is hold through brackets 20 on the vertical slide plates of the bar 6. As a consequence of this, the chain 16 itself permits a vertical movement of the bar along the guides of the uprights 9 on which the bar is mounted.

Finally the vertical uprights 9 are arranged on horizontal guides 21 which are placed in the upper part of the fixed framework 5. The displacement of the uprights 9 along the guides 21 is accomplished by a chain system similar to that of the vertical shifting assembly.

In fact, a chain 22 is arranged on return pulleys 23 which are moved by a transmission shaft 24 which is driven by a motor 25, the said chain being connected through brackets 26 with the upper parts of the vertical uprights 9 so that the vertical uprights 9 may be moved horizontally along the guides 21, together with all the supported devices.

In the present example, the lower parts of the vertical uprights may be either free or connected with further horizontal slide guides.

Such a multiple moving system permits the milling assembly 4 to be shifted in a synchronized way according to two translating movements, that is the horizontal movement on the guides 21 and the vertical movement on the uprights 9, and according to a rotary movement on the horizontal axes of the pivoted shafts 8.

The combination of the above described movements permits that the milling tools are moved in order to follow whatever kind of slab profile, the slab being arranged and fed horizontally on the conveyor belt 3.

In fact, different shifting parameters of the three motorized assemblies are set according to the slab profiles by simply selecting and synchronizing the duration and time of the operation of the single motors through a computerized control device.

In the Figures 4 and 5, a possible variant of the above described shifting devices is shown. It is an alternative to the movement of the chains 13, 16 and 22.

This variant is represented by a shifting system which comprehends re-circulating ball screws 27 and 28. The re-circulating ball screw 27 controls the vertical movement of the tool-holder bar on the uprights 9 while the re-circulating ball screw 28 controls the horizontal movement of the uprights 9 on the guides 21.

In the present case, the motorized pulley 29 engages a fixed rim 30 directly and permits an angular shifting of the tool-holder bar 6 on the axis of the horizontal shaft 8 on which the bar itself is mounted.

Finally, in Fig. 6, a variant of the movement of the vertical uprights 9 is shown in which the vertical uprights 9 are pivoted in the lower part on fixed shoes 32 through pivots 31 instead of being trailed along the upper guides 21.

In this case, the chain 33, which is similar to the chain 22, is connected through a hinge 34 with a connecting rod 35 which is connected in turn with the fixed framework through a bracket 36. Moreover, the connecting rod 35 engages a pivot 37 which is integral with the uprights 9.

During the movement of the chain 33, the connecting rod 35 acts on the pivot 37 and permits the upright 9 to be oscillated onwards or backwards. In this way, it is possible to obtain the same effects of the above-described solution.

The systems of displacement that have been described and represented according to preferred solutions may be also driven by moving means equivalent to the described ones such as hydraulic cylinders, racks or other suitable means, all to be considered included in the range of protection of the present invention.

Claims

1. System for shifting on three axes a mills holder bar, preferably in a machine for polishing the edges of slabs in stone, marble or similar materials, characterized mainly by the fact that the ends of the mills holder bar (6) are arranged on a pair of vertical uprights (9) in such a way that the bar may slide vertically and may rotate angularly, the vertical uprights (9) being in turn arranged on horizontal guides (21) in the lower part of a fixed frame-work (5); the angular rotation and the vertical slide of the bar (6) on the respective uprights (9) as well as the slide of the uprights (9) on the horizontal guides (21) being permitted by further trailing means which are driven by driving gears or the like.

2. System for shifting on three axes a mills holder bar as claimed in the claim 1, charaterized by the fact that the angular rotation and the vertical slide of the bar (6) on the respective uprights (9) as well as the slide of the uprights (9) on the horizontal guides (21) are caused by chains or the like (13, 16, 22) which are moved or intercepted singularly by motor pinions.

3. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that the angular rotation and the vertical slide of the bar (6) on the respective uprights (9) as well as the slide of the uprights (9) on the horizontal guides (21) are permitted, according to a possible variant, by re-circulating ball screws (27, 28) and/or racks, hydraulic cylinders or other similar moving means.

4. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that the bar (6), which bears the milling assemblies (7), is arranged horizontally between both uprights (9) and may slide vertically on the uprights (9) since the bar is mounted on plates which slide in vertical guides which are provided in the uprights (9).

5. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that the mills holder bar (6) may rotate angularly through the intervention of a rotating assembly which permits the bar (6) to accomplish angular displacements around the horizontal axis of the shafts (8) on which the bar itself is placed.

6. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that the rotating assembly consists of a fixed semi-circular toothed rim (15) which is provided with a chain (13) which is fixed at the ends (14) thereof to the rim itself and is intercepted by the pinion (12) of a motor (11) which is integral with the bar (6) so as to move the bar angularly.

7. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that the present multiple slide system permits that the milling tools assembly (7) may be displaced in a synchronized way according to two translating movements, namely horizontally in the guides (21) and vertically upon the uprights (9), and according to a rotating movement on the horizontal axis of the shafts (8) which support the bar (6).

8. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that depending on the profile of the slab to be polished, different shifting parameters for the motorized assemblies are set by simply selecting and synchronizing the duration and operating times of the single motors through a control device, for instance a computerized control device.

9. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that according to a possible variant, the vertical uprights (9) may be pivoted in the lower part at pivots (31) on fixed shoes (32) instead of being trailed along the upper guides (21).

10. System for shifting on three axes a mills holder bar as claimed in the foregoing claims, characterized by the fact that according to the above mentioned variant, the chain (33), which is similar to the chain (22), is connected through a joint (34) with a connecting rod (35) which is in turn connected on the one hand with the fixed framework at a bracket (36) while on the other hand, the connecting rod (35) intercepts a pivot (37) which is integral with the uprights (9).

