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(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**

Anordnung zum dreieckigen Verstellen einer Fräserbefestigungsstange in einer Maschine zum Kantenpolieren von Platten aus Stein, Marmor oder ähnlichen Materialien

Système pour le déplacement triaxial d'une barre porte-fraise dans une machine pour polir les bords de plaques en pierre, marbre ou matériaux similaires

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Description

The present patent for industrial invention refers to a three axes milling and/or polishing apparatus according to the preamble of claim 1.

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 machines 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.

These three kinds of displacement and adjustment for the tool-holder bar are all synchronizable 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 invention is defined in claim 1 and will be better understood from the following description of a preferred 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 embodying 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 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 assembly 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.

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.

Claims

1. Three axes milling and/or polishing apparatus, preferably for polishing the edges of slabs in stone, marble or similar materials, comprising a horizontal mills holder bar (6) arranged on two vertical uprights (9) and adjustable vertically along such uprights, characterized by the fact that the ends of the mills holder bar (6) are arranged on the 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 upper part of a fixed frame-work (5); the angular rotation and the vertical sliding of the bar (6) on the respective uprights (9) as well as the sliding of the uprights (9) on the horizontal guides (21) being realised by trailing means which are driven by driving gears or the like and being controlled by a control device.

2. Apparatus as claimed in the claim 1, 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 caused by chains or the like (13, 16, 22) which are moved or intercepted singularly by motor pinions.

3. Apparatus 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 by re-circulating ball screws (27, 28) and/or racks, hydraulic cylinders or other similar moving means.

4. Apparatus 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 pro-

vided in the uprights (9).

5. Apparatus 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. Apparatus 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. Apparatus 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. Apparatus 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. Apparatus as claimed in the foregoing claims, characterized by the fact that the vertical uprights (9) may be pivoted in the lower part at pivots (31) on fixed shoes (32).

10. Apparatus as claimed in claim 9, characterized by the fact that the chain (33) 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).

Patentansprüche

1. Apparat zum dreiachsigen Fräsen und/oder Polieren, vorzugsweise zum Polieren der Kanten von Platten aus Stein, Marmor oder ähnlichen Materialien, wobei ein horizontales Fräserhalter-Längsteil (6) an einem Paar vertikaler Ständer (9) angeordnet und enlang dieser Ständer vertikal verstellbar ist, dadurch gekennzeichnet, daß die Enden des Fräserhalter-Längsteils (6) derart an den vertikalen Ständern (9) angeornet sind, daß das Längsteil vertikal vershiebbar und winkelmäßig drehbar ist, wobei die vertikalen Ständer ihrerseits an horizontalen Führungen (21) im oberen Teil eines feststehenden Rahmenwerkes (5) angeordnet sind, wobei das winkelmäßige Verdrehen und das vertikale Verschieben des Längsteils (6) an den betreffenden Ständern (9) ebenso wie das Verschieben der Ständer (9) auf den horizontalen Führungen (21) durch Antriebsmittel ermöglicht und durch eine Steuereinrichtung gesteuert wird, wobei die Antriebsmittel durch Antriebsräder oder dergleichen angetrieben werden.

2. Apparat gemäß Anspruch 1, dadurch gekennzeichnet, daß die winkelmäßige Rotation und das vertikale Verschieben des Längsteils (6) an den betreffenden Ständern (9) ebenso wie das Verschieben der Ständer (9) an den horizontalen Führungen (21) durch Ketten oder dergleichen (13, 16, 22) verursacht wird, die einzeln durch Motortriebe bewegt oder angehalten werden.

3. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß die winkelmäßige Verdrehung und das vertikale Verschieben des Längsteils (6) an den betreffenden Ständern (9) ebenso wie das Verschieben der Ständer an den horizontalen Führungen (21) durch Kugelumlaufspindeln (27, 28) und/oder Zahnstangen, Hydraulikzylinder oder ähnliche Antriebsmittel ermöglicht wird.

4. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß das Längsteil (6), an welchem die Fräsergruppen (7) gelagert sind, horizontal zwischen zwei Ständern (9) angeordnet ist und vertikal an den Ständern (9) gleiten kann, da das Längsteil an Platten angebracht ist, die in vertikalen Führungen gleiten, welche an den Ständern (9) vorgesehen sind.

5. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß das Fräserhalter-Längsteil (6) durch die Einwirkung einer rotierenden Einrichtung winkelmäßig drehbar ist, die es dem Längsteil (6) ermöglicht, winkelmäßige Verlagerungen um die horizontale Achse der Schäfte (8) auszuführen, an denen das Längsteil angeordnet ist.

6. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß die rotierende Einrichtung aus einem feststehenden, halbkreisförmigen verzahnten Kranz (15) besteht, der mit einer Kette (13) versehen ist, die an ihren Enden (14) an dem Kranz festgelegt ist, und die mit dem Zahnrad (12) eines Motors (11) in Eingriff steht, der integral mit dem Längsteil (6) ausgebildet ist, um das

Längsteil (6) winkelmäßig zu bewegen.

7. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß das vorliegende Mehrfach-Verlagerungssystem erlabut, daß die Bearbeitungswerkzeug-Einrichtung (7) auf synchronisierte Weise gemäß zweier Translationsbewegungen, nähmich horizontal in den Führungen (21) und vertikal auf den Ständern (9), und gemäß einer Rotationsbewegung auf der horizontalen Achse der Schäfte (8), die das Längsteil (6) halten, verlagert werden kann.

8. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß in Abhängigkeit vom Profil der zu polierenden Platte underschiedliche Verlagerungsparameter für die motorisierten Einrichtungen gesetzt sind, durch einfaches Auswählen und Synchronisieren der Dauer und Betriebszeiten der einzelnen Motoren mittels einer Steuereinrichtung, z.B. einer computergestützten Steuereinrichtung.

9. Apparat gemäß den vorhergehenden Ansprüchen, dadurch gekennzeichnet, daß die vertikalen Ständer (9) im unteren Bereich an Zapfen (31) an feststehenden Schuhen (32) schwenkgelagert sind.

10. Apparat gemäß Anspruch 9, dadurch gekennzeichnet, daß die Kette (33) durch ein Gelenk (34) mit einer Verbindungsstange (35) verbunden ist, die ihrerseits an einem Lager (36) mit dem feststehenden Rahmenwerk verbunden ist, während die Verbindungsstange andererseits an einem Zapfen (37) angreift, der integral mit den Ständern (9) augebildet ist.

Revendications

1. Appareillage pour le freisage et/ou le polissage sur trois axes, de préférence pour polir les bords de plaques en pierre, marbre ou matériaux similaires, comprenant una barre porte fraises horizontale (6) disposée sur deux montants verticaux (9) et réglable verticalement long dits montants, caracterisé par le fait que les extremités de la barre (6) porte fraises sont appliquées sur les montants verticaux (9) en façon que la barre puisse glisser verticalement et puisse pivoter en angle, les montants verticaux (9) étant à leur fois disposés sur glissières horizontales (21) dans la partie superieure d'une châssis fixe (5); la rotation angulaire et le glissement vertical de la barre (6) sur les respectives montnts (9) ainsi que le glissement des montants (9) sur les glissières horizontales (21) étant realisé au moyen de moyens de traînement qui sont commandés par des organes moteurs ou similaires et étant commandés par un dispositif de commande.

2. Appareillage selon la revendication 1, caracterisé par le fait que la rotation et le glissement vertical de la barre (6) sur les respectifs montants (9) ainsi que le glissement des montants (9) sur les glissières horizontales (21) sont determinés par des chaînes ou similaires (13, 16, 22) qui sont mûes ou interceptées singolairement par des pignons de moteurs.

3. Appareillage selon les revendication précédentes, caracterisé par le fait que la rotation angulaire et le glissement vertical de la barre (6) sur les respectifs montants (9) ainsi que le glissement des montants (9) sur les glissières horizontales (21) étant permis par des vis (27, 28) à recyrcle de sphères et/ou de crémailleres, cylindres oléodinamiques ou par d'autres moyens de mouvement similaires.

4. Appareillage selon les revendications précédentes, caracterisé par le fait que la barre (6) qui porte le groupe fraisant (7), est disposée horizontalement entre les deux montants (9) et peut glisser verticalement sur ceux-ci, car elle est montée sur plaques qui glissent sur glissières verticales présentes sur les mêmes montants (9).

