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(54) **MACHINE FOR CLEAVING SLATE**

(57) This machine is intended to cleave a slate block to obtain slate sheets using a cutter on the upper side face of the slate block with the bases thereof arranged on vertical planes. It is characterized in that it comprises at least two work stations corresponding to two longitudinal beds of rollers (1) that are interrupted in a central transversal zone where there are tilting support elements

(3) that flip the slate blocks (4) initially drawn by these rollers. Level with this central transversal zone there is a movable truck (8) superiorly suspended from transversal guide bars (9), such that said truck incorporates the corresponding cutting cutter and also a characteristic clamp to seal the shear plane of the corresponding slate block (4).

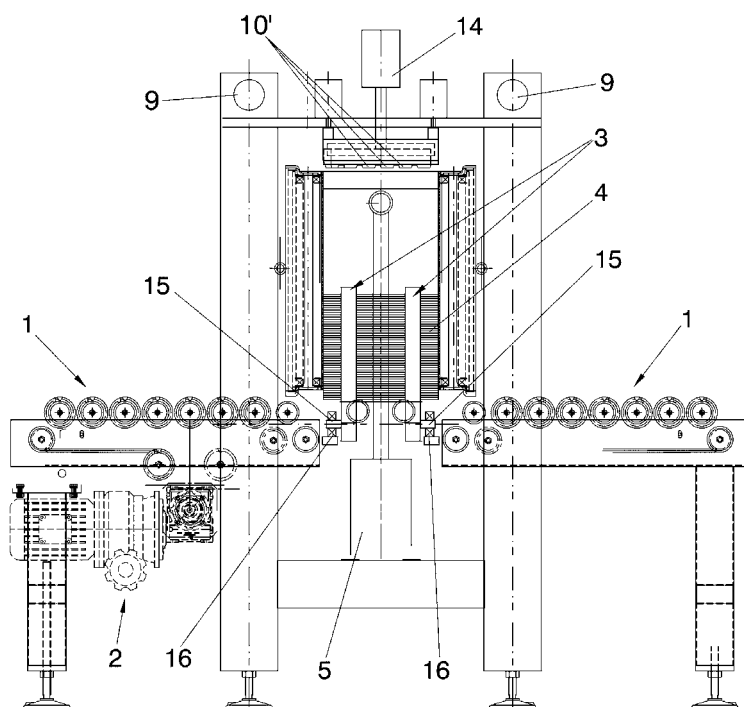


FIG. 1

Description

OBJECT OF THE INVENTION

[0001] The present invention, as expressed in the statement of this specification, relates to a machine for cleaving slate which significantly improves the cleaving process of the slate pieces by achieving a better seal at the side faces of the corresponding block to be cleaved, which detail is very important to obtain a high-quality clean cutting.

[0002] The machine of the invention is more versatile, while at the same time it allows achieving a high productivity with respect to other conventional machines for the same purpose.

[0003] Basically, the machine is responsible for handling two blocks to be cleaved to place them in a static position to then proceed to the cleaving by applying pressure with a cutter to begin an incision and fissure acting at successive stages on the side faces on cleavage planes parallel to the bases of the block where these bases are arranged on vertical planes, such that by said pressure and subsequent injection of pressurized air by the cleavage plane, the corresponding slate pieces will be obtained in successive stages.

BACKGROUND OF THE INVENTION

[0004] In the present day, the machines for cleaving slate which incorporate means to statically hold a slate block with its bases arranged in vertical planes are known.

[0005] In this situation an incision by pressure is subsequently applied on the upper side face with beginning of fissure by a cutter for obtaining in successive stages the various slate pieces with laminar structure as it is evident, in correspondence with the different cleavage planes of the slate block.

[0006] The French invention patent FR 2290051 describes a cleaving method which is carried out with a beginning of fissure along one of the sides or side faces of the block, such that the separation corresponding with the incision plane of the cutter, is produced by traction using suction cups that are applied against the opposite bases of the block, said suction cups being connected to a vacuum source.

[0007] The invention patent No. 513613 describes a cleaving method which is characterized in that the beginning of fissure is carried out practically over the entire length of one of the sides of the block joining the bases of the same and surrounding a closed chamber, inside of which a pressure higher than the ambient pressure that prevails on the opposite faces of the block is temporarily set.

[0008] For example, it is also known the invention patent number 9100276 relating to another cleaving method which is characterized in that it comprises the following stages: provision of a cutting cutter equipped with a cut-

ting edge that determines a straight alignment; arrangement of the block to be cleaved such that said side edge will be accessible to said cutter; application of said edge to said side edge; operation of said cutter for the introduction of the edge in the slate block, causing a brief crack in the same; and injection of a fluid under pressure into said crack until the total division of said slate block to be cleaved.

