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(54) **SANDING-POLISHING MACHINE FOR PLATE-LIKE PRODUCTS MADE OF STONE MATERIAL**

SCHLEIF-POLIER-MASCHINE FÜR PLATTENFÖRMIGE, AUS STEINMATERIAL HERGESTELLTE
PRODUKTE

MACHINE DE PONÇAGE-POLISSAGE POUR PRODUITS LAMELLAIRES CONSTITUÉS DE
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Description

[0001] The present invention relates to a sanding-polishing machine for plate-like products of stone material, such as marble, granite, agglomerate and the like, according to the general part of claim 1.

[0002] The sanding-polishing operations of the plate-like products made of stone material are normally carried out with machine tools equipped with one or more operating heads, equipped with spindles with abrasive tools.

[0003] At a construction level, a sanding-polishing machine consists of a support pallet provided with a conveyor belt where the advancing plate is positioned and with one or more machining stations, provided with operating heads equipped with spindles with abrasive tools.

[0004] By way of example, reference is made to the Italian patent application WO 2016/012950 A1, with priority of the Italian patent application TV2014A000111 (references in brackets relate to that document) wherein (Fig. 1) a sanding-polishing machine is described, comprising a support pallet (ref. 16) for the plates to be processed and a machining station (ref. 14), comprising two bridge support structures (refs. 20, 22) arranged transversely over the pallet (16), which support a spindle-supporting beam (ref. 24), which is thus arranged in the longitudinal direction parallel to the relative movement direction between the plate and the station, and is susceptible to flow over said bridge structures in a transverse direction, which is thus perpendicular to said longitudinal direction; in addition, at least one machining assembly or spindle-supporting structure (ref. 34) is mounted, rotatable about a respective vertical axis (ref. 32), on said movable beam (ref. 24).

[0005] Again, by way of example, reference is made to patent document WO 2015/087294 A1, with priority of the Italian patent application TV2014A000021 (references in brackets relate to said document), wherein (Figs. 1, 3) a sanding-polishing machine (ref. 10) is disclosed, said machine comprising a plurality of machining stations (ref. 14), mutually aligned longitudinally above the pallet (ref. 12), where the plate is placed and wherein all the aforementioned machining stations (ref. 14) are applied on a single beam (ref. 20), which is supported at the two ends by two opposite bridge support structures (refs. 16, 18), arranged transversely over the pallet (ref. 12), in which at least one motorization mechanism (ref. 21) is present and performing the transverse sliding (lag - make reference to the double transverse arrow) of said beam (ref. 20) and, consequently, also the simultaneous transverse sliding of all the machining stations (ref. 14).

[0006] As clearly visible in these documents, in the two machines disclosed above and, more generally, in all sanding-polishing machines for plate-like products of the known type, the machining stations are mounted being raised on fixed or mobile beams, supported by bridge structures or directly positioned on the bridge structures themselves.

[0007] With such constructive solutions, the spindles,

fixed or movable and rotating on vertical axes, as well as the tools associated with said spindles, rotating around vertical axes (pad head) or rotating around horizontal axes (roller head), are always in a considerably elevated position, and in some cases also cantilevered, so that, in practice, they have the disadvantage of not being sufficiently stable due to the vibrations that are generated in the entire machining station and which cause, in extremely critical conditions, up to the transverse bridge oscillation (particularly the beam (ref. 24) of document WO 2016/012950 A1 and the beam (ref. 20) of document WO 2015/087294 A1 (which discloses a sanding-polishing machine according to the preamble of claim 1) with the negative consequence of an uneven tool / plate approach, which compromises the final quality of the machined surface.

[0008] The object of the present invention is to provide a sanding-polishing machine for plate-like products of stone material, which is free of any drawbacks showed, by similar products of the known type.

[0009] Specifically, the object of the present invention is to provide a sanding-polishing machine for plate-like products made of stone material in which the bearing structure of the machining stations remains non-deformable and free from any vibration, allowing for optimum processing even in the heaviest working condition.

[0010] A further object of the present invention is to provide a sanding-polishing machine for plate-like products in stone material where the different machining stations are able to operate in a mutually independent manner and, consequently, are able to produce trajectories and / or velocity fields arbitrarily settable and specific for said individual machining stations.

[0011] Still another object of the invention is to provide a sanding-polishing machine for plate-like products made of stone material, consisting of several machining stations, taking up a smaller space with respect to the conventional machines of the known type, so that it can also be installed in medium sized warehouses.