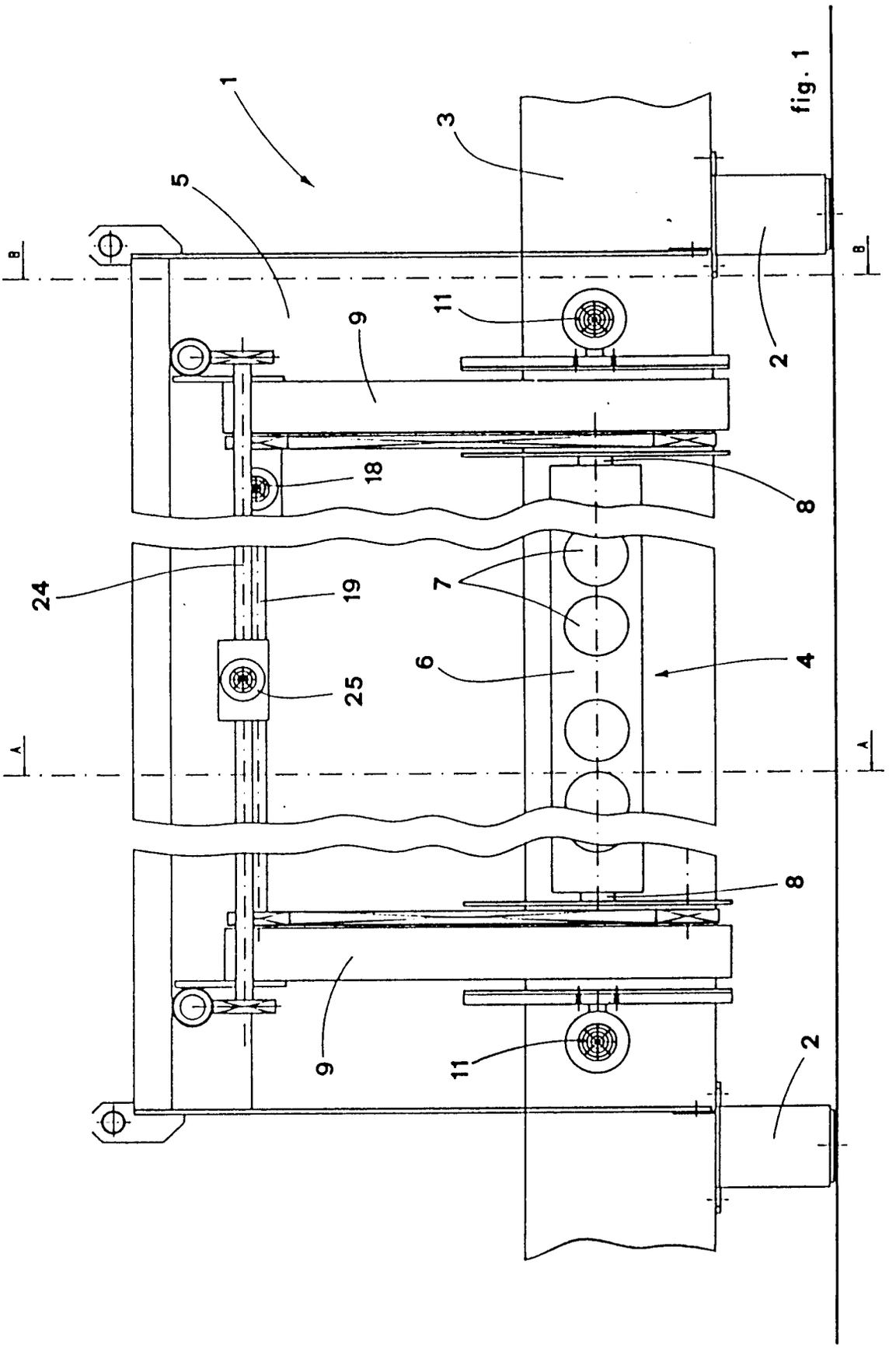

fig. 1

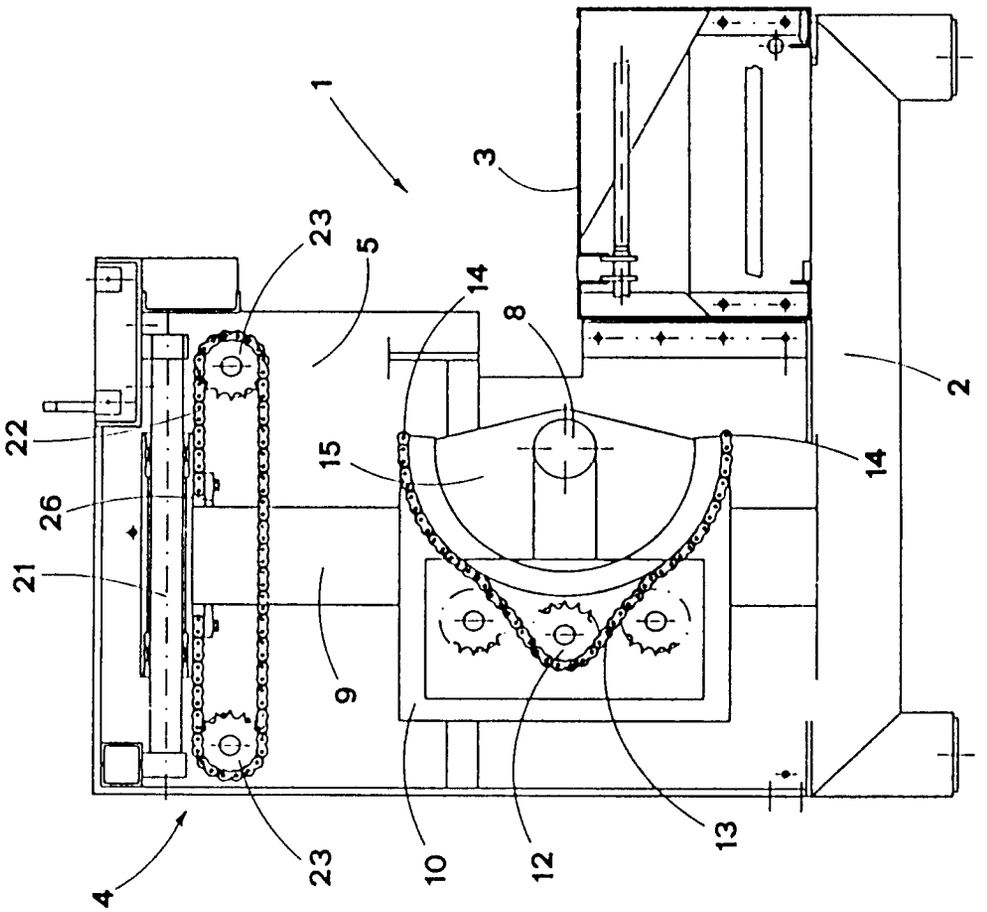
1
3
23
5
14
8
2
22
15
14
26
21
9
4
23
10
12
13