5. Appareillage selon les revendications précédentes, caracterisé par le fait que la barre (6) porte outils peut pivoter en angle au moyen de l'intervention d'un groupe de rotation qui permet à la barre même d'effectuer des déplacements angulaires autour de l'axe horizontal des arbres sur lesquels elle est appliquée.

6. Appareillage selon les revendications précédentes, caracterisé par le fait que le group de rotation est formé par une couronne dentée fixe (15) demi-circulaire, comprenant une chaîne (13), fixée en correspondence de ses extremités (14) à la couronne même et interceptée par un pignon (12) d'un moteur (11), solidale à la barre (6) en manière de la mouvoir en angle.

7. Appareillage selon les revendications précédentes, caracterisé par le fait que ce système de glissement multiple permet que le groupe outils fraisants (7) puisse se déplacer d'une façon synchronisé selon deux mouvements de traslation, c'est à dire horizontalement sur les glissières (21) et verticalement sur les montants (9), et selon un mouvement de rotation sur l'axe horizontal des arbres (8) qui portent la barre (6).

8. Appareillage selon les revendications précedentes, caracterisé par le fait que selon le profil de la plaque à polir sont introduits certaines paramètres de déplacement des groupes motorisés, simplement selectionant et synchronisant, par un dispositif de contrôle par exemple computerisé, la durée et les temps d'action de chaque moteur.

9. Appareillage selon les revendications précédentes, caractérisé par le fait que les montants verticaux (9) peuvent être fixés dans la partie inférieure en correspondence des pivots (31) sur sabots fixes (32).

10. Appareillage selon la revendication 9, caractérisé par le fait que la chaîne (33) est engagée par une charnière (34) à une bielle (35), cette bielle d'une côté est liée au châssis fixe, en correspondence d'une bride (36), tandis que l'autre intercepte un pivot (37) solidaire aux montants (9).