[0012] Such objects are achieved by realizing a sanding-polishing machine for plate-like products made of stone material in which every machining station operates in a mutually independent manner of each other, as defined in independent claim 1. Preferred embodiments are defined in the dependent claims.

[0013] By way of example, reference is made to patent document CN 101 362 312 A (references in brackets are made to that document), where (Figs. 1-3) a machine for enamelling / polishing ceramic tiles is disclosed, comprising a conveyor belt (ref. 1) of the tiles and a plurality of enamelling / polishing devices (ref. 2), provided with a pair of grinders (ref. 3), arranged linearly in the advancement direction of said belt. As can be seen in Figs. 6-7, each single enamelling / polishing device (ref. 2) includes a frame (ref. 201) firmly holding a bridge transverse beam (ref. 203), which supports the entire machining station (ref. 206), which is movably connected on said beam (ref. 203) by means of a central rotating pin.

[0014] Still on the frame (ref. 201), a bracket (ref.202) is retained, supporting a motor reducer (ref. 204) which, through a mechanism (ref. 205), moves the entire machining station (ref. 206). Consequently, in practice, the grinder (ref. 3) are subject to a roto-translatory combined movement consisting of an angular rotation associated with a transverse component, so that it can in no way be compared to a "lag motion" providing only and exclusively a transverse movement.

[0015] Specifically, the mechanism (ref. 205) is of the rod / crank type, so that the entire machining station (ref. 206) is subject to an alternating rotation motion on the central support pin. It follows that the law of motion of the spindles results from the composition of the rotation movement of the machining station around the pin and of the rod / crank transmission. Being this composition of movements quite complex, it is difficult to implement specific trajectories and / or velocity fields for the spindles. With the present invention a sanding-polishing machine for plate-like products made of stone material is provided, in which each individual machining station, besides operating in a mutually independent manner in respect of the other machining stations, is characterized by the fact that it moves only transversely, relative to the longitudinal direction of the conveyor belt of the plate, that is, it is only provided with the so-called "lag motion", and such a transverse sliding motion, which extends over the whole width of said conveyor belt, is realized by means of a specific and dedicated mechanism applied to the structure supporting the single machining station and said mechanism is applied to the base of said machining station; said base consists of two supporting devices, disposed transversely and positioned right above the pallet containing said conveyor belt, without protruding from the two sides of said pallet.

[0016] Another document of the state of the art is CN 104802051 A.

[0017] At a construction level, the single machining station is characterized in that it is made of a single-block welded structure, supporting one or more operating heads, provided at the base with support blocks, protruding from the two transverse sides, which engage on two supporting bars, transversely supported on the two side walls of the sliding table; this structure is also provided with a lag mechanism performing the transversal sliding motion of said structure.

[0018] The invention will be better defined by the disclosure of one of its possible embodiments, merely described as a non-limiting example, with the help of the attached drawings, where:

- Fig. 1 represents a top plan view of a sanding-polishing machine for plate-like products made of stone material according to the present invention;
- Fig. 2 represents an elevation view of this machine, sectioned according to line II-II of Fig. 1;
- Fig. 3 represents a top plan view of the supporting and moving zone of two machining stations;

- Fig. 4 represents an elevation view, sectioned according to the line IV-IV of Fig. 3;
- Figs. 5, 6 represent two opposing perspective views of the bearing structure;
- Fig. 7 represents a perspective view of a machining station in the operational phase;
- Fig. 8 represents a perspective view of the sanding-polishing machine for slab products of Figs. 1-2.

[0019] As can be seen in Figs. 1 and 2, the sanding-polishing machine for plate-like products made of stone material, generally indicated by reference 100, comprises a plurality of machining stations, indicated by reference 101, containing the operating heads positioned above a supporting pallet 102, where the conveyor belt 103 slides, supporting the plate 104; said supporting pallet 102 and said conveyor belt 103 are comprised in the machine; said machining stations 101 are arranged in series, each of them containing movable operating heads provided with spindles with abrasive tools T, all of which is known per se.

[0020] The novelty of the invention is that each individual machining station 101 operates independently and is sustained individually and supported at the base by means of two supporting devices, generally indicated by reference 10, arranged transversely with respect to the advancement direction of the plate 104 and where there is at least one lag mechanism, generally designated by reference 20, which actuates the transverse sliding motion (lag motion - arrows X_1 , X_2 , X_3) of the entire machining station 101 disclosed above. Each machining station 101 is configured to move itself specifically and solely in the only transverse direction with respect to the longitudinal direction of the conveyor belt 103 and in a mutually independent manner with respect to the transverse movement of the other machining stations 101.

