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

(11) **EP 1 870 201 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
26.12.2007 Bulletin 2007/52

(51) Int Cl.:
B23Q 3/18 *(2006.01)* ***B28D 1/04*** *(2006.01)*
B28D 7/00 *(2006.01)*

(21) Application number: **07008850.5**

(22) Date of filing: **02.05.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **02.05.2006 IT MO20060138**

(71) Applicant: **Pedrini, Luigi**
24060 Carobbio Degli Angeli (Bergamo) (IT)

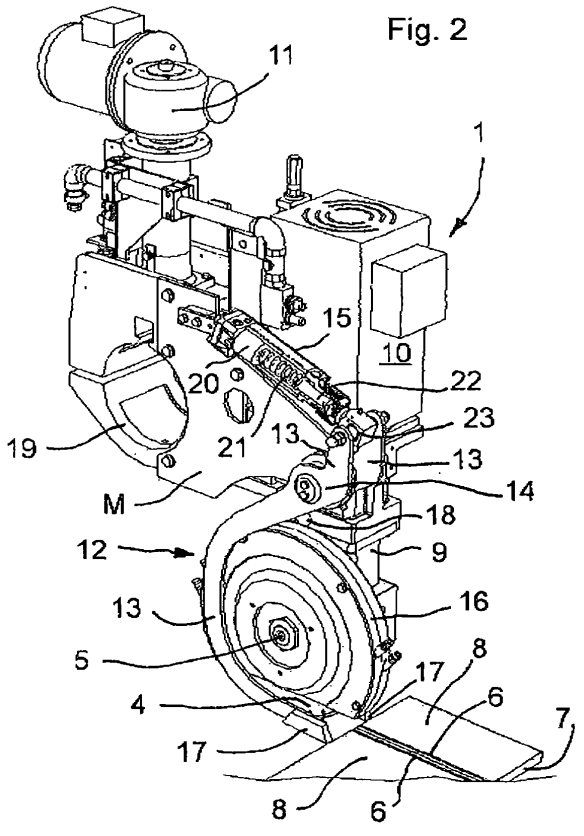
(72) Inventor: **Pedrini, Luigi**
24060 Carobbio Degli Angeli (Bergamo) (IT)

(74) Representative: **Rustichelli, Monica**
Brand & Patent
Via Ganaceto, 123
41100 Modena (IT)

(54) **Automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone**

(57) Automatic cross cutting machine for cutting plate-shaped elements comprising transversal cutting heads, at least one of said heads being provided with a double cutting disc (4), and with an alignment device (12) comprising feelers (17) mounted at the extremity of two pivoting arms (13) located on both sides of the cutting discs (4) and pivoting in an area (14) above the cutting discs (4), said feelers acting on the edge of said plate-shaped elements (8) by means of an elastic pressure element (21) and at least one programmed yielding element (15).

Fig. 2



EP 1 870 201 A1

Description

Field of the invention

[0001] The present invention relates to an automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone, that is a machine for precision cutting of the edges of the plate, slab, strip or tile, i.e. to cross cut, during the cutting process of the above, in automatic and multiple way with high precision, groups of plates, slabs, strips or tiles, when they are aligned on at least one gauge side, perpendicular to the direction of cutting.

Prior Art

[0002] The cross cutting machines of the prior art are provided with multiple heads which cut a plate, slab or strip with one size prevailing on another in order to divide it into plate-shaped elements having a given size and to make three of the four sides of the element, with the two corners included, precise and perpendicular to each other.

[0003] In cutting a plate, strip or long slab, the heads operate after it has been positioned in the work area and one of its sides has been placed against an alignment gauge, generally on the opposite side in the cutting direction of the discs. The heads with the cutting discs, spaced apart at the required distance, then subdivide them into single plate-shaped elements. Cutting is carried out with a single or double disc, in the case that two near ends of two plates, slabs or strips are to be cross cut.

[0004] Moreover, the cross cutting of short and light plate-shaped elements is not easy with the prior art heads since it is not possible to align perfectly the row of plate-shaped elements which the conveyor belt brings to the cutting by the machine.

[0005] In fact, the prior art alignment devices, acting on the gauge side, generally the side facing the operator, do not always ensure that cutting takes place exactly in a perpendicular direction between said gauge element and the cutting direction of the heads. The plate-shaped elements, through compaction effect of the row arriving on the conveyor belt, are positioned with only little space between their facing edges in the forward direction of the underlying belt. Said forward direction is close to the alignment gauge direction but, due to the previous working operations, the plate-shaped element may have edges which are not square-cut, i.e. perpendicular to the alignment gauge side; in this way, the compaction action of the conveyor belt incorrectly aligns the short and light element, preventing correct positioning of the longitudinal edge for alignment to the gauge.

[0006] Finally, the cross cutting of plates, slabs, strips or tiles can take place one by one, but with a considerable increase in costs and reduced productivity compared to the cost of the machine.

[0007] The technical problem underlying the present invention is to provide a machine for automatic cross cutting of short and light plate-shaped elements, with high production and which is easy to set up upon change of their shape.