DESCRIPTION OF THE INVENTION

[0009] The machine for cleaving slate constituting the object of the invention is characterized in that it comprises two work stations and one movable truck carrying a cutting cutter that comes into contact with an upper side face of the slate block previously placed in a stable and static manner on a central area of one of the two work stations.

[0010] Another feature of the invention is the incorporation of a clamp which comprises in a first embodiment two sets of opposing rollers, each of which has pairs of support collateral rollers and one central roller made of soft material that seals the cleavage plane or shear plane during the process of separation when the cutting cutter comes into contact with the upper side face of the slate block arranged vertically with its bases placed on two vertical planes. In a second embodiment of the clamp each central roller is replaced by a pneumatic mattress with a rigid base.

[0011] Some conventional machines, instead of using the collateral rollers mentioned above, use rubber plates that are less accurate and very damageable.

[0012] Both the cutting cutter and the two sets of opposing rollers are supported by the movable truck superiorly suspended from a pair of transversal guide bars to be able to place said truck set in correspondence with one or another work station arranged in two parallel longitudinal directions.

[0013] In correspondence with each of the work stations there is located a longitudinal bed of rollers that is interrupted in a central transversal zone where there are two tilting support elements to flip and place the block of slate in the correct position to then proceed to obtain the various slate sheets through the cutting cutter that will come into contact with the upper side face of the corresponding slate block initially dragged by the rollers to the respective tilting support element located in the central transversal zone, in correspondence with which is located the movable truck that will run above the slate block that is driven on the referenced transversal guide bars.

[0014] The cutter moves vertically to separate the different slate pieces by a linear actuator, such as a pneumatic or oil-hydraulic cylinder. In turn, the block is held by one of its bases against a seat of the tilting support element, while on the other matching base other front linear actuators press in a controlled manner.

[0015] With this described arrangement, a slate block is supported in principle by one of its bases on the respective longitudinal bed of rollers of one of the work

stations, dragging it to the respective tilting support element located in the central transversal zone of the machine, which tilting support element will flip the slate block 90 ° until placing it in such a position that its bases will be arranged on vertical planes, which slate block will be maintained supported on said tilting support element, while the static position of the slate block is ensured by the linear front actuators referred to above.

[0016] In this situation, the movable truck is placed on top of the slate block so that through the cutting cutter it pushes down on the upper side face of the slate block in correspondence with a cleavage plane or shear plane parallel to the bases of the slate block, and then pressurized air is blown into the incision made to facilitate the cleaving, such that it is important that the air does not escape through the sides of the slate block but that it does escape through the bottom, once the cleaving has ended. Therefore, the new sealing system is envisaged based on a central roller with rubber coating the generatrix of which enters into contact with the surface of the block creating the necessary closure, after pressure from the slate block on said side faces. Said necessary closure can also be carried out with the pneumatic mattress instead of the central roller.

[0017] Next, in order to facilitate a better understanding of this specification and forming an integral part thereof, figures are accompanied in which the object of the invention has been represented with an illustrative character and without limitation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Figure 1.- It shows an elevational view of the machine for cleaving slate, object of the invention. Said slate pieces are obtained from a block using a cleaving process.

Figure 2.- It shows a profile view of the machine of the invention.

Figure 3.- It shows an elevational view of the cleaving machine.

Figure 4.- It shows a plant view of the machine of the invention.

Figure 5.- It depicts a view of a part of the machine showing essentially a clamp equipped with a roller made of soft material that seals the shear plane during the cleaving process of the slate block.

Figure 6.- It depicts a view similar to the previous one where the clamp incorporates a pneumatic mattress instead of the central roller made of soft material.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0019] Considering the numbering adopted in the figures, the machine for cleaving slate comprises a frame which supports two longitudinal beds of rollers 1 rotating

through two reducing motors 2 while their continuity is interrupted in a central transversal zone 2 where there are two tilting support elements 3 with an L-shaped angular structure, such that in the initial position, the major branch of such tilting support elements 3 is located in the same horizontal plane as the longitudinal beds of rollers 1, on which the slate blocks 4 are supported in principle by one of their bases, being drawn until placing them on the respective tilting support element 3, and, at such time, it will tilt through a major oil-hydraulic cylinder 5 until being positioned in a vertical position in which the major branch of such tilting support element 3 will be arranged in a vertical plane as the bases of the slate block 4, on the free base of which a pair of front oil-hydraulic cylinders 6 will press to ensure the stability and static clamping of the slate block 4.

[0020] The minor branch of the tilting support elements 3 forms a height-adjustable seat base 7 to adjust the height of the slate block 4.

