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(54) **CONSTRUCTION ELEMENT PRODUCTION DEVICE, AND RELATED SYSTEM, METHOD AND CONSTRUCTION ELEMENT**

(57) Construction element (1) production device comprising a hopper (2) for input of construction material (12) into an extruder (21) that pushes said construction material (12) towards a nozzle (3), wherein said nozzle (3) comprises at least a first rectangular section (33) and a second rectangular section (34) laterally offset from each other and at least partially joined along their largest faces (11a). The invention also relates to a production system associated with a construction element (1) production device having a screw extruder (21). A method of producing construction elements (1) using the aforementioned production system is also claimed, as is a construction element (1) obtained through this method. The construction element (1) comprises a plurality of rectangular prisms (11) joined along parts of their largest faces (11a). This allows an easy placement thanks to a self-assembling structure, while limiting sonic and/or thermal transmission.

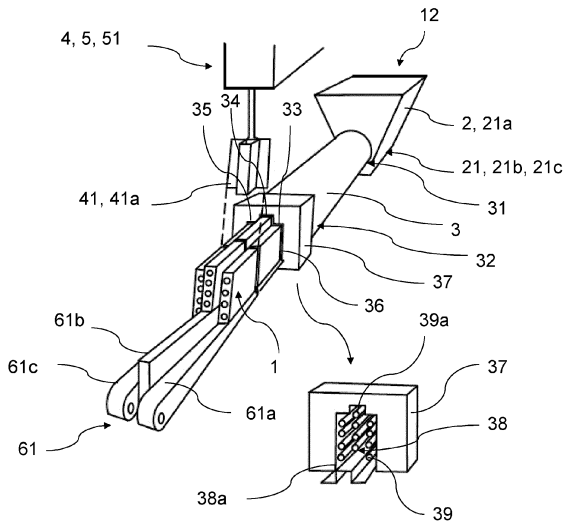

FIG. 7

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Description

[0001] The present invention relates to a construction element production device comprising an inlet hopper that feeds construction material towards an extruder that pushes the material towards a nozzle with the shape of offset rectangular sections, a production system including conveyor belts, the associated production system and method, and the construction element itself, as described in the Claims, incorporating notable innovations and benefits.

Background of the invention

[0002] There are known construction element production devices that include some of the features mentioned in the preamble of Claim 1 for this invention. And in particular, with respect to the construction element mentioned in Claim 14, there are multiple construction elements, such as ceilings, perforated bricks, ceiling placards, concrete panels, etc. which usually require a specialist for their installation.

[0003] Additionally, there are various known state-of-the-art production devices and systems. As described in patent CN2158P1271, a lifting cooling device for the production of refractory bricks performs the lifting of a cooling plate of refractory bricks through a pneumatic module assembly and performs the direct blowing of refractory bricks by the arrangement of double air blowers to improve cooling efficiency. The device has a simple structure, is inexpensive to manufacture and is suitable for its application.

[0004] Furthermore, patent CN215857496 describes a polyhedral mosaic slope protection brick for a water conservation project. The brick consists of a main body and sand-gravel material. The main body is a polyhedral hollow structure of reinforced concrete in the form of an arrow composed of a top face, a bottom face, two side faces, a front face and a rear face. The two side faces are arranged in parallel, half of one side face is angled inwards to form a bell mouth, and half of the other side face protrudes outwards to form a spout. The bell mouth and spout are equal in shape and size and correspond to each other in position; the front end face of the main body has the form of a sheet that protrudes outward, the rear end face of the main body has the form of a sheet that sinks inward, and the front end face and the rear end face have the same form and size. It has the advantages of being a simple structure, easy to manufacture, convenient to use, highly efficient and economical.

[0005] Additionally, patent CN215848732 describes a regular brick production system comprising a raw material processing device, the lower part of which is connected to a material-pushing device. High polymer materials are combined with straw powder, related adhesives, foaming agents and similar materials, thereby reducing the cost of the production process.

[0006] However, it is still desirable to develop a specific production device for construction elements that allows the element to be installed without technical expertise, being a self-assembling structure with no potential risk of incorrect installation, while simultaneously seeking to limit sonic and thermal transmission.

