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(54) APPARATUS FOR HANDLING AND CUTTING STONE PLATES

(57) An apparatus (1) for handling and cutting stone slabs, comprising a pair of posts (2, 3) for delimiting a cutting area (4) and slab loading/unloading area (5), a support surface (8) for a slab, moving between the loading/unloading area (5) and the cutting area (4), a longitudinal load-bearing beam (9) slidingly mounted to the posts (2, 3) and moving in a transverse direction (T) and a cutting unit (10) slidingly mounted to the beam (9) over the support surface (8). The support surface (8) comprises a pair of work tables (14, 15) mounted to respective carriages (16, 17) defining each a substantially horizontal plate bearing surface (18, 19), and each carriage (16, 17) moving along guide means (20) secured to the ground between the cutting area (4) and the loading/unloading area (5). Drive means (23) are provided for translating each of the work tables (14, 15) between end positions corresponding to the cutting area (4) and the loading/unloading area (5). Each of the work tables (14, 15) comprises a tilting device (39) hinged to a carriage (16, 17) to pivot between a horizontal position in which it is coplanar with a respective bearing surface (18, 19) and a tilted position in which it is inclined to the respective bearing surface (18, 19) to facilitate loading/unloading of the slabs.

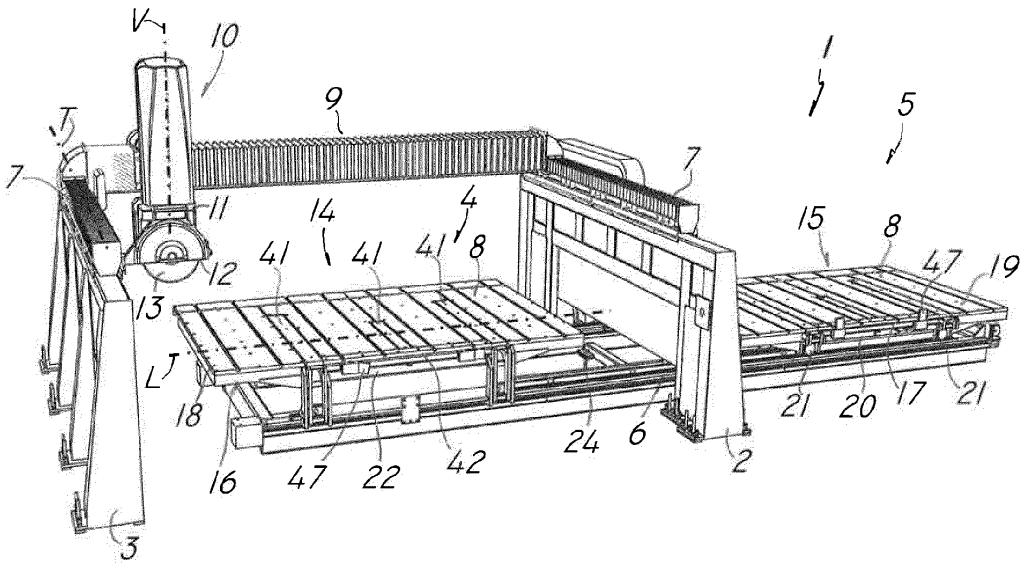

FIG. 1

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Description

Field of The Invention

[0001] The present invention generally finds application in working stone materials such as stone, marble, granite, and the like, and particularly relates to an apparatus for handling and cutting stone slabs.

Background art

[0002] Stone slab working has been long known to be carried out using cutting machines and apparatus comprising a load-bearing structure for delimiting a cutting zone and a horizontal beam with a cutting unit slidingly mounted thereto.

[0003] The cutting unit comprises a carriage sliding on the beam and a cutting head with a motorized spindle having a disk cutting tool rotatably associated therewith.

[0004] Furthermore, a slab supporting surface is located in the cutting area, and the cutting unit is configured to be vertically moved from the top face of the horizontal beam to the bottom face of the support surface.

[0005] The support surface may be fixed or movable and may be associated with slab-carrying trolleys which slide along rails or with a handling unit having suction cups, adapted to pick up the slabs from a loading/unloading workstation and to lay them on the support surface in the cutting area and vice versa.

[0006] A first drawback of this arrangement is that the provision of handlers with suction cups complicates construction, thereby considerably increasing the costs associated with fabrication and management of the machine or apparatus.

[0007] A further drawback is that the use of such sliding trolleys increases the slab loading/unloading times, thereby also considerably increasing the overall processing times.

[0008] In an attempt to at least partially obviate these drawbacks, machines or apparatus have been developed that use a plurality of sliding carriages with respective bearing planes, which alternately define the support surface in the cutting area, and the loading/unloading surface outside it.

[0009] ITVI20110165 discloses an apparatus comprising two carriages that move between a cutting zone and a loading/unloading area, having respective horizontal bearing surfaces adapted to alternately define the support surface or the loading/unloading surface when the carriages are in the cutting area or in the loading/unloading area respectively.

[0010] When one of the carriages is in the cutting area for supporting a slab that is being worked, the other carriage is in the loading/unloading area for an operator to unload the previously cut slab and load a new plate to be cut.

[0011] Each carriage is motorized and able to slide along a pair of rails in respective longitudinal directions. Furthermore, the bearing surfaces of the carriages have different heights and widths, to avoid mutual interference as they slide in opposite directions.