[0021] Above the central transversal zone where the two tilting support elements 3 are, there is a movable truck 8 coupled and guided on a pair of transversal guide bars 9 fixed at their ends to the frame of the machine.

[0022] This movable truck 8 carries a cutting cutter 10-10' and also a clamp 11 - 11' that in a first embodiment comprises two groups of vertical rollers, each of which groups includes a central roller 12 with elastomeric surface and two pairs of supporting collateral rollers 13, such that the central roller 12 seals the shear plane or separation of the slate block 4. The cutter 10-10' moves through a vertical cylinder 14.

[0023] In a second embodiment, the central roller 12 is replaced by a pneumatic mattress 12' with a rigid base 18, such that in this case the pneumatic mattress 12' is the element that seals the shear plane of the slate block 4. Optionally, an air pressure system may be included that will introduce pressurized air into the pneumatic mattress 12', adapting it better to the irregularities that the slate block 4 has.

[0024] The structure of the cutting cutter may comprise a conventional configuration convergent structure 10 or comprise a modular structure 10' formed by several cutter portions arranged in the same vertical plane.

[0025] Thus, the machine of the invention has a double work station which corresponds to the two longitudinal beds of rollers 1, such that the movable truck 8 which carries the cutter 10-10' performs a cut on the upper side face of the respective slate block 4, which movable truck 8 will move alternately to one and the other work station.

[0026] Once the incision or fissure has been carried out with the cutting cutter 10-10' on the upper side face of the slate block 4, pressurized air is blown into the incision made to produce the cleaving, being equally important to achieve that the air does not escape through the sides of the block, but that it does it through the bottom after the cleaving. Therefore, the new sealing system based on the central roller 12 with rubber coating has been envisaged, the generatrix of which contacts the sur-

face of the block, creating the necessary closure, after pressure from the slate block 4 on the corresponding opposing side faces.

[0027] Said necessary closure can also be carried out by means of the pneumatic mattress 12' instead of the central roller 12 made of soft material.

[0028] It should be noted that in the case of a modular cutter formed by small individual portions of cutter, they can be replaced one by one to improve the incision on the slate block 4.

[0029] The tilting support elements 3 have lateral portions 15 associated to horizontal guides 16 to control the mobility of said tilting support element 3 during its tilting for flipping the slate blocks 4.

[0030] Each group of vertical rollers 11 is coupled to opposing supports 17 with adjustment to adapt to the width of the slate blocks 4.

[0031] Is also important to highlight the management and control that the electrical components installed have on the mechanics, from the automatic logic controller to the ones that provide the accurate readings of the dimensions of the pieces to be cleaved.

[0032] The process to perform the cutting of the pieces is the following.

[0033] Initially and after having positioned the slate block, an accurate measurement of the thickness of the piece to be cut is carried out. The automatic logic controller makes a precise calculation of the measures at which it has to make the cuts (within pre-set tolerances), with the aim of cutting all the block into pieces of equal size without leaving the last piece out of measure as rejection. It is understood that the measures of the pieces of a block to be cleaved, shall be equal to the difference of the two blocks divided by the number of pieces. Also, certain dimensions can be preset, at the front and rear parts of the faces of the block as a useless discards due to their irregularities or little value, in which case the automatic logic controller will not consider these two preset dimensions as part of the block and it will make the subdivisions without these discards.

[0034] On the other hand, the machine of the invention incorporates a pneumatic reservoir with adjustable pressure (not shown in the figures) to feed the pneumatic mattress 12' of the clamp 11, as well as to blow the pressurized air into the incisions on the slate block 4 to produce the cleaving and in general to supply pressurized air to any element or part of the machine that may need it.

Claims

1. Machine for cleaving slate, which being intended to cleave a block of slate to obtain slate sheets using a cutter on the upper side face of the slate block with the bases thereof arranged on vertical planes, is **characterized in that** it comprises at least two work stations corresponding to two longitudinal beds of rollers (1) that are interrupted in a central transversal

zone where there are tilting support elements (3) that flip the slate blocks (4) initially dragged by these rollers (1), and in correspondence with said central transversal zone there is a movable truck (8) superiorly suspended from transversal guide bars (9) to move alternatively to one and the other work station, which movable truck (8) incorporates the cutting cutter and also a clamp that includes two groups of vertical rollers, each of which incorporates in turn pairs of supporting collateral rollers (13) and a central element that seals the shear plane of the block in correspondence with the vertical side faces of the slate block (4).