fig. 3

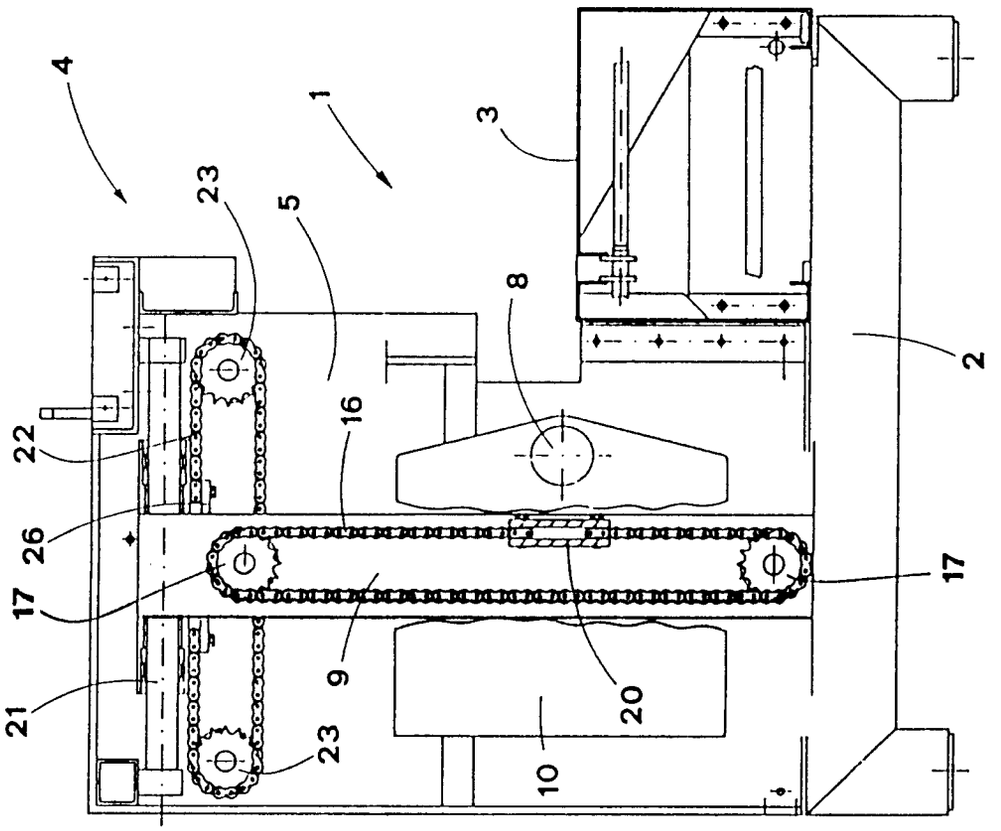
4
1
3
23
5
8
2
22
16
26
17
17
21
9
20
23
10