[0021] As can be seen in the detail figures, the machining station 101 comprises a single-block welded structure 1, provided at the base with blocks 2 protruding from the two transversal sides, engaging on transversal supporting bars 3, sustained at the two ends by uprights 4, protruding from the two side walls 105 of the supporting pallet 102, said two transversal supporting bars 3 and said uprights 4 being part of the machine. The lag mechanism 20, which generates the lag of the machining station 101, applied on a longitudinal side of the single-block welded structure 1, comprises two mechanical transmissions of the pinion / rack type 21, where the two opposing pinions 22 are actuated by an actuator 23, which triggers the connecting shaft 24, while the two racks 25, arranged in the transverse direction with respect to the longitudinal direction of the conveyor belt 103 and parallel to the transverse sides of the specific machining station 101, are supported by the upright 4.

[0022] From the above it can be seen that the intended purposes have been fully achieved, since each machining station 101, which may contain spindle-supporting heads of different conformation (by way of example, ref-

erence is made to the Italian patent document VI2003A000098), is provided with a single-block welded structure 1, which is sustained at the base with supporting devices 10, being part of the machine, welded directly on the pallet 102 of the conveyor belt 103, so that it is realized a single rigid structure preventing the generation of vibrations. All of these components, in particular the machining stations 101, the supporting devices 10 and the lag mechanisms 20, are contained within the transverse width of the pallet 102, so that there is no additional encumbrance, which in the present machines usually consists of the bridge structure.

[0023] Of course it is possible to realize even different embodiments with respect to the illustrated one and the various components may be replaced by technically equivalent elements, for example it is possible to foresee the use in the lag mechanism 20 of an oleodynamic or pneumatic actuator 23 and that the supporting bars 3 are provided with ball-bearing skids on linear guides, provided that this is all within the inventive concept defined by the following claims.

Claims

1. SANDING-POLISHING MACHINE FOR PLATE-LIKE PRODUCTS MADE OF STONE MATERIAL said machine comprising a plurality of machining stations (101) containing operating heads positioned above a supporting pallet (102), where a conveyor belt (103) slides, said supporting pallet (102) and said conveyor belt (103) being comprised in the machine, said conveyor belt (103) supporting a plate (104), the operating heads being arranged in series, and each machining station (101) containing movable operating heads provided with spindles with abrasive tools (T), each machining station (101) being configured to move itself specifically and solely in the only transverse direction (lag motion - arrows X_1 , X_2 , X_3) with respect to the longitudinal direction of the conveyor belt (103)
said sanding-polishing machine (100) being characterized in that each machining station (101) can also move in a mutually independent manner with respect to the transverse movement of the other machining stations (101) and wherein said single transverse movement of the entire above mentioned machining station (101) is realized by the action of a specific and dedicated lag mechanism (20), associated to said machining station (101), and **in that** the lag mechanism (20), applied to the machine on the corresponding machining station (101), comprises two mechanical transmissions of a pinion/rack type (21), arranged externally with respect to the two transversal sides of said machining station (101).
2. SANDING-POLISHING MACHINE (100) according to claim 1, wherein each of the two transmissions

comprises two pinions (22) actuated by an actuator (23) through a connecting shaft (24), engaging with two corresponding racks (25) arranged in the transverse direction with respect to the longitudinal direction of the conveyor belt (103) and arranged parallel to the transverse sides of the specific machining station (101).

3. SANDING-POLISHING MACHINE (100) according to one or more of the preceding claims, **characterized in that** each machining station (101) is supported at its base by means of two supporting devices (10), being part of the machine, arranged transversely with respect to a longitudinal advancement direction of the plate (104) and which are integral with the supporting pallet (102), without protruding from the two sides of said supporting pallet (102).
4. SANDING-POLISHING MACHINE (100) according to claim 3, **characterized in that** the two supporting devices (10) are positioned right above the conveyor belt (103).
5. SANDING-POLISHING MACHINE (100) according to one or more of the preceding claims, **characterized in that** each machining station (101) comprises a single-block welded structure (1), provided at the base with blocks (2), protruding from the two transversal sides and engaging on two transversal supporting bars (3), being provided that said transversal supporting bars (3) are sustained at their two ends by uprights (4), protruding from the two side walls (105) of the supporting pallet (102), said two transversal supporting bars (3) and said uprights (4) being part of the machine.