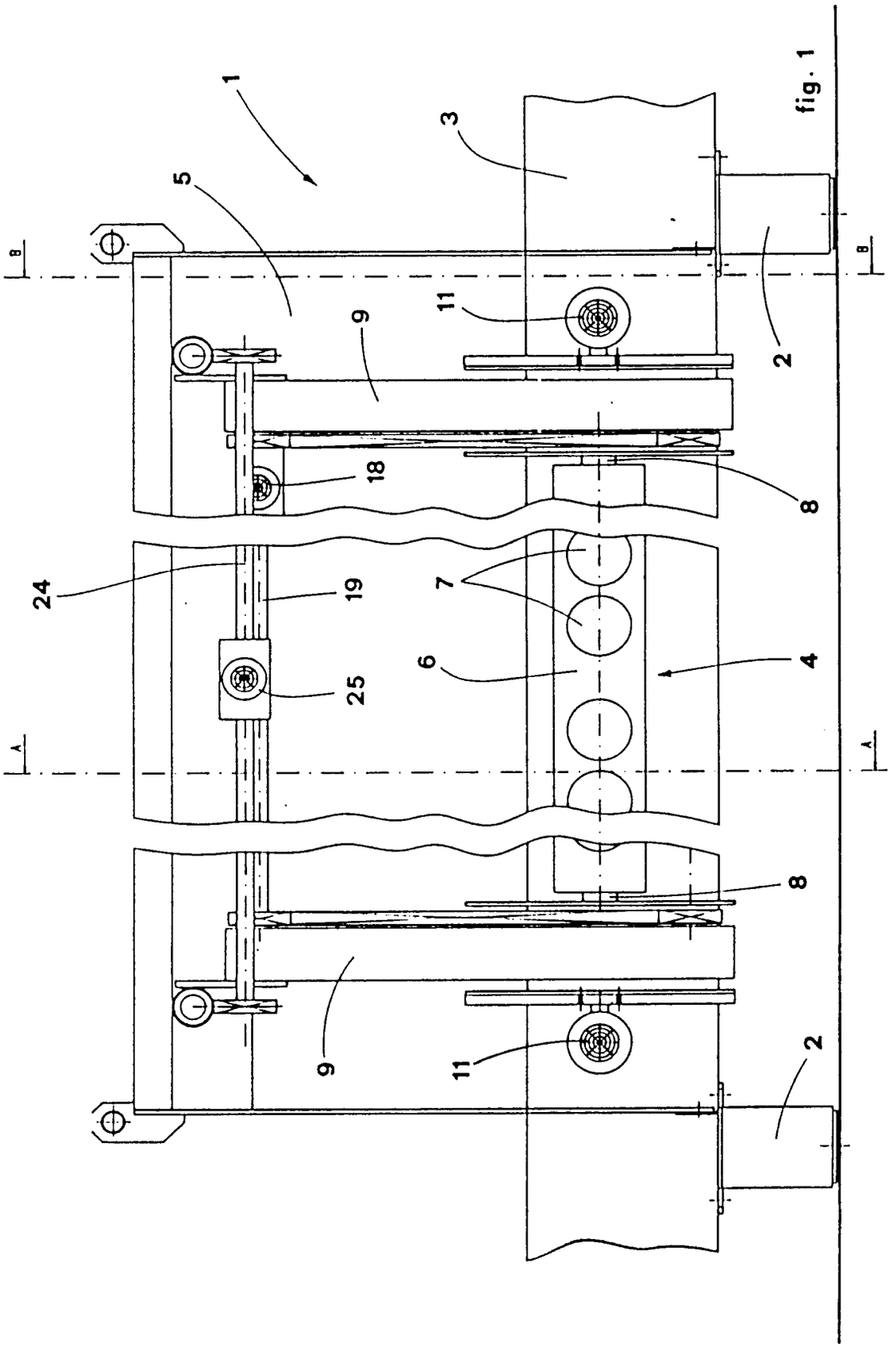

fig. 1

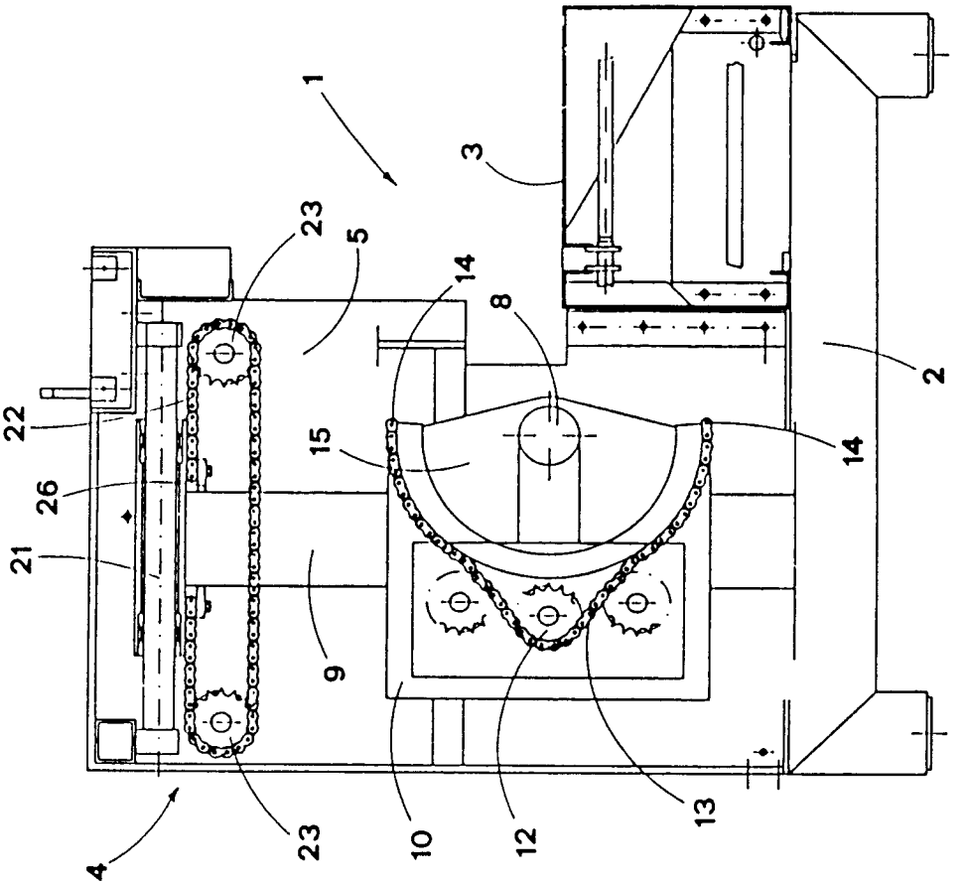
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fig. 3