[0008] A further aim of the invention is to provide an alignment device for plates, slabs, strips and tiles, when they are transported by a conveyor belt to the working area of the machine and said device is easy to mount also on existing machines.

Summary of the invention

[0009] This problem is solved, according to the present invention, by an automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone, comprising: several cutting heads transversal to the forward direction of the underlying conveyor belt; at least one or more of said heads being provided with a double adjacent cutting disc; said heads being mobile, on a single beam longitudinal along the feed of the cutting, in a transversal direction to said conveyor belt; a gauge and alignment element longitudinal to the direction of the conveyor belt and perpendicular to the cutting direction of the discs mounted on said heads, of the strips, slabs or plate-shaped elements; characterized in that it provides, associated to at least one head, or at least to said at least one head provided with a double adjacent cutting disc, a device for aligning the strips, slabs or plate-shaped elements by pushing the two plate-shaped elements, which are positioned near said head and intended to be cut on the facing edges by said double cutting disc; the alignment device comprising a double feeler each placed on the sides of the double cutting disc, an elastic pressure element on the edge of the plate-shaped elements and at least one programmed yielding element at the end of the initial alignment run and at the beginning of the cutting.

[0010] In a preferred embodiment, the cross cutting machine is further provided with the transversal cutting heads each provided with a double cutting disc, coupled and spaced apart at the required distance on the same mandrel, except for the first and last head of the machine, in a longitudinal direction to said conveyor belt, provided instead with a single disc; each head being provided with an alignment device; the two end heads optionally having he same configuration as the central heads and being provided with the same alignment device.

[0011] In a further embodiment, the cross cutting machine is further provided with the alignment device comprising two arms, pivoted in the area above the cutting discs, each provided with a feeler, and an elastic element placed between one end of said arms and the structure of the cutting head.

[0012] In a further preferred embodiment, the cross cutting machine is further provided with the programmed yielding element consisting of a pneumatic cylinder acting on the two arms, pivoted in the area above the cutting discs, each provided with a feeler, and wherein the elastic

element placed between one end of said arms and the structure of the cutting head is housed directly on the shaft of said cylinder.

[0013] In a preferred embodiment, the alignment device of the automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone, can be mounted on a single head of transversal cutting or cross cutting machines with a double cutting disc; characterized in that it has a double feeler each placed on the sides of the double cutting disc, an elastic pressure element on the edge of the plate-shaped elements and at least one programmed yielding element at the end of the initial alignment run and at the beginning of the cutting; further provided with a supporting element, which can be mounted on said cutting head, to which the alignment device is connected.

[0014] In a preferred embodiment of the alignment device, the programmed yielding element consists of a pneumatic cylinder, acting on two advantageously arched arms, pivoted in the area above the cutting discs, each provided with a feeler, flanking the casing of the cutting discs, and wherein the elastic element placed between one end of said arms and the structure of the cutting head is housed directly on the shaft of said cylinder.

[0015] The features and advantages of the present invention, in the production of an automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone, will become more apparent from the following detailed description of an exemplary but non-limiting embodiment thereof, as illustrated in the accompanying drawings.

Brief description of the drawings

[0016]

- Figure 1 represents a schematic frontal view limited to some of the adjacent heads of the cross cutting machine according to the invention;
- figure 2 represents a schematic view in perspective of a single head, provided with an alignment device before the starting of the cutting step of the plate, slab, strip or tile;
- figure 3 represents a schematic view in perspective of the alignment device of the cross cutting machine according to the invention;
- figures 4 and 5 represent a schematic view, beside the single head in Figure 2, of the two subsequent steps of approach and alignment;
- figure 6 represents the start of the cutting step, in a schematic lateral view of the single head in Figure 2;
- figures 7 and 8 represent two subsequent steps, in a schematic lateral view of the single head in Figure 2, of enlarging the cut and cutting the last section of the plate, slab, strip or tile.

Detailed description of a preferred embodiment

[0017] The automatic cross cutting machine, Figure 1, comprises a plurality of heads 1, longitudinally aligned above a conveyor belt 2 with single cutting heads 3 or coupled 4 on the same mandrel 5; cutting of the abutting edges 6 takes place perpendicularly to the longitudinal gauge edge of each plate-shaped element 8. Moreover, the head comprises transmission 9 of motion to the cutting discs by means of an electric motor 10; a geared motor group 11 adjusts the cutting discs as the shape of the work pieces changes. Figure 1 also shows the alignment device 12 comprising the arched pushers 13, oscillating on a longitudinal pivot 14 through the action of a spring-loaded pneumatic piston 15; said device is advantageously supported to an plate M connected to the head 1. In the starting position, the pushers flank the casing 16 of the cutting discs and terminate with feelers 17 in rigid material but which do not damage the longitudinal thrust edge of the plate-shaped element 8, towards the gauge edge 7; said arched pushers 13 are positioned during working against a retainer 18 fixed to the external structure of the motion transmission 9.