[0012] A first drawback of this arrangement is that slab positioning on the horizontal bearing surfaces of the carriages by the handling devices requires special skills of the operator.

[0013] Furthermore, direct positioning of the slabs on the horizontal surfaces increases the probability that slabs will be broken or damaged during loading/unloading.

[0014] A further drawback is that each carriage has an independent motor drive, separate from that of the other carriage, whereby the assembly and control of the apparatus will be very complex.

[0015] Another drawback is that the independent carriage drives increase the overall consumption and costs of the apparatus.

[0016] A further drawback is that positioning and leveling of rails are particularly complex during operation of the apparatus.

[0017] Yet another drawback is that the carriages cannot be stably locked in the cutting area while they are being worked and after being handled.

Technical Problem

[0018] In view of the prior art, the technical problem addressed by the present invention consists in providing an apparatus for handling and cutting stone slabs that can simplify carriage movement and afford very quick slab loading/unloading.

Disclosure of the invention

[0019] The object of the present invention is to obviate the above drawback, by providing an apparatus for handling and cutting stone slabs that is highly efficient and relatively cost-effective.

[0020] A particular object of the present invention is to provide an apparatus as described hereinbefore that affords very quick and simple slab loading and unloading.

[0021] A further object of the present invention is to provide an apparatus as described hereinbefore that affords simultaneous movement of the carriages while limiting the complexity of the drive means.

[0022] Another object of the present invention is to provide an apparatus as described hereinbefore that can reduce the dead times for loading and unloading the slabs thereby increasing the overall throughput.

[0023] A further object of the present invention is to provide an apparatus as described hereinbefore, that can reduce the overall operation and installation times.

[0024] Yet another object of the present invention is to provide a apparatus as described hereinbefore, that requires no particular skill of an operator for handling thereof.

[0025] A further object of the present invention is to

provide an apparatus as described hereinbefore that affords stable locking of the carriages in the cutting area.

[0026] These and other objects, as more clearly explained below, are fulfilled by an apparatus for handling and cutting stone slabs as defined in claim 1, comprising a pair of posts for delimiting a cutting area and a slab loading/unloading area, a support surface for a slab, moving between the loading/unloading area and the cutting area, a longitudinal load-bearing beam slidingly mounted to the posts and moving in a transverse direction and a cutting unit slidingly mounted to the longitudinal beam over the support surface.

[0027] The support surface comprises a pair of work tables mounted to respective carriages defining each a substantially horizontal plate bearing surface, and each carriage moving along guide means secured to the ground between the cutting area and the loading/unloading area. Drive means are further provided for causing each of the work tables to translate between end positions corresponding to the cutting area and the loading/unloading area.

[0028] Each of the work tables comprises a tilting device hinged to a carriage to pivot between a horizontal position in which it is coplanar with a respective bearing surface and a tilted position in which it is inclined to the respective bearing surface to facilitate loading/unloading of the slabs.

[0029] Advantageous embodiments of the invention are obtained in accordance with the dependent claims.

Brief Description of The Drawings

[0030] Further characteristics and advantages of the invention will be more apparent upon reading of the detailed description of a preferred, non-exclusive embodiment of an apparatus for handling and cutting stone which is described as a non-limiting example with the help of the annexed drawings, in which:

FIG. 1 is a perspective view of an apparatus for handling and cutting stone slabs according to the invention;

FIGS. 2 and 3 are top view and side views of a first detail of the apparatus of Fig. 1;

FIGS. 4 and 5 are enlarged perspective views of the first detail of the apparatus as shown in Figs. 2 and 3;

FIGS. 6 and 7 are a front view and a respective enlarged view of the first detail as shown in Figs. 2 and 3;

FIG. 8 is an enlarged perspective view of a third detail of the drive assembly of the invention.

Detailed description of a preferred exemplary embodiment

[0031] Particularly referring to the figures, there is shown an apparatus for handling and cutting stone slabs, generally designated by numeral 1.

[0032] Namely, the apparatus 1 may be used for cutting or shaping slabs made of a stone material, such as stone, marble, granite, conglomerate stone and concrete materials, to obtain a plurality of specially shaped strips or portions.

[0033] As is known per se, the apparatus 1 comprises a pair of posts 2, 3 secured to the ground and adapted to delimit a cutting area 4 zone and a slab loading/unloading area 5, external to the cutting area 4.

[0034] As shown in FIG. 1, one of the posts 2 comprises an opening 6 to allow communication of the cutting area 4 with the slab loading/unloading area 5. Furthermore, both posts 2, 3 have transverse guides 7 at their tops.

[0035] The apparatus 1 comprises a support surface 8 for at least one slab, moving between the cutting area 4 and the loading/unloading area 5 and a longitudinal load-bearing beam 9 which is slidingly mounted to the posts 2, 3, particularly to the transverse guides 7, and moves along a respective transverse direction T.

[0036] In addition, a cutting unit 10 is slidingly mounted to the longitudinal beam 9 over the support surface 8 for forming a plurality of cuts or outlines on the slabs.

[0037] The cutting unit 10 is slidingly mounted to the longitudinal beam 9 and comprises a head 11 with a motorized spindle 12 equipped with a disk cutting tool 13.

[0038] The head 11 with the cutting tool 13 may be configured to rotate and translate relative to the beam 9 along a substantially vertical axis V, to be positioned and moved proximate to the surface 8 that supports the slab that is being worked.