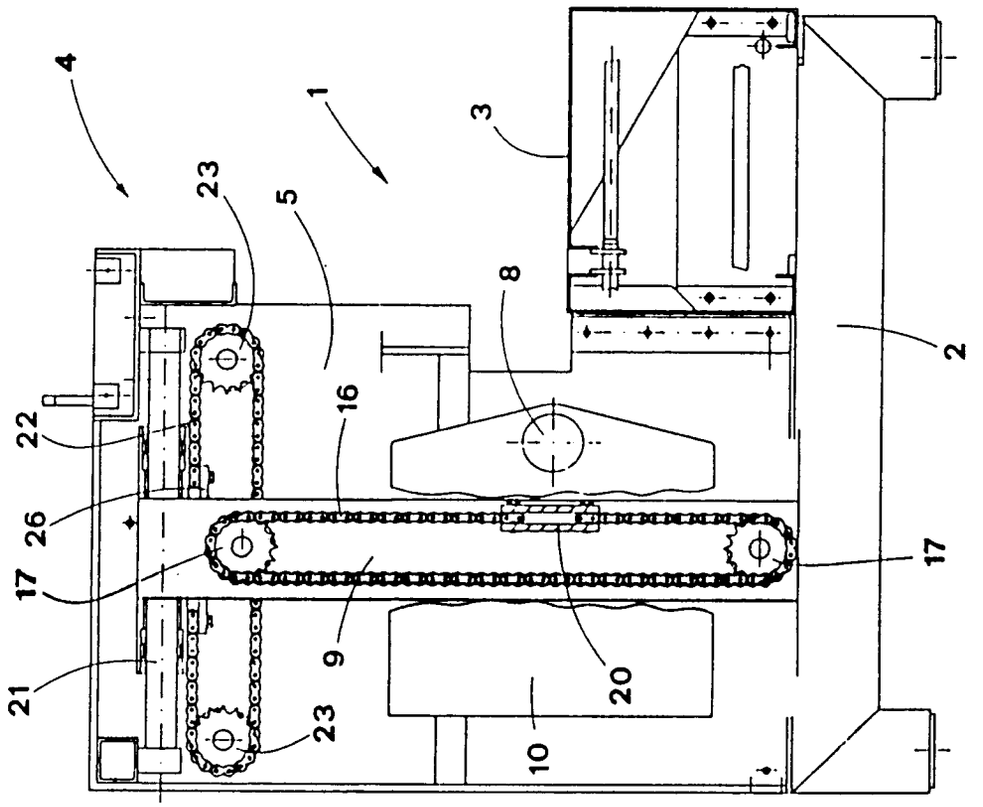
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fig. 2