Patentansprüche

1. SCHLEIF-/ POLIERMASCHINE FÜR PLATTEN-ÄHNLICHE ERZEUGNISSE AUS STEINMATERIAL, wobei die Maschine eine Vielzahl von Bearbeitungsstationen (101) umfasst, die Arbeitsköpfe enthalten, die über einer Trägerpalette (102) angeordnet sind, auf der ein Förderband (103) gleitet, wobei die Trägerpalette (102) und das Förderband (103) in der Maschine enthalten sind, wobei das Förderband (103) eine Platte (104) trägt, wobei die Arbeitsköpfe in Reihe angeordnet sind und jede Bearbeitungsstation (101) bewegliche Arbeitsköpfe enthält, die mit Spindeln mit Schleifwerkzeugen (T) versehen sind, wobei jede Bearbeitungsstation (101) so konfiguriert ist, dass sie sich spezifisch und ausschließlich in der einzigen Querrichtung (Verzögerungsbewegung - Pfeile X_1 , X_2 , X_3) in Bezug auf die Längsrichtung des Förderbandes (103) bewegt, **wobei die Schleif-/Poliermaschine (100) dadurch gekennzeichnet ist, dass** jede Bearbeitungsstation

(101) sich auch in einer voneinander unabhängigen Weise in Bezug auf die Querbewegung der anderen Bearbeitungsstationen (101) bewegen kann und wobei die einzelne Querbewegung der gesamten oben erwähnten Bearbeitungsstation (101) durch die Wirkung eines spezifischen und zweckbestimmten Verzögerungsmechanismus (20) realisiert wird, der der Bearbeitungsstation (101) zugeordnet ist, und **dadurch, dass** der Verzögerungsmechanismus (20), der an der Maschine an der entsprechenden Bearbeitungsstation (101) angebracht ist, zwei mechanische Getriebe vom Typ Ritzel/Zahnstange (21) umfasst, die in Bezug auf die beiden Querseiten der Bearbeitungsstation (101) außen angeordnet sind.

2. SCHLEIF-/ POLIERMASCHINE (100) nach Anspruch 1, wobei jedes der beiden Getriebe zwei Ritzel (22) umfasst, die durch einen Aktor (23) über eine Verbindungswelle (24) betätigt werden und in zwei entsprechende Zahnstangen (25) eingreifen, die in der Querrichtung in Bezug auf die Längsrichtung des Förderbandes (103) und parallel zu den Querseiten der spezifischen Bearbeitungsstation (101) angeordnet sind.
3. SCHLEIF-/ POLIERMASCHINE (100) nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** jede Bearbeitungsstation (101) an ihrer Basis mittels zweier Trägervorrichtungen (10) getragen wird, die Teil der Maschine sind, quer in Bezug auf eine Längsvorschubrichtung der Platte (104) angeordnet sind und die mit der Trägerpalette (102) einstückig sind, ohne aus den beiden Seiten der Trägerpalette (102) vorzustehen.
4. SCHLEIF-/ POLIERMASCHINE (100) nach Anspruch 3, **dadurch gekennzeichnet, dass** die beiden Trägervorrichtungen (10) direkt über dem Förderband (103) angeordnet sind.
5. SCHLEIF-/ POLIERMASCHINE (100) nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** jede Bearbeitungsstation (101) eine aus einem einzigen Block bestehende Schweißkonstruktion (1) umfasst, die an der Basis mit Blöcken (2) versehen ist, die aus den beiden Querseiten vorstehen und auf zwei Querträgerstangen (3) in Eingriff stehen, wobei die Querträgerstangen (3) an ihren beiden Enden von Stützen (4) getragen werden, die aus den beiden Seitenwänden (105) der Trägerpalette (102) vorstehen, wobei die beiden Querträgerstangen (3) und die Stützen (4) Teil der Maschine sind.

Revendications

1. MACHINE PONCEUSE/POLISSEUSE POUR DES

PRODUITS EN PLAQUES RÉALISÉS EN PIERRE, ladite machine comprenant une pluralité de postes d'usinage (101) contenant des têtes d'usinage positionnées au-dessus d'une palette de support (102), où glisse une bande transporteuse (103), ladite palette de support (102) et ladite bande transporteuse (103) étant comprises dans la machine, ladite bande transporteuse (103) supportant une plaque (104), les têtes d'usinage étant disposées en série, et chaque poste d'usinage (101) contenant des têtes d'usinage mobiles pourvues de broches avec des outils abrasifs (T), chaque poste d'usinage (101) étant configuré pour se déplacer spécifiquement et uniquement dans la seule direction transversale (mouvement de décalage - flèches X_1 , X_2 , X_3) par rapport à la direction longitudinale de la bande transporteuse (103)