[0039] This support surface 8 comprises, and is alternately defined by, a pair of work tables 14, 15 mounted to respective carriages 16, 17 and each defining a substantially horizontal slab bearing surface 18, 19.

[0040] Each carriage 16, 17 moves along guide means 20 secured to the ground between the cutting area 4 and the loading/unloading area 5, in a longitudinal feed direction L and through the opening 6 formed in the post 2. In addition, each carriage 16, 17 is mounted to wheels 21 and comprises respective side walls 22, 22'.

[0041] Each of the work tables 14, 15 is caused to translate along the guide means 20 between end positions corresponding to the cutting area 4 and the slab loading/unloading area 5 by means of suitable drive means 23.

[0042] The work tables 14, 15 may have different heights and transverse dimensions and each carriage 16, 17 may comprise at least one longitudinal edge parallel to the direction of feed L and at least one transverse edge substantially orthogonal to the direction of feed L.

[0043] The guide means 20 will consist of pairs of transversely offset rails 24, 24' which are adapted to support the wheels 21 of either one of the carriages 16, 17.

[0044] This will prevent mutual interference of the carriages 16, 17 as they translate in opposite directions between end positions.

[0045] This configuration allows an operator to unload a cut slab and load a new slab to be cut on one of the

carriages 16 while another slab, supported by the other carriage 17 is being worked in the cutting area 4.

[0046] As best shown in FIGS. 4 to 8, the drive means 23 may comprise, proximate to the guide means 20, a pair of motorized, closed-loop belts 25, 26 or strips.

[0047] The belts 25, 26 will be placed on each side of the longitudinal feed axis L and each may be connected to both work tables 14, 15 to cause to simultaneously translate in opposite directions from the cutting area 4 to the loading/unloading area 5 and vice versa.

[0048] Each belt 25, 26 may be wound in a closed loop on a respective pair of powered pulleys 27, 28 mounted to respective substantially vertical axes V'.

[0049] Furthermore, the pulleys 27', 27", 28', 28" of each pair will be located at the longitudinal ends of the rails 24, 24', i.e. One at the cutting area 4 and the other at the loading/unloading area 5.

[0050] In particular, one longitudinal section 25' of the closed loop of a belt 25 is connected to a lateral wall 22 of one carriage 16, and the other longitudinal section 25" of the closed loop of the same belt 25 is connected to the side wall wall 22' of the other carriage 17.

[0051] Therefore, the two-way sliding movement of the longitudinal sections 25', 25" of a belt 25 around the respective pulleys 27, 27' is synchronized with the two-way sliding movement of the longitudinal sections 26', 26" of the other belt 26, located on the transversely opposite side, and allows simultaneous displacement of the carriages 16, 17.

[0052] Advantageously, each belt 25, 26 is connected to a respective carriage 16, 17 by means of a vertically and transversely offset cantilever bracket 29, as best shown in FIGS. 7 and 8.

[0053] Each bracket 29 may comprise an outer member 30 secured to the side wall 22, 22' of the carriage 16, 17 and an inner member 31 facing the side wall 22, 22' and connected to the outer member 30 at the lower end.

[0054] The inner member 31 may have a U-shaped section, with a cavity 32 that faces the outer member 30 to accommodate and lock a portion of a corresponding longitudinal section 25', 25" of the belt 25 against the respective outer member 30.

[0055] Preferably, for each work table 14, 15, the apparatus 1 may comprise a locking member 33 selectively operable to lock the work tables 14, 15 in one of the end positions.

[0056] As best shown in FIG. 5, the locking elements 33 each comprise a latch 34 with an upper cavity 35 adapted to accommodate one of the wheels 21 of each carriage 16, 17.

[0057] Each latch 34 may be coupled to a respective actuator 36 which is adapted to cause the latch 34 to be lifted and interact with the wheel 21 to lock the latter.

[0058] Preferably, a plurality of latches 34 may be provided in the cutting area 4 and in the loading/unloading area 5 and each of them may be associated with one of the longitudinal rails 24, 24'.

[0059] The actuator 36 may be accommodated in the profile of the rail 24, 24' and the latch 34 will be adapted to vertically and selectively translate beyond the top surface 37 of the rail 24, 24' through a slot 38 to interact with the respective wheel 21 of the carriage 16, 17 that runs on the rail 24, 24'.

[0060] In a peculiar aspect of the invention, each of the work tables 14, 15 comprises a tilting device 39 hinged to a respective carriage 16, 17 at a longitudinal edge thereof, as best shown in FIGS. 2 and 3.

[0061] Each tilting device 39 may pivot between a horizontal position in which it is coplanar with a respective bearing surface 18, 19 and a tilted position in which it is inclined to the respective bearing surface 18, 19 to facilitate loading/unloading of the slabs.

[0062] Advantageously, each tilting device 39 may comprise at least one fork structure 40 consisting of at least a pair of transverse bars 41, joined together by a longitudinal bar 42.

[0063] Nevertheless, the fork structure may also comprise a different number of transverse bars 41, without departure from the scope of the present invention.

[0064] In the embodiments of the figures, the fork structure 40 comprises three transverse bars 41, two at the ends and one in the middle, which is shorter than those at the ends, to ensure stable support for the slabs during loading and unloading.

[0065] The fork structure 40 is adapted to support at least one slab at a time before and during tilting and to define a portion of the respective bearing surface 18, 19 when the latter is in a horizontal position.