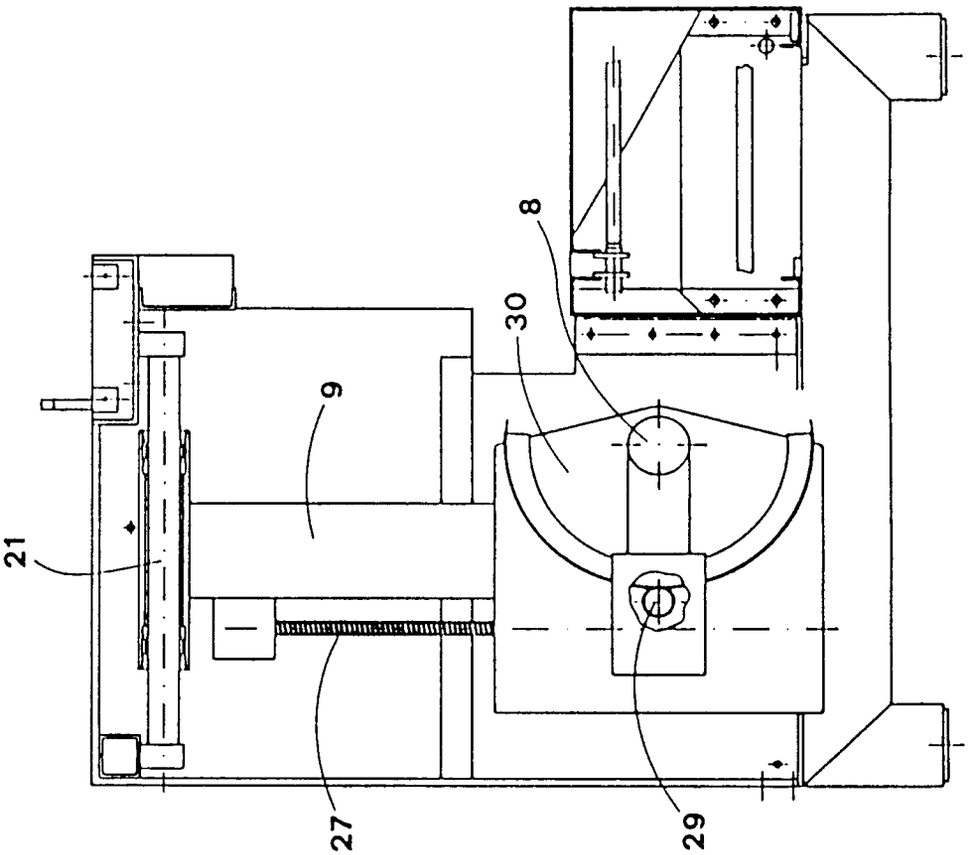

fig. 5

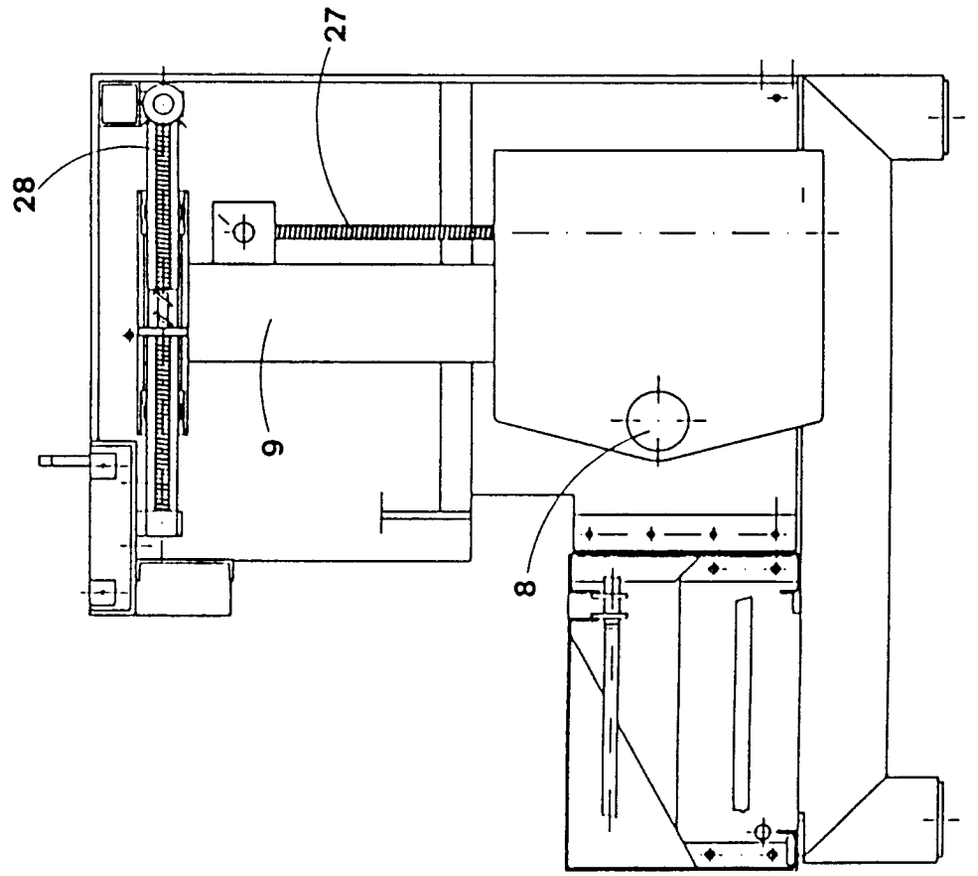