[0018] Figure 2, besides the housing 19 of the beam, not illustrated, longitudinal to the machine carrying the heads 1, also shows the piston 20 of the pneumatic cylinder 15 provided with an internal spring 21; the shaft 22 of the cylinder acts on the arched pushers 13 by means of the pivot 23, adjusting its position with respect to the longitudinal thrust edge when aligning the plate-shaped elements 8.

[0019] Moreover, Figures from 4 to 8 illustrate the supporting metal structure 24 of the conveyor belt 2 and the longitudinal gauge 25, for aligning the edge 7 of each plate-shaped element 8, in the resting position detached from the row of elements 8, Figures 4 and 8, and in the engagement position against the edge 7 of said plate-shaped elements, Figures 5, 6 and 7.

[0020] The alignment device 12, during operation of the automatic cross cutting machine for the plate-shaped elements, operates as follows.

[0021] The row of plate-shaped elements 8 is carried forward on the conveyor belt until it reaches the retainer on the abutting edge 6 of the first element in the row, said retainer not illustrated in the Figure. The continued movement of the conveyor belt 2 brings the transversal edges of each element 8 in contact with the edges of the previous and successive elements, so as to present a row of N-1 plate-shaped elements for cutting under the N heads which the machine is provided with. The first and the Nth head can be provided with just one cutting disc 3, while the intermediary heads are advantageously provided with two cutting discs 4 mounted on the same mandrel 5.

[0022] The cross cutting method can now start since the position of the heads and the gauge, with respect to

the elements 8, is illustrated in Figure 4. The longitudinal alignment gauge 25 is brought forward into alignment position, defining the straight line on which the edges 7 of each plate-shaped element 8 must be aligned, independently of the original conformation and alignment of the edges 6, still imprecise during the previous work step; at the same time, the longitudinal beam pushes the heads 1 towards the longitudinal gauge 25, so that the feelers 17 of the arched arms 13, of each alignment device 12, push the elements 8 against said longitudinal gauge 25, aligning the edge 7 against the longitudinal gauge, as can be seen in Figure 5.

[0023] Start of the abutting cutting step, visible in Figure 5, takes place with the cutting discs 3, in the edges of the row of plate-shaped elements, and 4 in the area where the edges 6 between two consecutive plate-shaped elements face each other. In the latter case, as can be seen on Figures 1 and 2, cutting takes place with removal of waste from both adjacent edges, so that they are both perfectly abutted perpendicularly, i.e. at 90°, compared to the longitudinal direction of the longitudinal gauge 25.

[0024] As cutting progresses, Figure 6, the alignment device 12 is no longer necessary and the pneumatic piston 20, which until the previous step was in a withdrawn position, allowing the spring 21 to release its elastic action compressing the edge of the plate-shaped element 8 concerned, advances, removing the feelers 17 of each arched arm 13 from the edge of the relative plate-shaped element 8, after the cutting disc 3, 4 has completely entered into the plate-shaped element 8.

[0025] The cutting discs 3, 4 advance, as can be seen in Figure 7, until they reach the longitudinal gauge 25. Just before cutting terminates, Figure 8, so as to avoid contact between the cutting disc and the longitudinal gauge 25, the latter is withdrawn and cutting is completed using only the friction reaction of the plate-shaped element 8 on the conveyor belt 2. Once cutting is completed, the heads 1 are withdrawn and the conveyor belt can advance with a new group of strips, slabs or plate-shaped elements of natural stone to be cut by the machine.

[0026] The alignment device 12 can advantageously be mounted on cutting heads of existing machines since it can be applied to a head by means of the support plate M, obviously modifying its original operation cycle; i.e. integrating it with the operation of the longitudinal gauge 25 according to the position reached by the discs during cutting.

[0027] Naturally, in order to satisfy contingent and specific requirements, a person skilled in the art may apply to the above-described automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone according to the invention many modifications and variations, all of which, however, are included within the scope of protection of the invention as defined by the following claims. Therefore, even if less advantageously, the spring 21 can be placed outside the pneumatic cylinder 15 or connected directly to the arched arms 13. Moreover, the pneumatic cylinder can be replaced with an elastic yielding leverage programmed with the angular rotation of said arched arms, during cutting progress, and brought back into position after the head returns to the machine bed for alignment.

Claims

1. Automatic cross cutting machine for strips, slabs or plate-shaped elements of natural stone, comprising: several cutting heads (1) transversal to the forward direction of an underlying conveyor belt (2); at least one or more of said heads being provided with a double cutting disc (4); said heads being mobile, on a single beam longitudinal along the feed of the cutting, in a transversal direction to said conveyor belt (2); a gauge and alignment element (25), longitudinal to the direction of the conveyor belt (2) and perpendicular to the cutting direction of the discs mounted on said heads, of the strips, slabs or plate-shaped elements (8); **characterized in that** it provides, associated to at least one head (1), or at least to said at least one head provided with a double adjacent cutting disc (4), a device (12) for aligning the strips, slabs or plate-shaped elements (8) by pushing the two plate-shaped elements, which are positioned near said head and intended to be cut on the facing edges (6) by said double cutting disc (4); the alignment device comprising a double feeler (17) each placed on the sides of the double cutting disc (4), an elastic pressure element (21), on the edge of the plate-shaped elements, and at least one programmed yielding element (15) at the end of the initial alignment run and at the beginning of the cutting.