[0066] The longitudinal bar 42 may be hinged to a respective carriage 16, 17 to allow the fork structure 40 to controllably pivot between the horizontal position and the tilted position.

[0067] The bearing surfaces 18, 19 of each work table 14, 15 may have respective transverse and longitudinal recesses 43 whose shape is complementary to that of the transverse bars 41 and the longitudinal bar 42 and which are adapted to horizontally accommodate them.

[0068] Therefore, when the transverse bars 41 and the longitudinal bar 42 are in their horizontal position, accommodated in their respective recesses 43, their top surface 44 is coplanar with the respective bearing surface 18, 19 of the work table 14, 15 and defines a portion thereof.

[0069] Advantageously, each of the work tables 14, 15 comprises actuator means 45, which are coupled to the transverse bars 41 and are adapted to be selectively actuated to cause the fork structure 40 to move from the horizontal position to the tilted position and vice versa.

[0070] The actuator means 45 may comprise a plurality of hydraulic or pneumatic pistons 46 coupled, for example, to the end transverse bars 41 of the fork structure 40 and placed on the respective carriage 16, 17 below the plane of the bearing surface 18, 19.

[0071] The actuator means 45 and the powered pulleys 27, 28 may be connected to a control unit, not shown, which can be managed by an operator to control operation thereof.

[0072] Conveniently, the longitudinal bar 42 of each carriage 16, 17 may comprise at least one bearing member 47 for supporting the cut slab to be unloaded or the new slab to be loaded when the transverse bars 41 are in a tilted position, thereby preventing the slab from slipping toward the ground.

[0073] The bearing member 47 may be transversely hinged to the longitudinal edge of each work table 14, 15 and comprise suitable supports 48 for orienting its vertical or horizontal extent, as schematically shown in FIGS. 1 to 4 and in FIG. 6.

[0074] It will be appreciated from the foregoing that the apparatus for handling and cutting stone slabs fulfills the intended objects and particularly simplifies slab loading and unloading and carriage drive.

[0075] While the handling and cutting apparatus has been described with particular reference to the accompanying figures, the numerals referred to in the disclosure and claims are only used for the sake of a better intelligibility of the invention and shall not be intended to limit the claimed scope in any manner.

Industrial Applicability

[0076] The present invention may find application in industry, because it can be produced on an industrial scale in stone working factories, namely stone slab working factories.

Claims

1. An apparatus (1) for handling and cutting stone slabs, which apparatus (1) comprises:

- a pair of posts (2, 3) for delimiting a cutting area (4) and a slab loading/unloading area (5);
- a support surface (8) for at least one slab, movable between said loading/unloading area (5) and said cutting area (4);
- a longitudinal load-bearing beam (9) slidingly mounted to said posts (2, 3) and movable in a transverse direction (T);
- a cutting unit (10) slidingly mounted to said longitudinal beam (9) over said supporting surface (8);

wherein said support surface (8) comprises a pair of work tables (14, 15) located at different heights and mounted to respective carriages (16, 17), each defining a substantially horizontal slab bearing surface (18, 19) and

wherein each of said work tables (14, 15) comprises a tilting device (39), which is adapted to pivot between a horizontal position and a tilted position relative to said bearing surface (18, 19) to facilitate loading/unloading of the slabs, and

wherein each carriage (16, 17) is movable along guide means (20) secured to the ground between said cutting area (4) and said loading/unloading area (5) in a longitudinal feed direction L, drive means (23) being provided for causing said work tables (14, 15) to translate between end positions corresponding to said cutting area (4) and loading/unloading area (5);

characterized in that said tilting device (39) is hinged to a respective carriage (16, 17) at an edge substantially parallel to said longitudinal direction (L), said horizontal position of said tilting device (39) being coplanar with a respective bearing surface (18, 19), said drive means (23) being connected to both of said work tables (14, 15) to cause it to simultaneously translate in opposite directions from the cutting area (4) and the loading/unloading area (5) and vice versa.

2. Apparatus as claimed in claim 1, **characterized in that** said drive means (23) comprise, proximate to said guide means (20), a pair of motorized, closed-loop belts (25, 26) or strips, connected to each of said work tables (14, 15).

3. Apparatus as claimed in claim 2, **characterized in that** said closed-loop belts (25, 26) are wound on respective powered return pulleys (27, 28) mounted to substantially vertical axes (V').

4. Apparatus as claimed in claim 2, **characterized in that** each of said belts (25, 26) is connected to a respective carriage (16, 17) by a cantilever bracket (29) which is vertically and transversely offset to cause said work tables (14, 15) to simultaneously translate in opposite directions with no mutual interference.

5. Apparatus as claimed in claim 1, **characterized in that** each of said tilting devices (39) comprises at least one fork structure (40) consisting of at least a pair of transverse bars (41) joined by a longitudinal bar (42) adapted to support at least one slab before and during tilting thereof and to define a corresponding portion of the respective bearing surface (18, 19).

6. Apparatus as claimed in claim 5, **characterized in that** said bearing surface (18, 19) of each work table (14, 15) has respective transverse and longitudinal recesses (43) for accommodating said transverse bars (41) and longitudinal bar (42) of each fork structure (40) in the horizontal position.