2. Machine for cleaving slate, according to claim 1, **characterized in that** the tilting support elements (3) comprise an L-shaped structure, the major branch of which is initially arranged in the same horizontal plane as the longitudinal beds of rollers (1), to receive the slate blocks (4) previously dragged by said rollers (1), while its minor branch forms a height-adjustable seat base (7) of the slate block (4) when it is vertically arranged for its subsequent cleaving
3. Machine for cleaving slate, according to claim 2, **characterized in that** the tilting support elements (3) have lateral portions (15) coupled to horizontal guides (16) through which they move during the movement of such tilting support elements (3) through a major oil-hydraulic cylinder (5) the rod of which is connected to the major branch of the respective tilting support element (3).
4. Machine for cleaving slate, according to any one of claims 2 or 3, **characterized in that** the slate blocks (4) are fastened at the front through a pair of front cylinders (6) that press against the vertical free base of the aforementioned slate blocks (4).
5. Machine for cleaving slate, according to any one of the preceding claims, **characterized in that** the cutter comprises a modular structure (10') formed by small individual cutter portions.
6. Machine for cleaving slate, according to any one of the preceding claims, **characterized in that** the cutter moves vertically through a linear device, such as a vertical cylinder (14).
7. Machine for cleaving slate, according to any one of the preceding claims, **characterized in that** the clamp (11) of the movable truck (8) incorporates a central element determined by a central roller (12) with a coating of soft material, such as elastomeric coating.
8. Machine for cleaving slate, according to any one of claims 1 to 6, **characterized in that** the clamp (11')

of the movable truck (8) incorporates a central element determined by a pneumatic mattress (12') with a rigid base (18).

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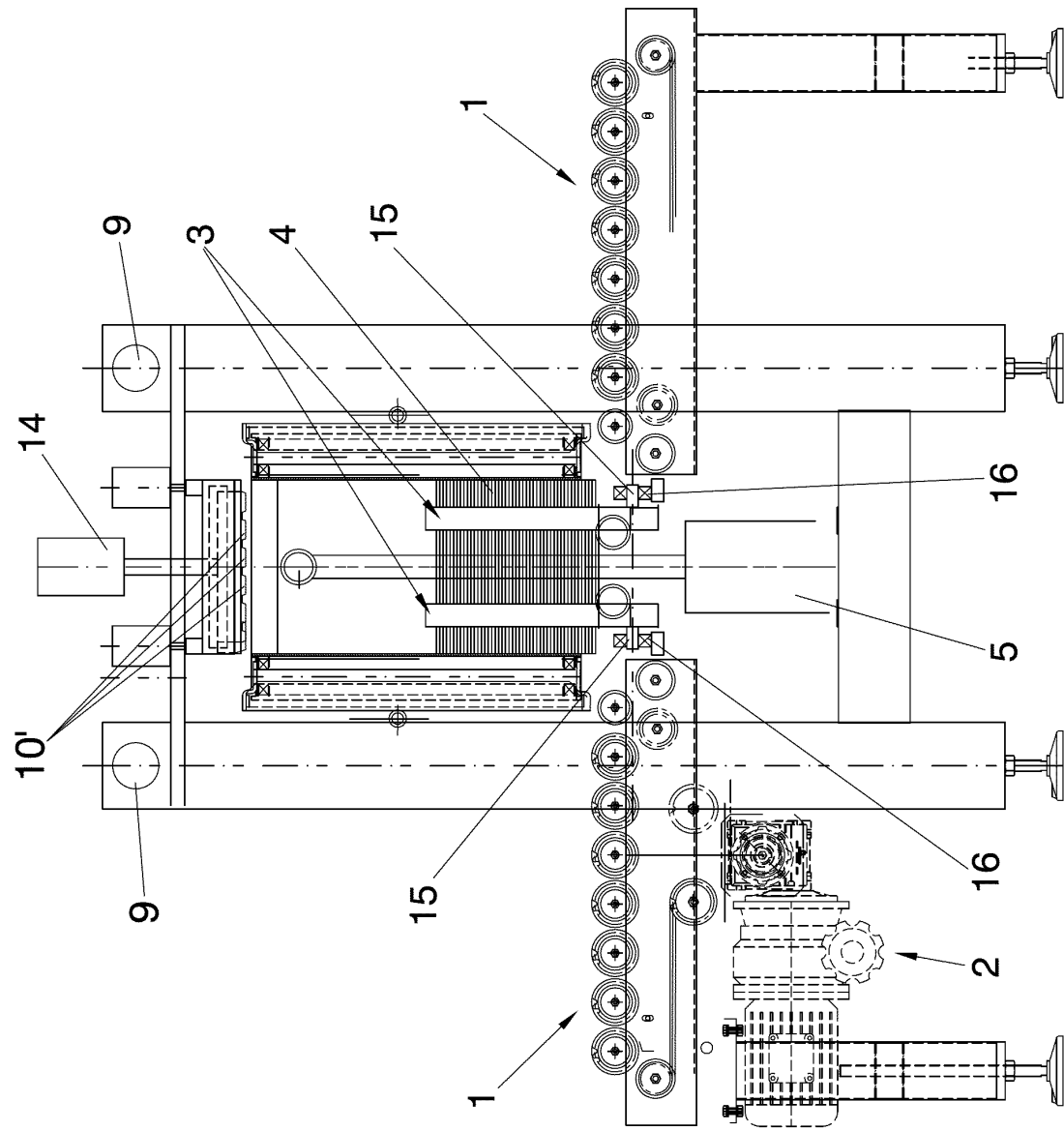