Description of the invention

[0007] The purpose of the present invention is to provide a specific production device for a construction element, with the associated system, method and element, which addresses the aforementioned difficulties involved during installation and offers other advantages which will be described below.

[0008] In accordance with this purpose and the first aspect of the invention, the present invention provides a construction element production device comprising an inlet hopper that feeds construction material towards an extruder, pushing the material towards a nozzle, whereby said nozzle comprises at least a first and second rectangular section offset laterally from each other and at least partially joined on one side.

[0009] In this way, a construction element is pushed out of the nozzle in the form of two staggered blocks, which facilitates assembly on site, reduces thermal transmission between the inside and outside of the building and reduces sound transmission. It should be noted that the term "hopper" refers to the component through which the construction material is introduced, preferably having a funnel shape to facilitate the dumping of material.

[0010] The nozzle also comprises a third rectangular section, parallel to the first rectangular section and symmetrical with respect to the second rectangular section, where the first rectangular section and the third rectangular section are partially below the second rectangular section. This produces a construction element of three bodies or a triple rectangular prism, obtaining three levels, the two sides at the same height, thus achieving greater stability of the resulting construction element once resting on the ground or mounted on another construction element. According to one embodiment, the production device comprises a piston with a cutting element, preferably located at the nozzle outlet. In this way, the construction material can be sectioned as it exits the nozzle to produce the construction element.

[0011] More specifically, the aforementioned first cutting element is a wire, so that a clean cut is produced with no burrs when cutting the construction material and returning to its initial position, obtaining a construction element of higher quality.

[0012] As an option, the cutting element can be in the form of a guillotine, which can have a flat shape, or preferably a stepped shape, so that the protruding construction element has a shape that can be longitudinally fitted with another construction element for easier assembly and better thermal and sound insulation performance.

[0013] More specifically, the extruder comprises a cavity with a leadscrew that pushes the construction material

towards the nozzle in a way that the speed at which the material is extruded can be regulated in order to speed up or slow down production or accommodate the consistency of the construction material used.

[0014] It should be noted that the leadscrew is driven by a motor, allowing faster production and more precise control.

[0015] In addition, the nozzle comprises an inlet attached to the cavity of the extruder and an outlet, in order to provide a conduit that gives the desired shape to the construction element in its final state.

[0016] According to another embodiment, the nozzle outlet comprises a replaceable head which comprises at least one mouth through which the construction material passes, so that the construction element can take various forms, depending on the configuration of the replaceable head, and in particular of the mouth. It should be noted that the first, second or third rectangular sections that form part of the nozzle may preferably be part of the head and in particular the mouth located at the nozzle outlet in order to form the construction element.

[0017] More specifically, the mouth comprises at least one inner wall and at least one horizontal rod through which the construction material passes, forming the contour and inner cavities or holes of the construction element, intended to house cable or ducting.

[0018] In addition, the horizontal rod is fixed to the inner wall of the mouth by means of a flat element in order to minimize the slowing down of the material as it passes through. It should be noted that the flat element, the inner wall and the horizontal rod are preferably parallel to the direction of movement of the construction material.

[0019] According to another embodiment, the production device comprises a sensor at the nozzle outlet, connected to a controller whereby when the sensor detects the presence of construction material, the controller stops the extruder and actuates the piston in order to make the cut that creates the construction element. The sensor therefore measures the horizontal travel, determining the length of the resulting construction element. As an option, the sensor may be a photocell sensor for optical detection without the need for physical contact.

[0020] According to the second aspect of the invention, the invention refers to a production system for a construction element, comprising the described production device in conjunction with a conveyor belt at the exit of the nozzle, which allows the automatic transportation of the produced construction elements and thus a higher rate of production.

[0021] It should be noted that said conveyor belt comprises a first level aligned with the first rectangular section of the nozzle and a second level aligned with the second rectangular section of the nozzle, such that the conveyor belt itself is adapted to the output shape of the construction material, i.e., the shape of the construction element.

[0022] As an option, the conveyor belt may comprise a third level aligned with a third rectangular section of the nozzle, so that the conveyor belt can stably transport construction elements of three rectangular bodies or prisms.

[0023] Another advantage is that the production system for the construction element comprises a moving carriage with a cutting element, wherein the movable carriage comprises at least a second motor in order to move along at least a first guide parallel to the conveyor belt, from a first position to a second position and then return to the first position. The movement of the conveyor belt is synchronized with that of the moving carriage so that the vertical cutting of the construction element occurs cleanly to the desired horizontal size.