7. Apparatus as claimed in claim 6, **characterized in that** said longitudinal bar (42) is hinged to a respective carriage (16, 17) to allow said fork structure (40) to be controllably pivoted between said horizontal position and said tilted position.

8. Apparatus as claimed in claim 6, **characterized in that** each of said work tables (14, 15) comprises actuator means (45) which are coupled to said transverse bars (41) and are adapted to be selectively actuated to cause them to move between said horizontal position and said tilted position.

9. Apparatus as claimed in claim 1, **characterized in that** said guide means (20) consist of pairs of rails (24, 24') which are transversely offset to avoid mutual interference as they simultaneously translate in opposite directions between said end positions.

10. Apparatus as claimed in claim 1, **characterized in that** it comprises, for each work table (14, 15), a locking member (33) that is selectively operable to lock said work tables (14, 15) in one of said end positions.

11. Apparatus as claimed in claim 10, **characterized in that** said carriages (16, 17) are mounted to wheels (21), each of said locking members (33) comprising a latch (34) with a cavity (35) for accommodating one of the wheels (21) of each carriage (16, 17), said latch (34) being coupled to a respective actuator (36) to cause the latter to be lifted and to interact with said wheel (21) to lock it in said longitudinal and positions.

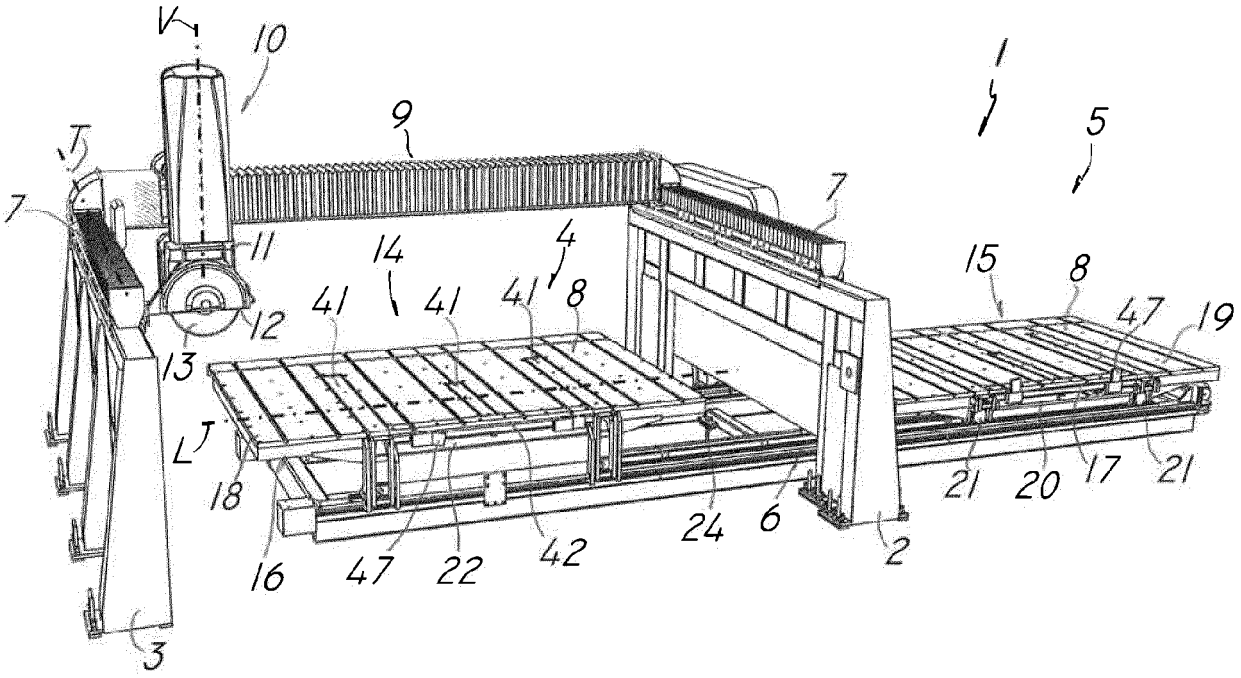
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FIG. 1