ladite machine ponceuse/polisseuse (100) étant caractérisée en ce que chaque poste d'usinage (101) peut également se déplacer de manière mutuellement indépendante par rapport au mouvement transversal des autres postes d'usinage (101) et dans laquelle ledit mouvement transversal unique de l'ensemble du poste d'usinage (101) susmentionné est réalisé par l'action d'un mécanisme de décalage (20) spécifique et dédié, associé audit poste d'usinage (101), et **en ce que** le mécanisme de décalage (20), appliqué à la machine sur le poste d'usinage (101) correspondant, comprend deux transmissions mécaniques du type pignon/crémaillère (21), disposées à l'extérieur par rapport aux deux côtés transversaux dudit poste d'usinage (101).

2. MACHINE PONCEUSE/POLISSEUSE (100) selon la revendication 1, dans laquelle chacune des deux transmissions comprend deux pignons (22) actionnés par un actionneur (23) par l'intermédiaire d'un arbre de liaison (24), s'engageant dans deux crémaillères correspondantes (25) disposées dans la direction transversale par rapport à la direction longitudinale de la bande transporteuse (103) et disposées parallèlement aux côtés transversaux de la station d'usinage (101) spécifique.

3. MACHINE PONCEUSE/POLISSEUSE (100) selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce que** chaque poste d'usinage (101) est supporté à sa base par deux dispositifs de support (10), faisant partie de la machine, disposés transversalement par rapport à une direction d'avancement longitudinale du plateau (104) et qui sont solidaires de la palette de support (102), sans faire saillie des deux côtés de ladite palette de support (102).

4. MACHINE PONCEUSE/POLISSEUSE (100) selon la revendication 3, **caractérisée en ce que** les deux dispositifs de support (10) sont positionnés juste au-

dessus de la bande transporteuse (103).

5. MACHINE PONCEUSE/POLISSEUSE (100) selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce que** chaque poste d'usinage (101) comprend une structure soudée monobloc (1), pourvue à la base de blocs (2), faisant saillie des deux côtés transversaux et s'engageant sur deux barres de support transversales (3), étant entendu que lesdites barres de support transversales (3) sont soutenues à leurs deux extrémités par des montants (4), faisant saillie des deux parois latérales (105) de la palette de support (102), lesdites deux barres de support transversales (3) et lesdits montants (4) faisant partie de la machine.