[0024] It should be noted that, in the first position, the cutting element makes a cutting movement from a first height to a second height, and in the second position the cutting element makes a return movement from a second height to a first height. Therefore, the cutting element does not return to the first height at the same place but after a horizontal displacement so that it finds a gap to return to its initial height without encountering the obstacle of the construction element or the construction material.

[0025] More specifically, the moving carriage comprises a second guide driven by a third motor for successive displacement of the cutting element from, first, a starting point and initial height to, second, a starting point and second height to, third, a finishing point and second height to, fourth, a finishing point and initial height and back to the starting point and initial height, confirming that the cutting element does not return upwards at the same place and thus avoids the construction element and construction material when returning to its starting position.

[0026] At this point, it is important to specify that at least the second and third motors are stepper motors, which allows them to receive precise commands for the final turning position. This can be achieved in conjunction with the sensor, which may be an optical sensor, in order to determine the location of the construction element resulting from the process, and thus act with greater precision, being self-regulating when in operation.

[0027] According to the third aspect of the invention, the invention also relates to the method by which a construction element is produced using the production system, comprising the following steps: i) introducing construction material into the hopper; ii) extruding construction material towards a nozzle; iii) actuating a piston with a cutting element when the presence of construction material is detected at the nozzle outlet; iv) collecting the construction element using a conveyor belt and thus obtaining a construction element comprising multiple rectangular bodies or prisms joined together by at least a partial surface of one of their faces, where the multiple rectangular prisms, or parallelepipeds, are partially joined together by the largest of their faces.

[0028] It should be noted that the construction element has at least one double body or rectangular prism. However, the solution of the triple body or rectangular prism

is preferable in order to achieve greater construction stability.

[0029] As an additional advantage, the multiple rectangular prisms that constitute the construction element are partially displaced from each other, vertically or horizontally, or preferably both, so that subsequent assembly on site is possible with a tight fit between the construction elements, thereby not requiring joining materials between the elements, such as cement or mortar, and achieving good thermal and sound insulation performance.

[0030] In a preferred embodiment of the invention, the multiple rectangular prisms that constitute the construction element include at least one longitudinally through-hole to form a channel through successive construction elements, allowing the passage of wiring or pipework for the building being constructed.

[0031] As a result of all the features described above, the construction element offers greater ease of assembly, allowing individual elements to interlock and be assembled without technical expertise, since its structure is self-assembling with no possibility of incorrect installation. In addition, it makes it possible to hermetically seal the construction with no detriment to the technical properties of the channels, in particular, 70 dBA and RF 120, depending on the specific material used.

[0032] It is also important to mention that the construction element enables a clean finish without the need for polishing, offering a wide range of sizes and weights in a wide variety of raw materials, such as, for example, mud, micro concrete, etc.

[0033] The attached drawings show, by way of non-limiting example, a device for producing a construction element and the associated system, method and element, constituted in accordance with the invention. Other characteristics and advantages of the construction element production device and associated system, method and element, subject of the present invention, will be evident from the description of a preferred, but not exclusive embodiment, which is illustrated by way of non-limiting example in the attached drawings.

Brief description of the drawings

[0034] For a better understanding of the description made herein, a set of drawings has been provided wherein, schematically and solely by way of a non-limiting example, a practical case of an embodiment is represented.

Figure 1 is a plan and profile view of the construction element, according to the present invention;

Figure 2 is a perspective view of the construction element in various embodiments, including two or more rectangular prisms, according to the present invention;

Figure 3 is a perspective view of the construction element mounted on a floor in various orientations, both horizontal and vertical, according to the present invention;

Figure 4 is a perspective view of the construction element mounted on a vertical wall, according to the present invention;

Figure 5 is a perspective view of the construction element mounted on a roof in various orientations, both horizontal and vertical, according to the present invention;

Figure 6 is a perspective view of the construction element including three rectangular prisms with their respective holes, according to the present invention;

Figure 7 is a schematic perspective view of the production system, including the construction element production device and the conveyor belts, according to the present invention;

Figure 8 is a schematic perspective view of the production system, including the construction element production device and a moving carriage, according to the present invention;

Description of a preferred embodiment

[0035] From the aforementioned figures and the adopted reference numbers, an example of a preferred embodiment of the invention can be observed therein, comprising the parts and elements indicated and described in detail below.