2. Automatic cross cutting machine, according to claim 1, wherein the transversal cutting heads (1) are each provided with a double cutting disc (4), coupled and spaced apart at the required distance on the same mandrel (5), except for the first and the last machine head, in the longitudinal direction of said conveyor belt (2), provided instead with a single disc (3); each head being provided with an alignment device (12); the two end heads optionally having the same configuration as the central heads and being provided with the same alignment device.

3. Automatic cross cutting machine, according to one of the previous claims 1, 2, wherein the alignment device (12) comprises two arms (13), pivoted (14) in the area above the cutting discs, each provided with a feeler (17), and with an elastic element (21) placed between one end of said arms and the structure of the cutting head.

4. Automatic cross cutting machine, according to one of the previous claims 1, 2, wherein the programmed

yielding element consists of a pneumatic cylinder (15) acting on two arms (13), pivoted (14) in the area above the cutting discs, each provided with a feeler (17), in association with the elastic element (21) placed between one end of said arms and the structure of the cutting head.

5. Automatic cross cutting machine, according to one of the previous claims 1, 2, wherein the programmed yielding element consists of a pneumatic cylinder (15) acting on two arms (13), pivoted (14) in the area above the cutting discs, each provided with a feeler (17), and wherein the elastic element (21) placed between one end of said arms and the structure of the cutting head is housed directly on the shaft (22) of said cylinder.

6. Automatic cross cutting machine, according to one of the previous claims 1, 2, wherein the programmed yielding element is composed of a pneumatic cylinder (15) acting on two advantageously arched arms (13), pivoted (14) in the area above the cutting discs, each provided with a feeler (17) flanking the casing (16) of the cutting discs, and wherein the elastic element (21) placed between one end of said arms and the structure of the cutting head is housed directly on the shaft (22) of said cylinder.

7. Alignment device (12) for an automatic cross cutting machine for strips, slabs or plate-shaped elements (8) of natural stone, which can be mounted on a single head (1) of a transversal cutting or cross cutting machine with double cutting disc (4); **characterized in that** it is provided with a double feeler (17) each placed on the sides of a double cutting disc, a pressure elastic element (21), on the edge of the plate-shaped elements, and at least one programmed yielding element (15) at the end of the initial alignment run and at the beginning of the cutting; further provided with a support element (M), which can be mounted on said cutting head (1), to which the alignment device (12) is connected.

8. Alignment device, according to claim 7, wherein the alignment device (12) comprises two arms (13), pivoted (14) in the area above the cutting discs (4), each provided with a feeler (17), and an elastic element (21) placed between one end of said arms and the structure of the cutting head.

9. Alignment device (12), according to claim 7, wherein the programmed yielding element consists of a pneumatic cylinder (15) acting on two arms, pivoted (14) in the area above the cutting discs, each provided with a feeler (17), in association with the elastic element (21) placed between one end of said arms and the structure of the cutting head.

10. Alignment device, according to claim 7, wherein the programmed yielding device consists of a pneumatic cylinder (15) acting on two arms (13), pivoted (14) in the area above the cutting discs, each provided with a feeler (17), and wherein the elastic element (21) placed between one end of said arms and the structure of the cutting head is housed directly on the shaft (22) of said cylinder.