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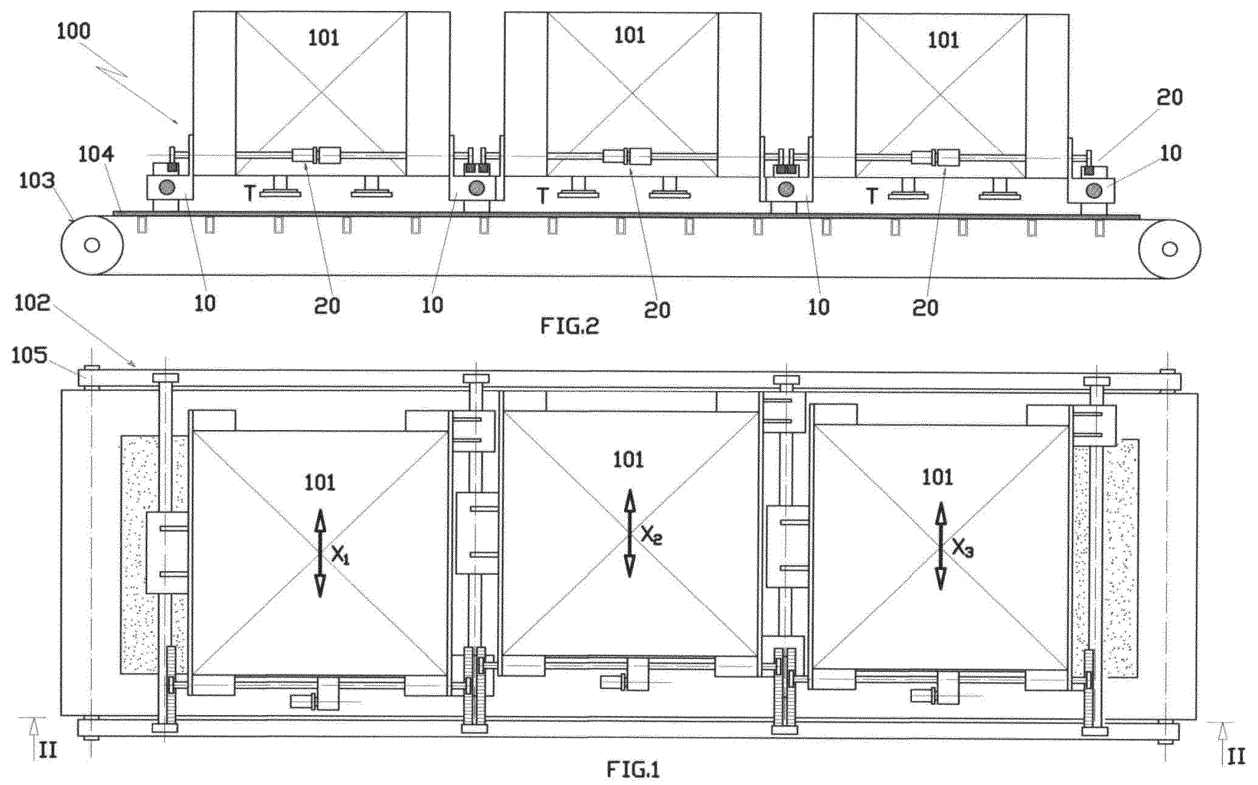
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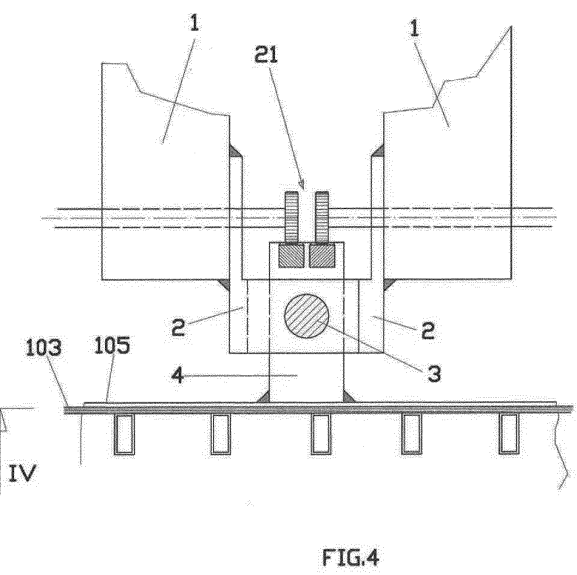
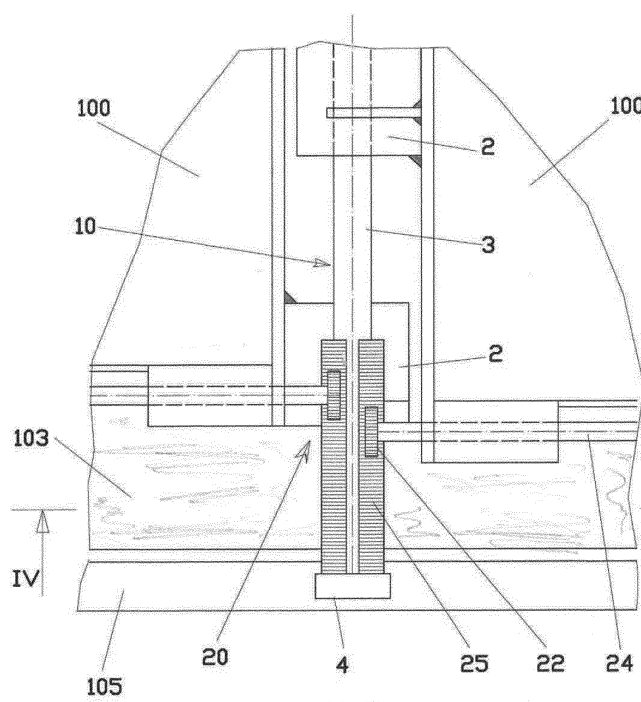
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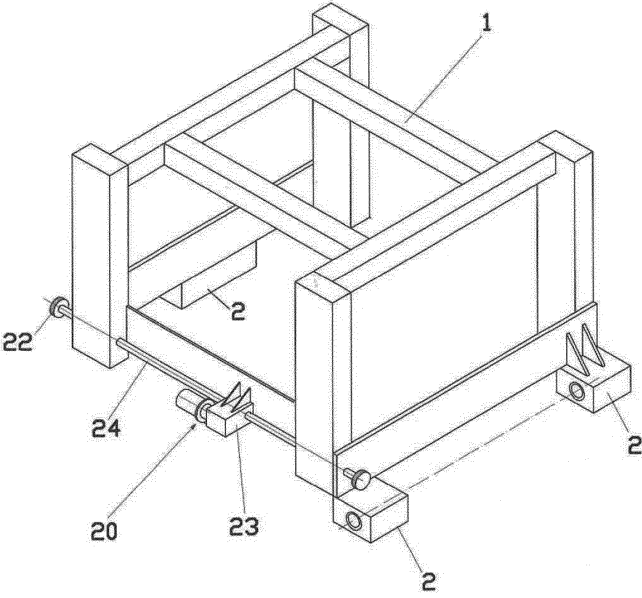