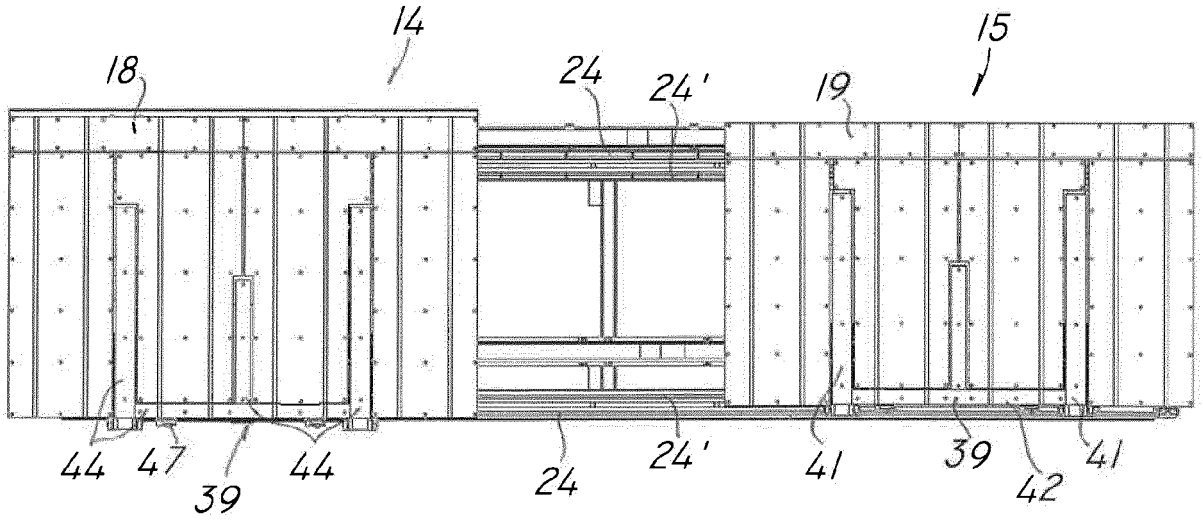
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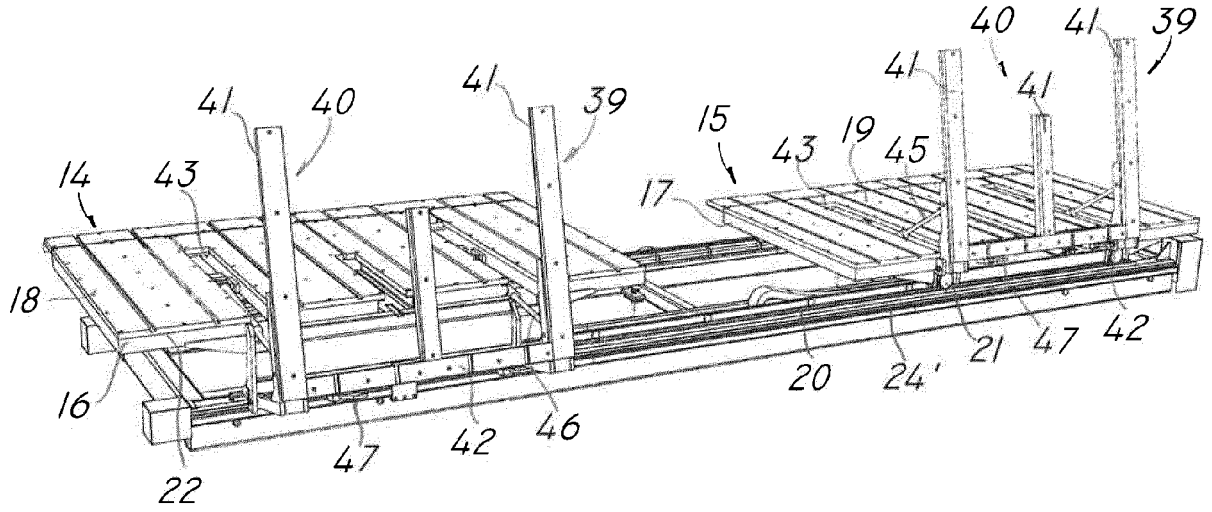
FIG.2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24'
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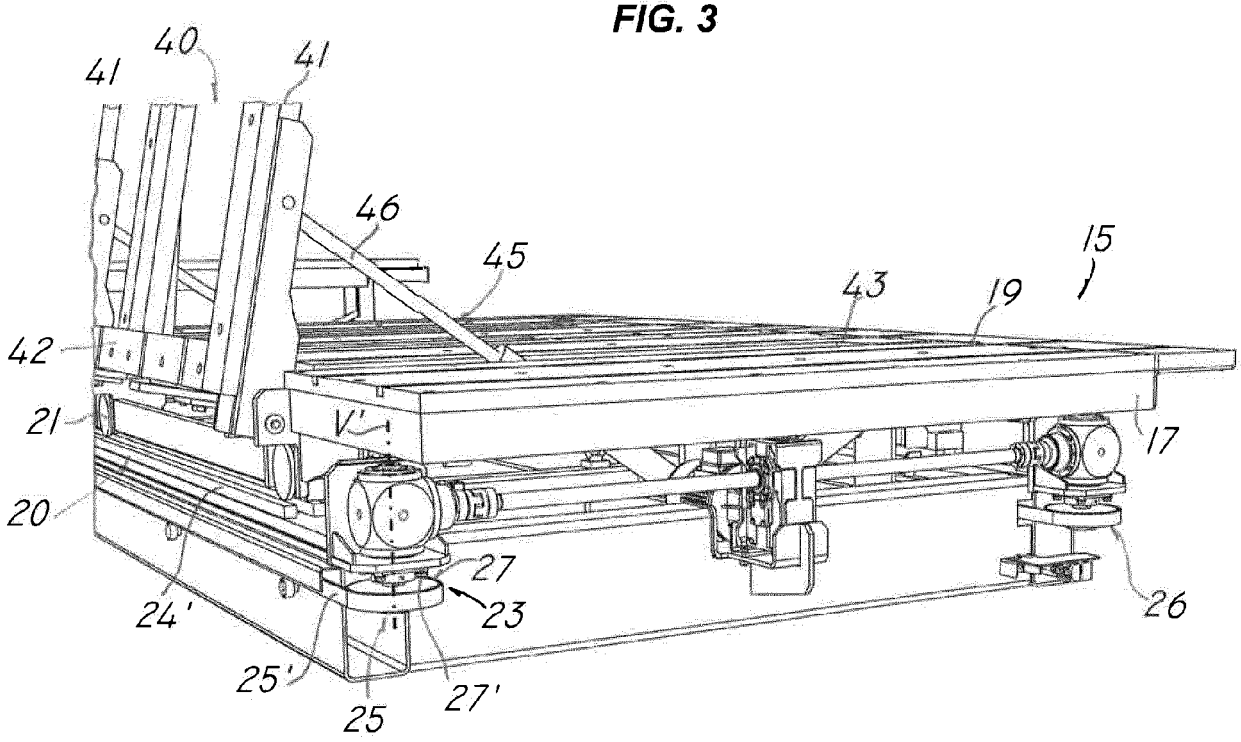
FIG. 3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V'
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26
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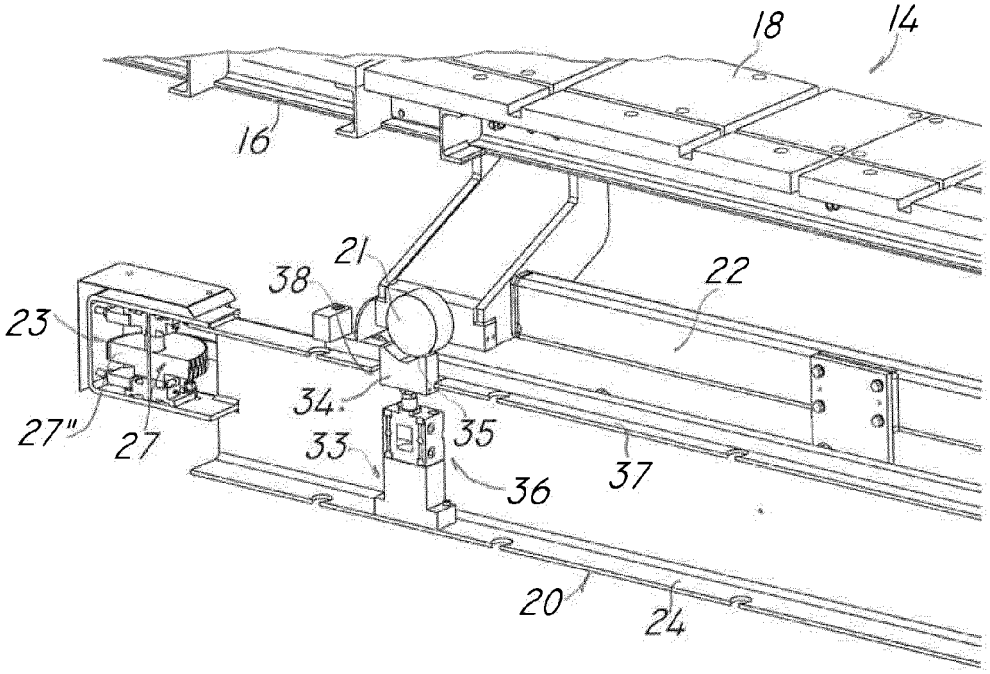
25'
27'
25