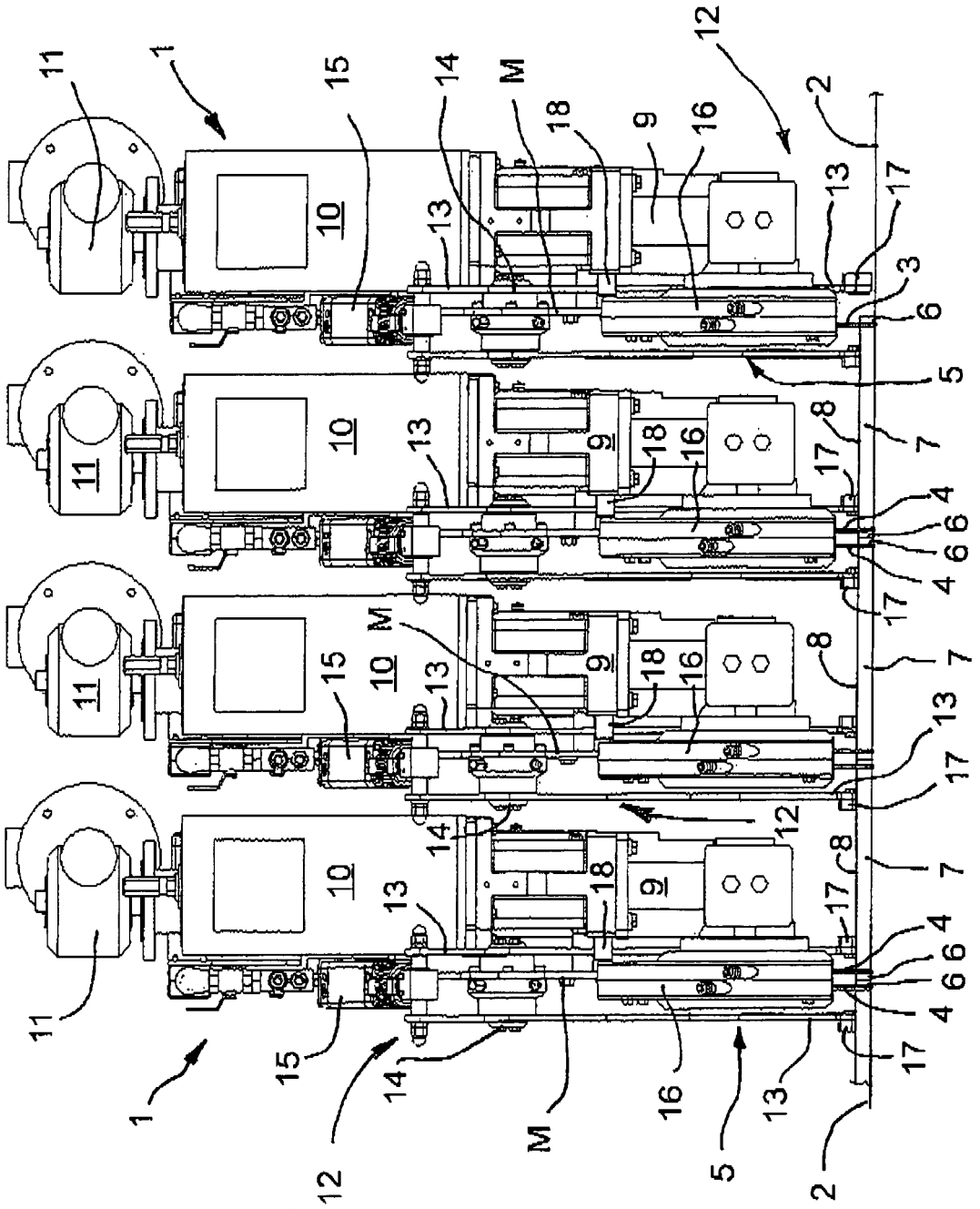

11
1
15
14
M
18
9
16
12
2
13
17
3
6
5
10
8
7
4
6
6
4
17
M
15
13
18
16
8
7
13
17
12
14
18
9
17
8