fig. 2

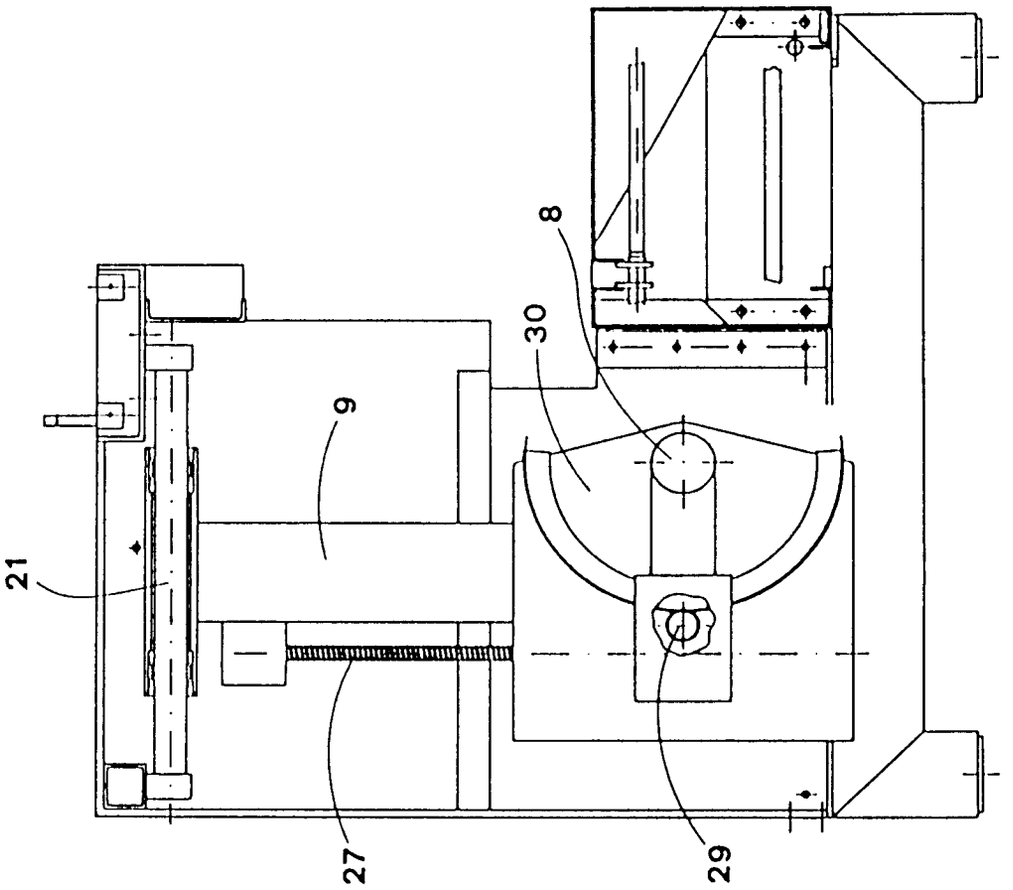

fig. 5

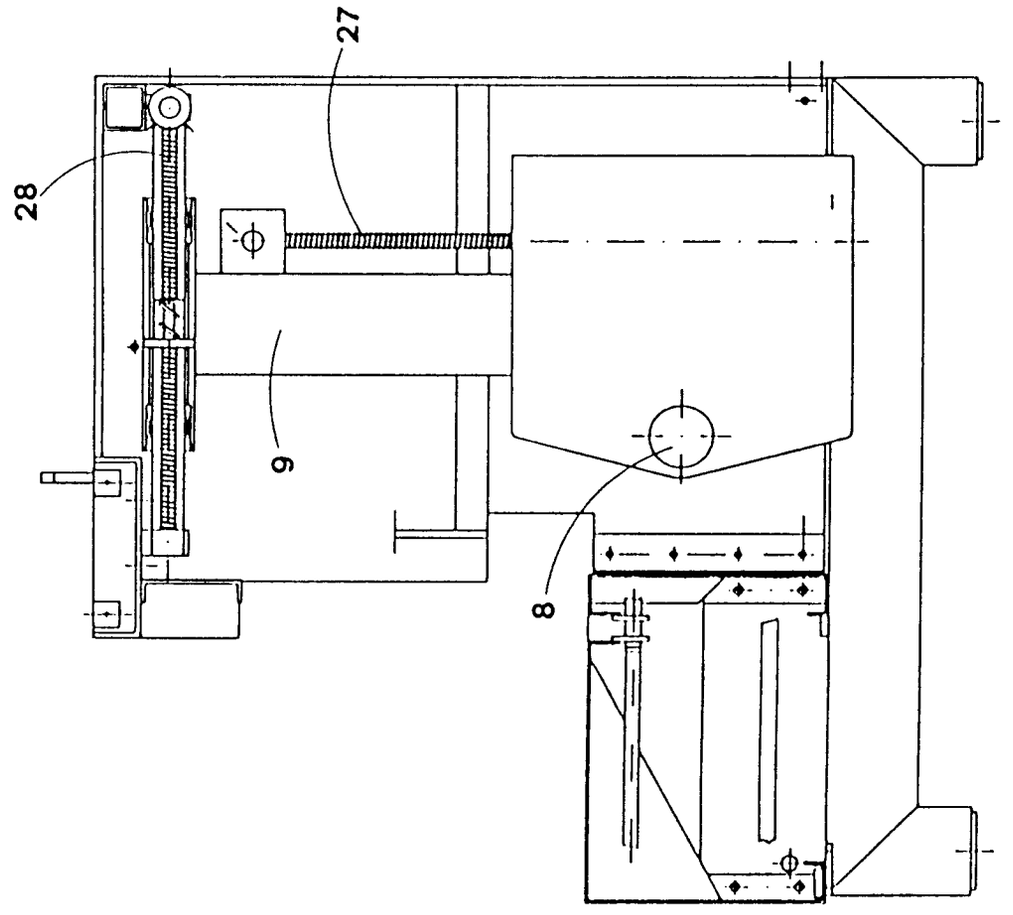

fig. 4

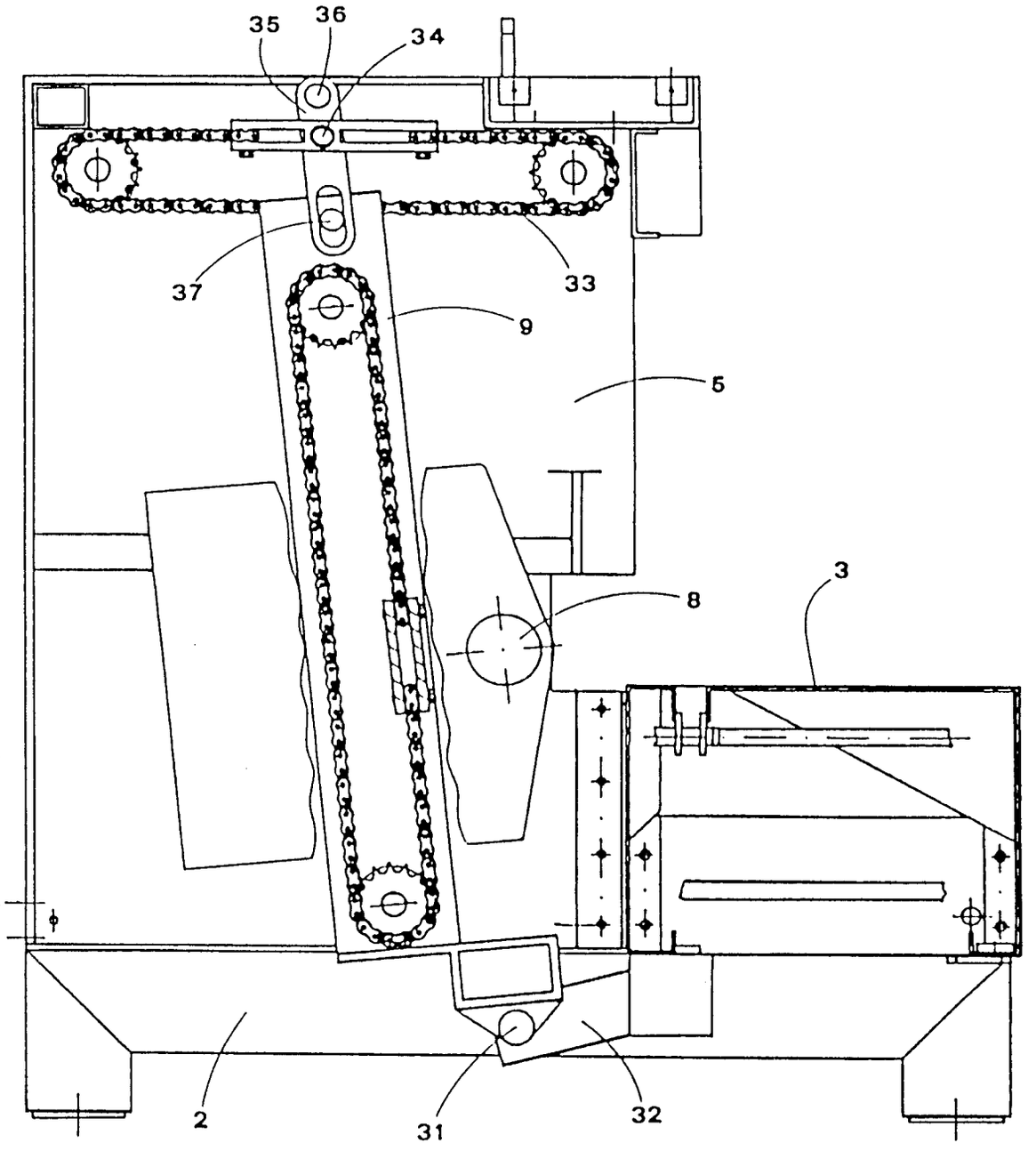

fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 83 0462

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.5)
Y	US-A-1 778 132 (J. WEGNER) * page 1, right column, line 1 - page 2, right column, line 63; claims 1-4; figures 1-4 *	1-5	B24B9/06
Y	EP-A-0 296 126 (MARMO MECCANICA - S. P. A.) * column 3, line 3 - column 4, line 3; figures 1-7 *	1-5	
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	8 April 1994	Wunderlich, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)