FIG.4


18
14
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21
38
22
23
34
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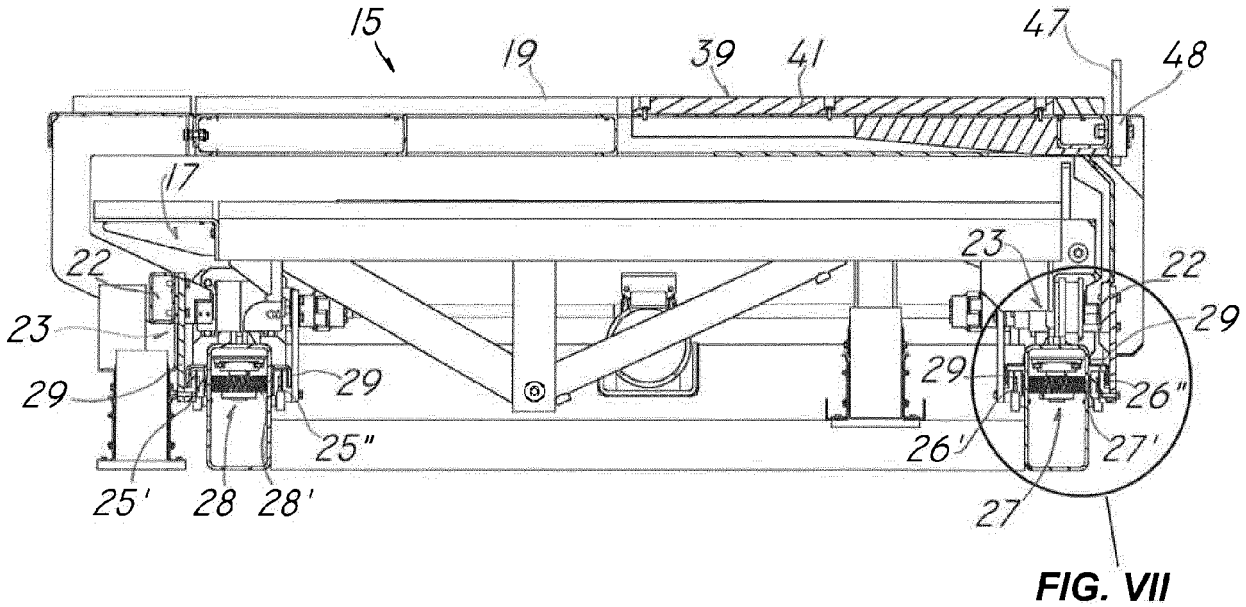
27"
27
33
36
37
20
24