fig. 4

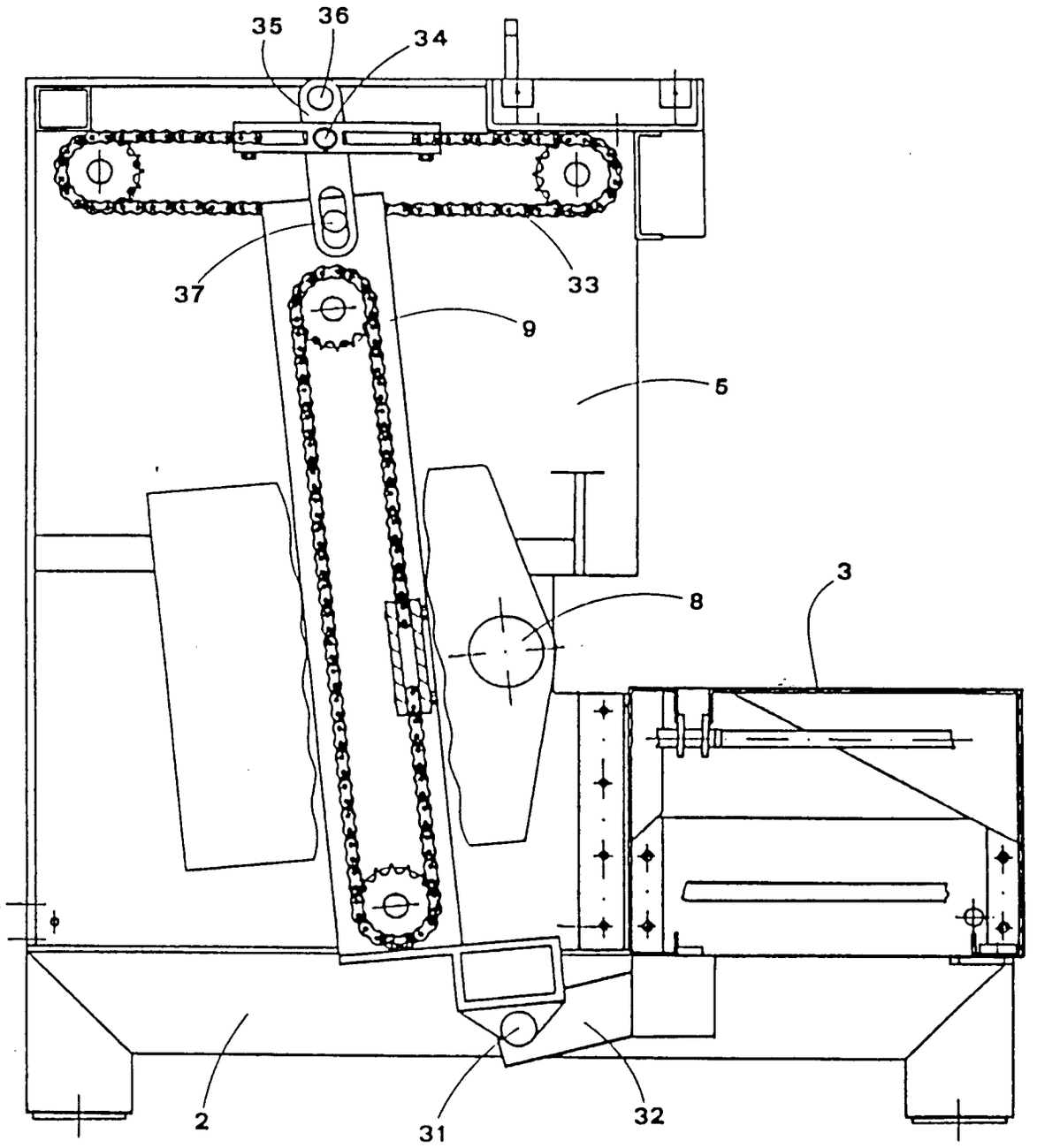

fig. 6