7
4
6
6
4
17
11
15
14
M
16
5
13
2
12
1

Fig. 1

Fig. 3

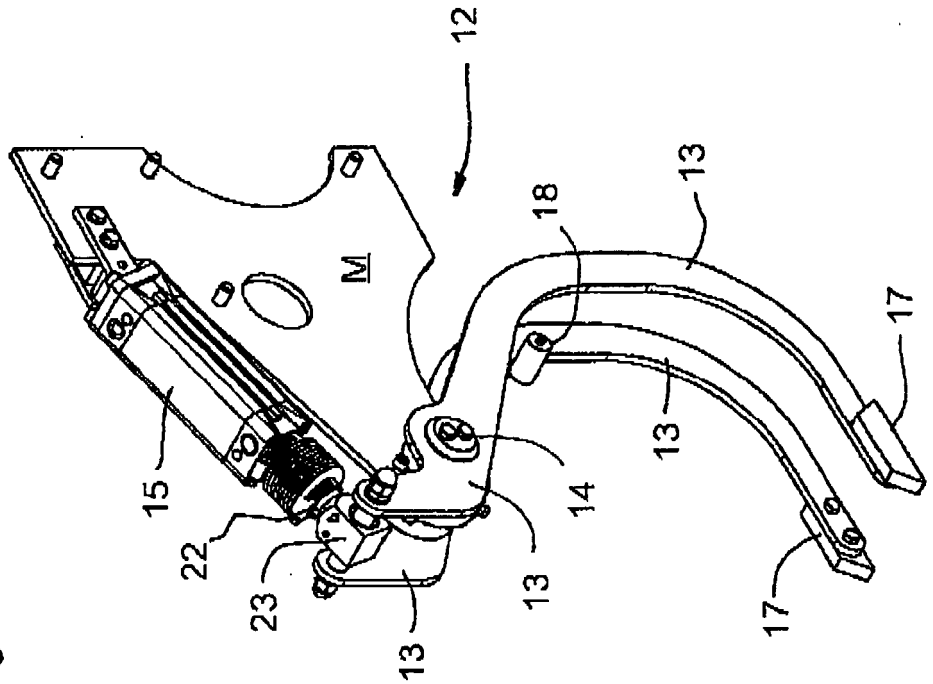
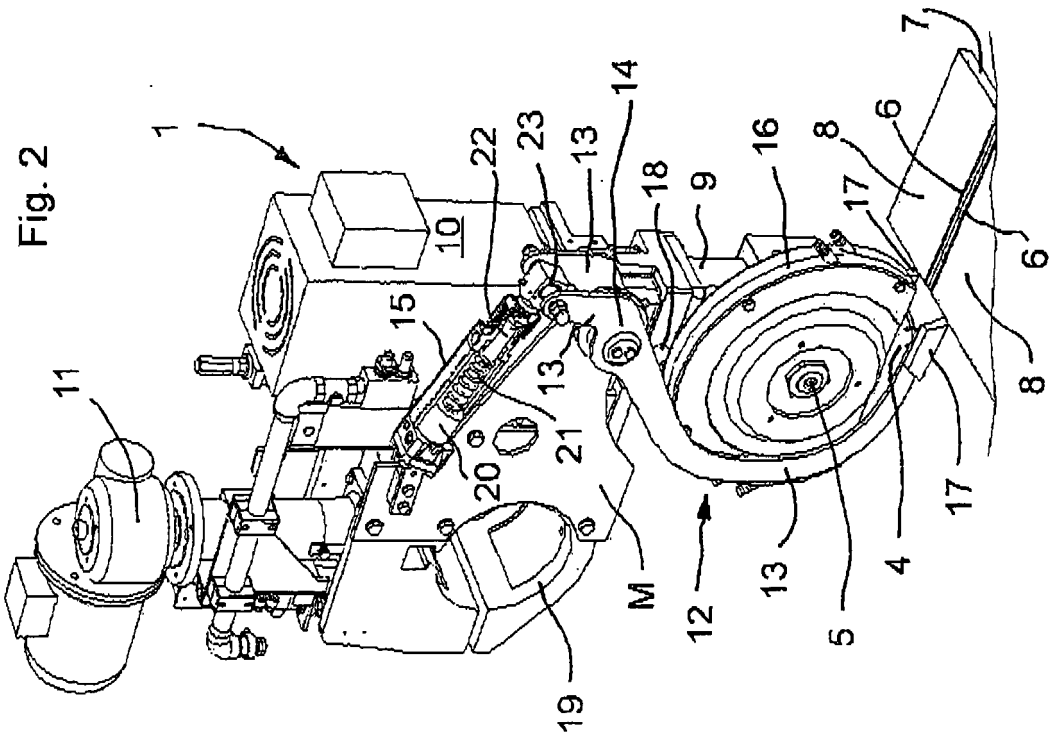