FIG. 5


15
19
39
41
47
48
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22
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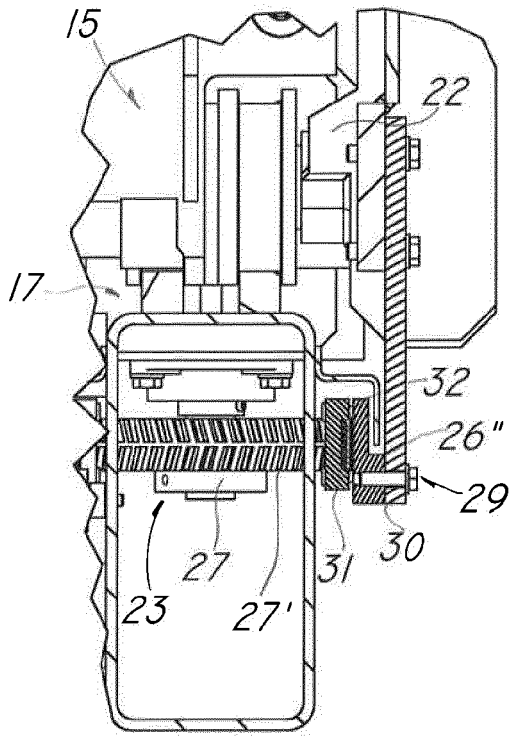
25"
25'
28
28'
26"
26'
27'
27
FIG. VII

FIG. 6


15
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26"
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27
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30
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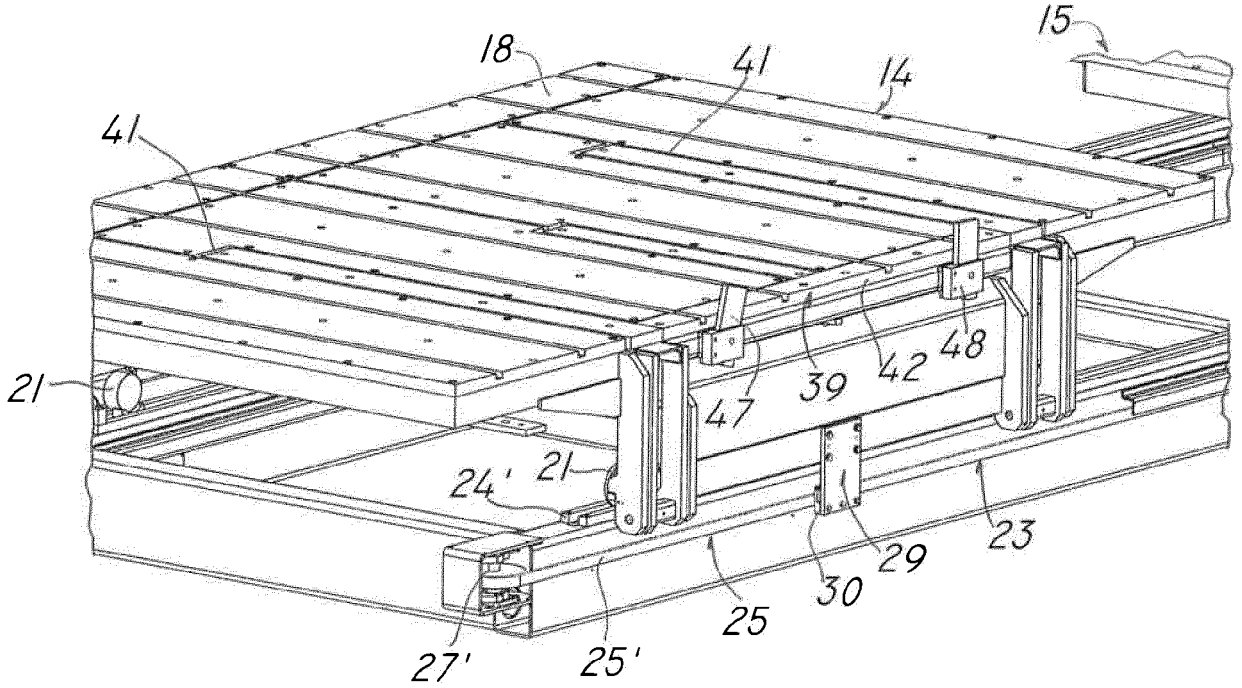
27'

FIG. 7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27'
25'

FIG. 8

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1397

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,D	IT VI20 110 165 A1 (DONATONI MACCHINE S R L) 24 December 2012 (2012-12-24) * claims * * figures 1-3,6,7 *	1	INV. B28D1/04 B28D7/04
A	EP 1 219 398 A2 (PROTEC SRL [IT]) 3 July 2002 (2002-07-03) * paragraphs [0014], [0022], [0024] * * figures 2-4,12,14,16 *	1	
A	EP 2 998 088 A1 (BIESSE SPA [IT]) 23 March 2016 (2016-03-23) * paragraphs [0001], [0027] - [0030], [0052] - [0054] * * figures 1-4 *	1	
A	DE 100 40 552 A1 (BURKHARDT GMBH [DE]) 7 March 2002 (2002-03-07) * column 2, line 53 - column 3, line 14 * * figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B28D
B23D
B27B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 October 2018	Chariot, David

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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10-10-2018

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