FIG. 5

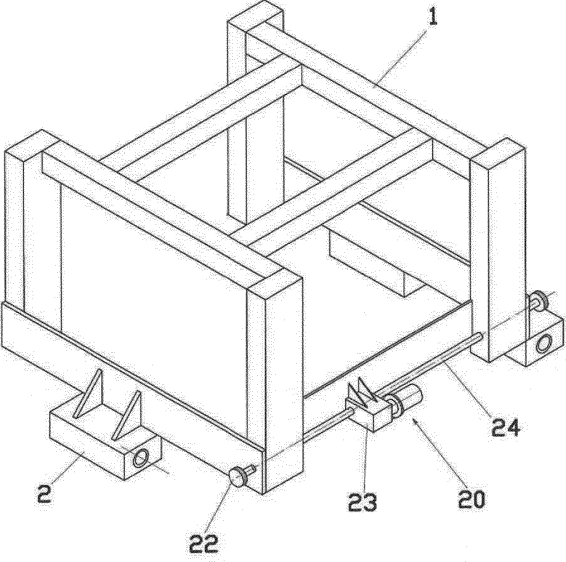
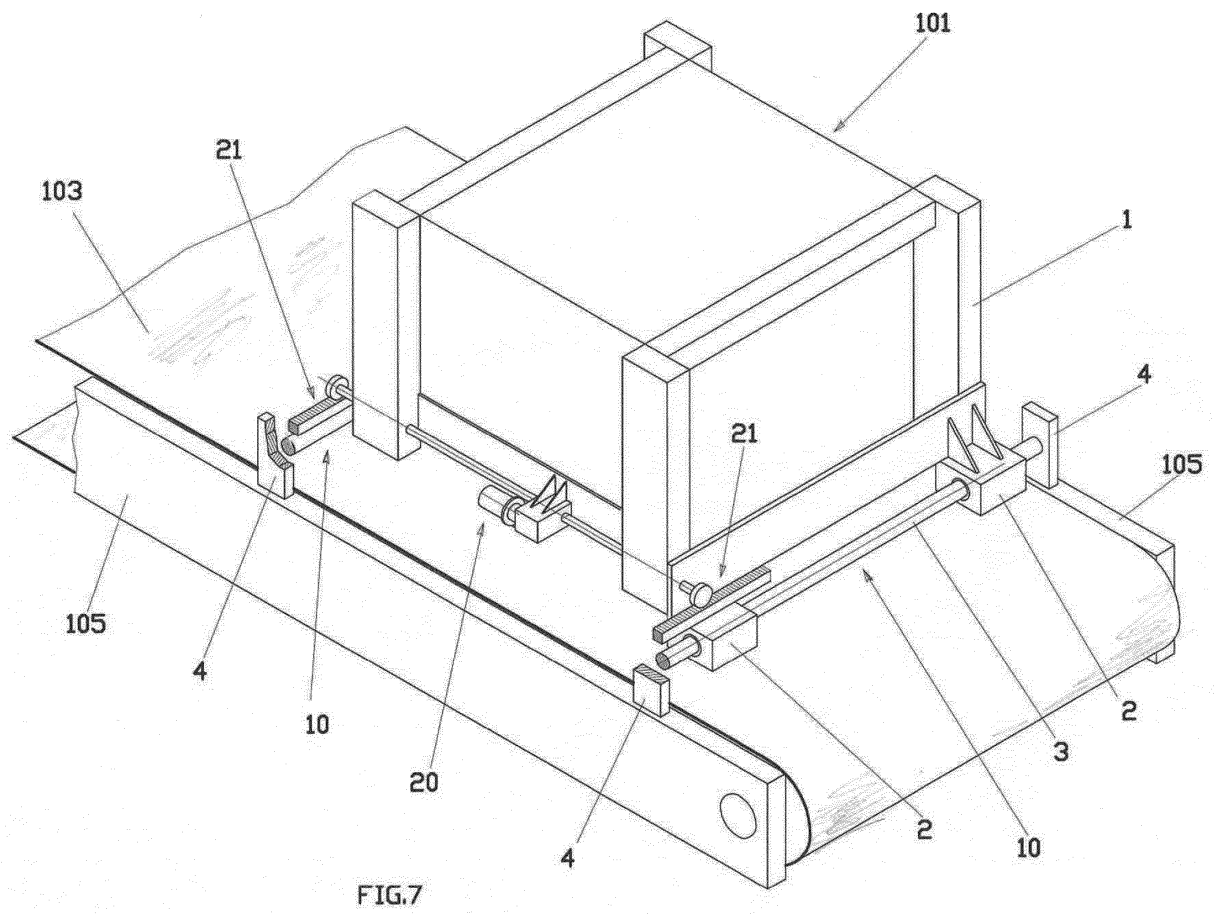
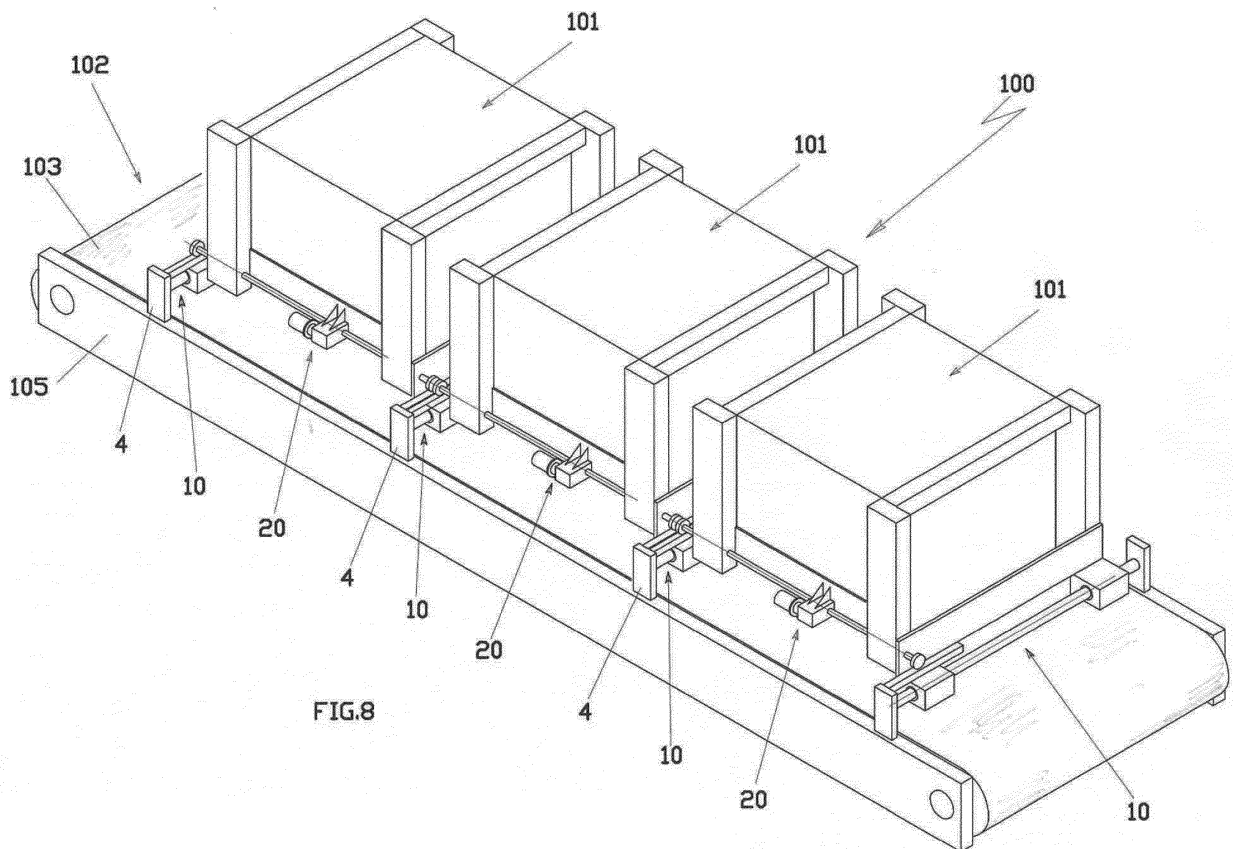


FIG. 6





REFERENCES CITED IN THE DESCRIPTION

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