12
M
18
13
17
15
14
22
23
13
13
17
13

Fig. 2


1
10
22
23
13
14
18
9
16
8
6
7
17
6
15
13
11
20
21
8
M
12
13
4
17
5
19

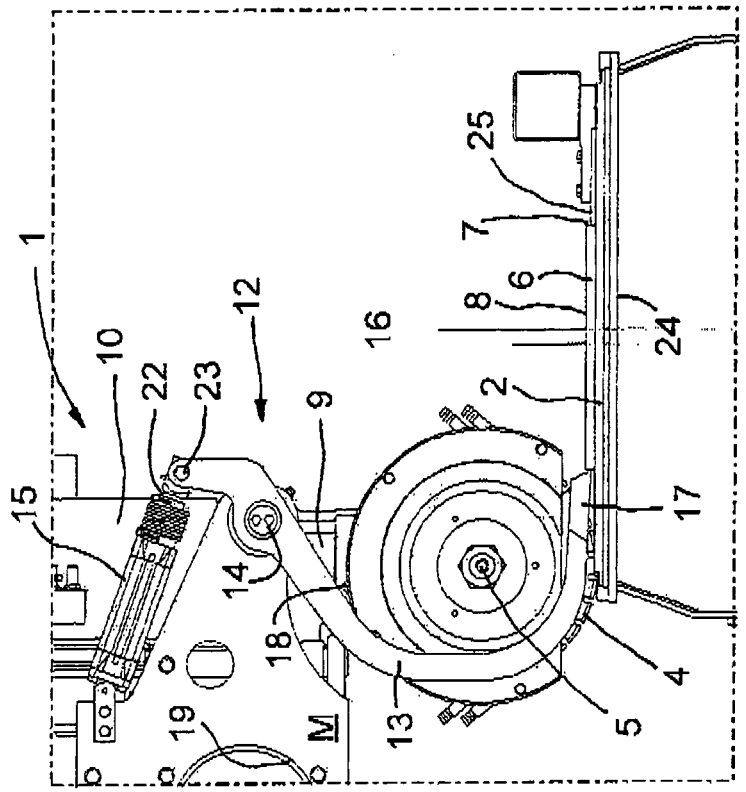

1
10
22
23
12
9
16
25
7
6
8
24
2
17
15
14
18
4
5
13
19
M

Fig. 5

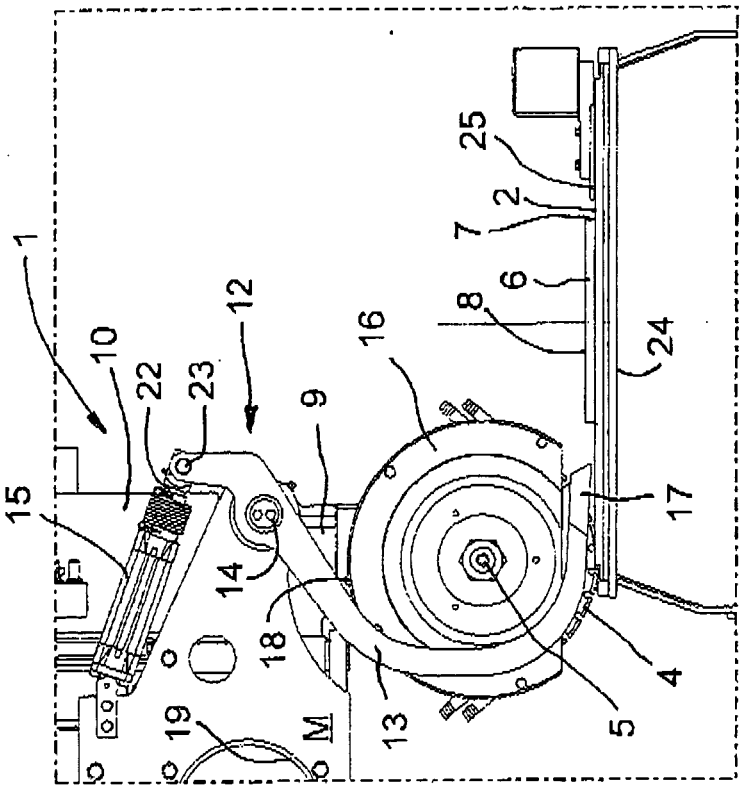

1
10
22
23
12
9
16
25
2
7
6
8
24
17
15
14
18
4
5
13
19
M

Fig. 4

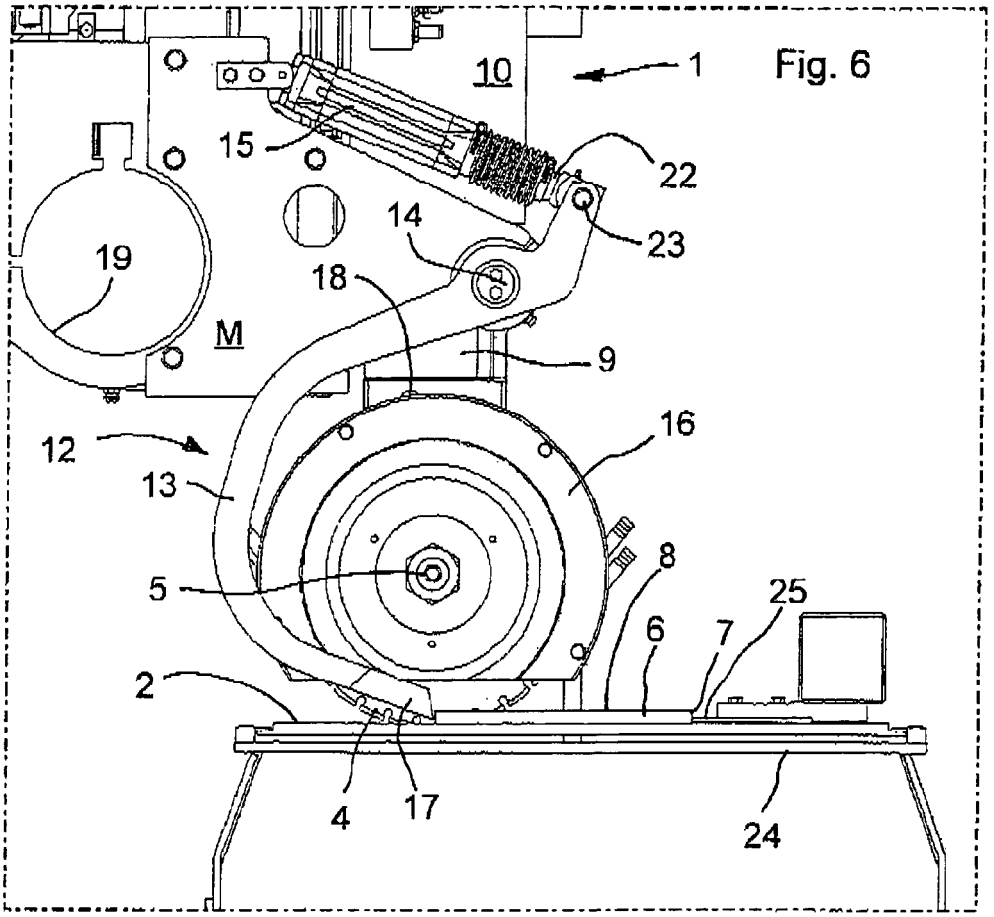


Fig. 6

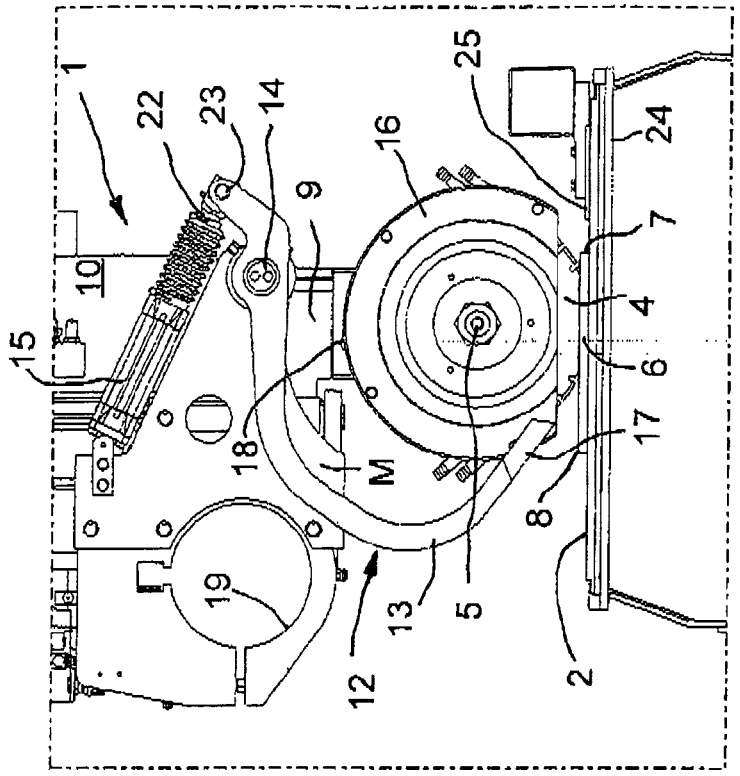

1
22
23
14
9
16
25
24
7
4
6
17
8
2
5
13
12
M
18
19
10
15

Fig. 8

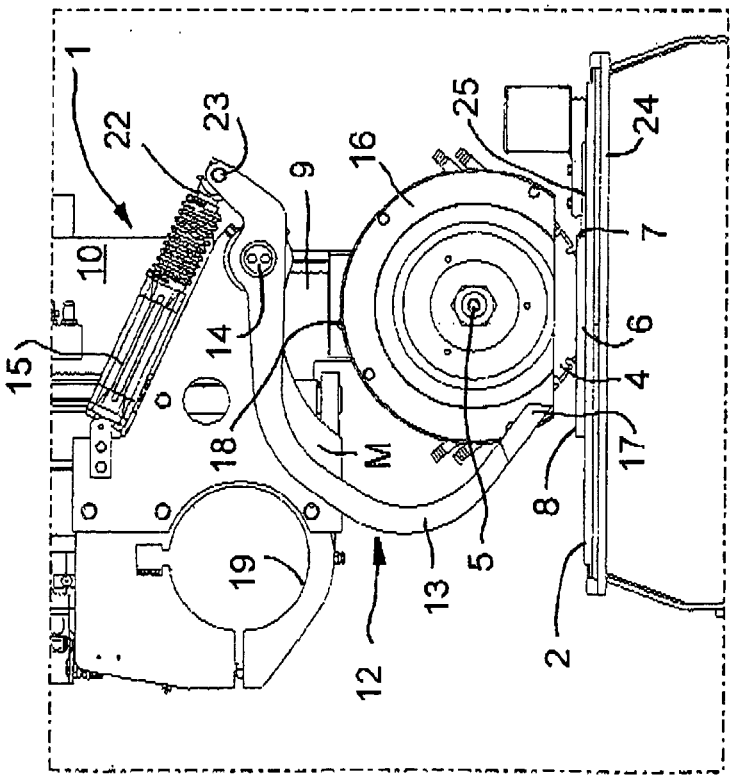

1
22
23
9
16
25
24
7
6
4
17
8
2
5
13
12
M
18
14
19
10
15

Fig. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 00 8850

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	FR 1 278 873 A (PERROT & AUBERTIN ETS) 15 December 1961 (1961-12-15) * the whole document * -----	1	INV. B23Q3/18 B28D1/04 B28D7/00
A	BE 344 114 A (N.E. NEWMAN) 30 September 1927 (1927-09-30) * page 3, line 13 - page 6, line 28 * * figures 1-5 * -----	1,7	
A	EP 0 191 455 A (STEINBEARBEITUNGS MASCHINENFAB [DE]) 20 August 1986 (1986-08-20) * page 9, line 34 * * page 10, lines 8-21 * * page 11, lines 12-18 * * page 19, line 7 - page 21, line 10 * * figures 1,2,4,5 * -----	1,7	
A	US 3 840 000 A (BIBLE E) 8 October 1974 (1974-10-08) * column 1, lines 4-6 * * column 2, lines 13-57 * * column 3, lines 18-22 * * figures * -----	7	

TECHNICAL FIELDS SEARCHED (IPC)

B23Q
B28D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	3 August 2007	Chariot, David

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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 00 8850

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

03-08-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 1278873 A	15-12-1961	NONE	
BE 344114 A		NONE	
EP 0191455 A	20-08-1986	DE 3504581 A1	14-08-1986
US 3840000 A	08-10-1974	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82