FIG. 1

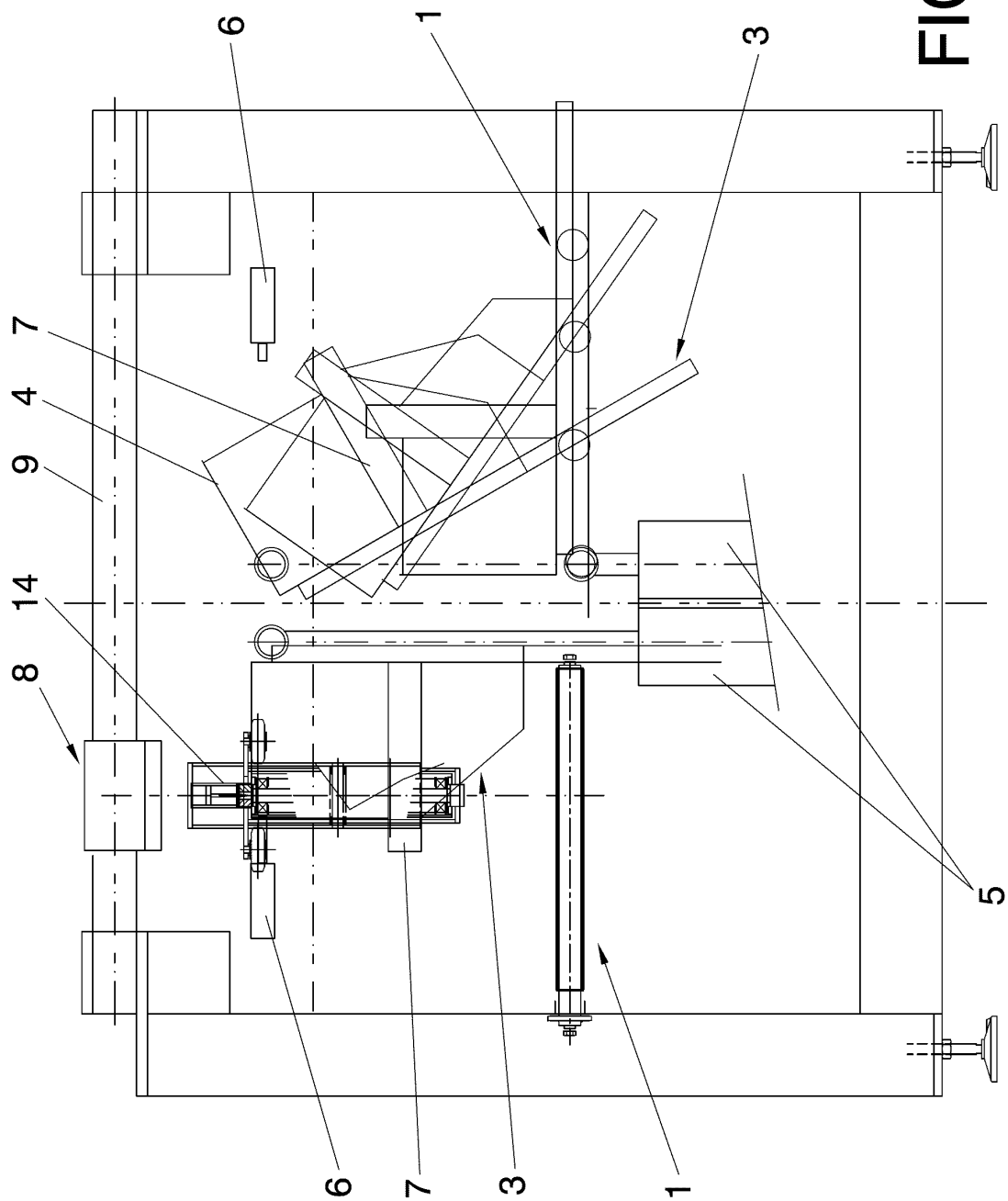


FIG. 2

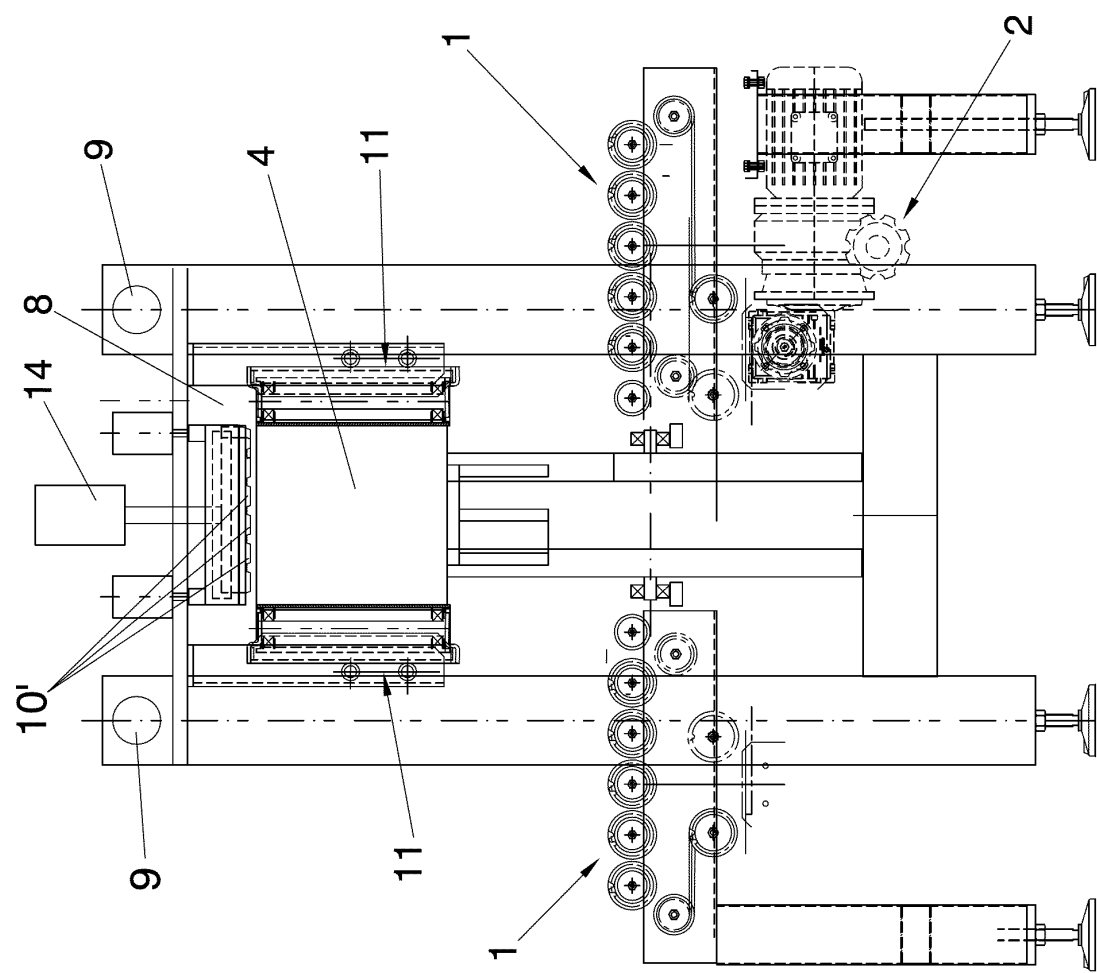


FIG. 3

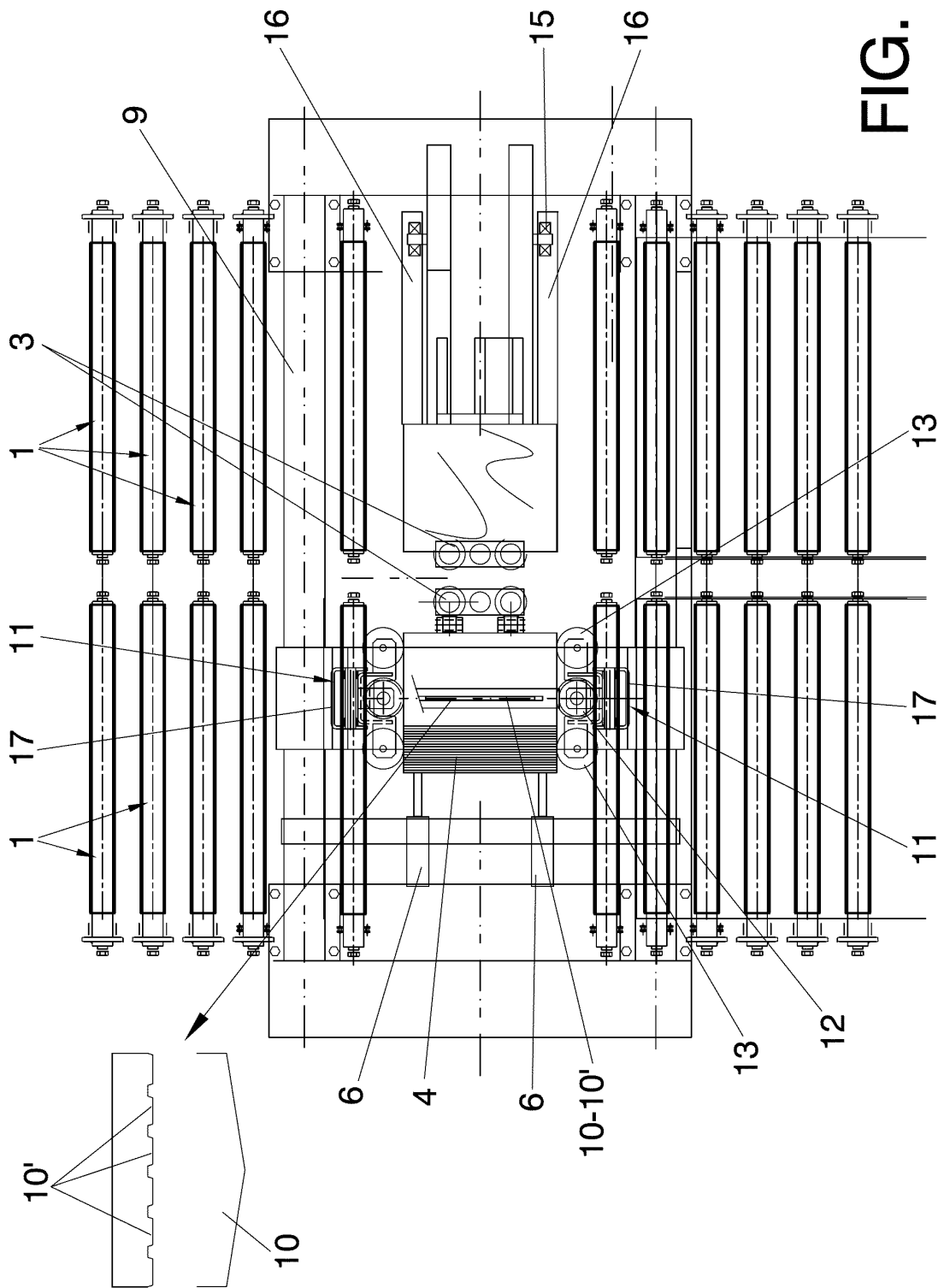


FIG. 4

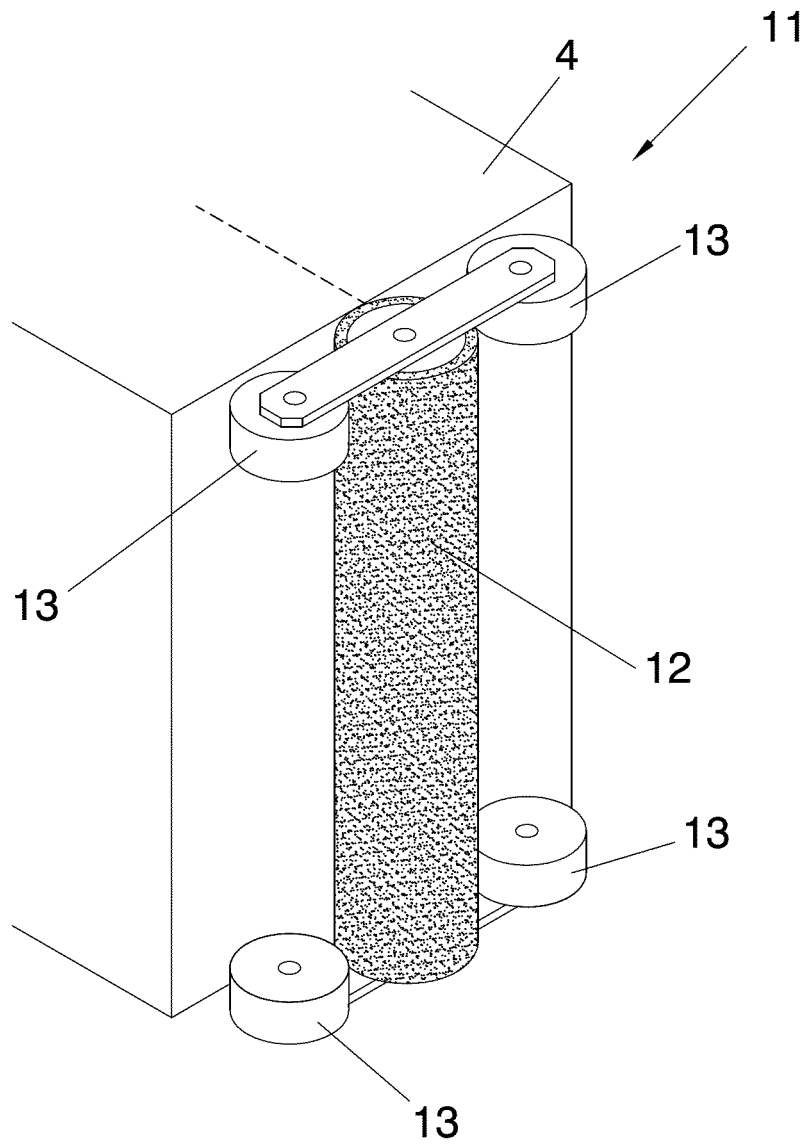


FIG. 5

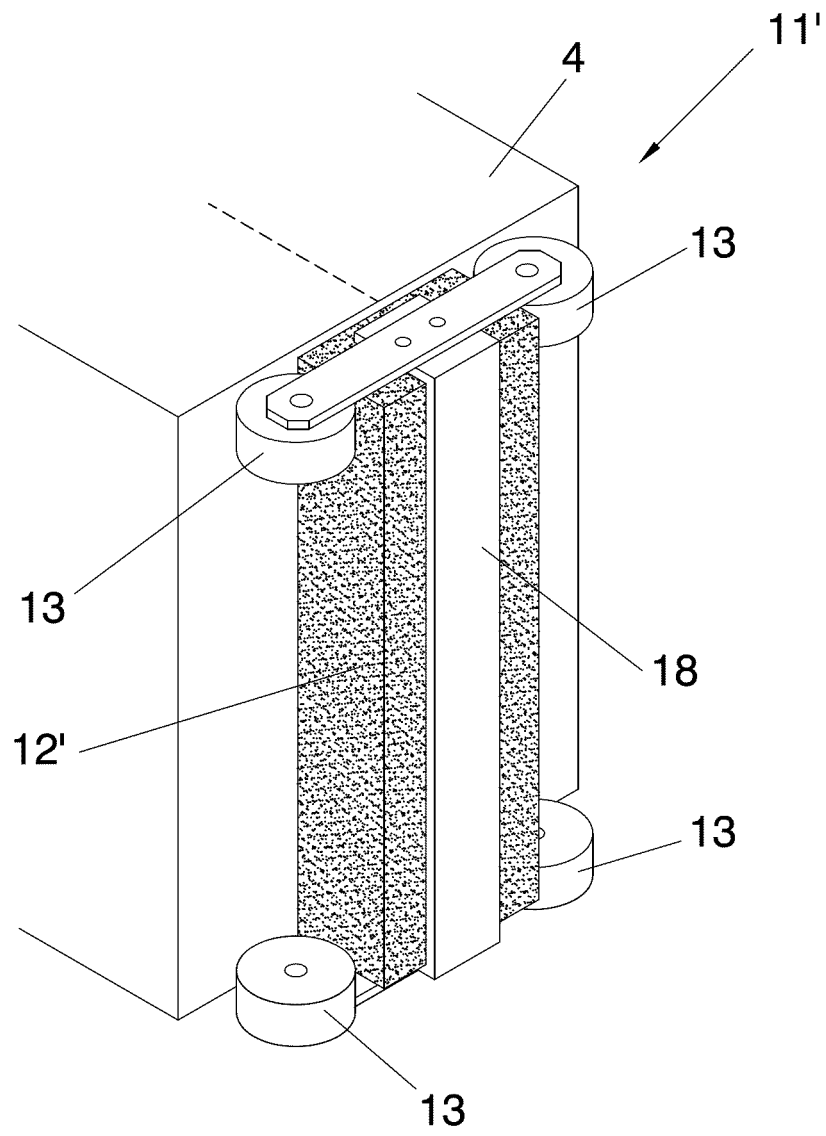


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2011/070168

A. CLASSIFICATION OF SUBJECT MATTER

B28B1/32 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B28B, B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, INVENES

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	ES 2028598 A6 (FERNÁNDEZ SÁNCHEZ) 01/07/1992, Columnas 1-2; figures 1-3	1

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"E" earlier document but published on or after the international filing date	
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"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search
07/06/2011Date of mailing of the international search report
(27/07/2011)

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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/ES2011/070168

Information on patent family members

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Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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- FR 513613 [0007]
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