[0036] Therefore, as seen in Figure 7, the construction element production device (1) comprises an inlet hopper (2) that feeds construction material (12) towards an extruder (21) that pushes said construction material (12) towards a nozzle (3), where said nozzle (3) comprises at least a first rectangular section (33) and a second rectangular section (34) displaced laterally from each other and at least partially joined on one side (35).

[0037] Additionally, as can be seen in Figures 6 and 7, the nozzle (3) comprises a third rectangular section (35) parallel to the first rectangular section (33), and symmetrical with respect to the second rectangular section (34), where the first rectangular section (33) and the third rectangular section (35) are partially below the second rectangular section (34).

[0038] According to one embodiment, as can be seen in Figure 7, the construction element production device (1) comprises a piston (4) with a cutting element (41).

[0039] As seen in Figure 7, the cutting element (41) is preferably a guillotine. Said guillotine has a square Z-shaped horizontal section, with the straight intermediate section vertically, in the event that the nozzle (3) comprises a first rectangular section (33) and a second rectangular section (34). Alternatively, for the embodiment in which the nozzle (3) comprises a first rectangular section (33), a second rectangular section (34) and a third rectangular section (35), the guillotine has a square U-shaped horizontal section with a straight section perpendicular to each side of each of the ends of the U.

[0040] It should be mentioned that, as can be seen in Figure 7, the extruder (21) comprises a cavity (21a) with

a leadscrew (21b) that pushes the construction material (12) towards the nozzle (3). The leadscrew (21b) is operated by a first motor (21c), and the nozzle (3) comprises an inlet (31), attached to the cavity (21a) of the extruder (21), and an outlet (32).

[0041] According to a preferred embodiment of the invention, as can be seen in Figure 7, the outlet (32) comprises a replaceable head (37) which comprises at least one through-hole (38) for the construction material to pass through (12).

[0042] More specifically, as seen in Figure 7, the mouth (38) comprises at least one inner wall (38a) and at least one horizontal rod(39).

[0043] Additionally, as can be seen in Figure 7, the horizontal rod (39) is fixed to the inner wall (38a) of the mouth (38) by means of a flat element (39a).

[0044] Furthermore, as can be seen in Figure 7, the construction element production device (1) includes a sensor (51) at the outlet (32) of the nozzle (3), connected to a controller(5), whereby when the sensor (51) detects the presence of construction material (12), the controller (5) stops the extruder (21) and actuates the piston (4). This sensor (51) can be placed directly over the outlet of the nozzle (3) or a certain distance away from the nozzle, equivalent to the length of the resulting constructive element (1).

[0045] Another aspect of the invention, as can be seen in Figure 7, is the construction element production system (1) which comprises the production device and also a first conveyor belt (61) at the outlet (32) of the nozzle (3).

[0046] Additionally, as can be seen in Figure 7, in the construction element production system (1), the conveyor belt (61) comprises a first level (61a) aligned with the first rectangular section (33) of the nozzle (3), and a second level (61b) aligned with the second rectangular section (34) of the nozzle (3).

[0047] In a preferred embodiment of the invention, as seen in Figure 7, the conveyor belt (61) comprises a third level (61c) aligned with a third rectangular section (35).

[0048] According to one embodiment, as can be seen in Figure 8, the construction element production system (1) includes a moving carriage (7) with a cutting element (41), where the moving carriage (7) comprises at least one second motor (21d) for movement on at least one first guide (71) parallel to the conveyor belt (61), from a first position (81) to a second position (82).

[0049] It should be noted that, as seen in Figure 8, in the first position (81), the cutting element (41) makes a cutting movement from a first height (H1) to a second height (H2), and in the second position (82), the cutting element (41) returns from the second height (H2) to the first height (H1). Therefore, the cutting movement is preferably descending on the protruding construction material (12) towards a second height (H2), and the return movement is preferably ascending to the first height (H1), where the first height (H1) is greater than the second height (H2).

[0050] Furthermore, as seen in Figure 8, the moving carriage (7) comprises a second guide (72) driven by a third motor (21e) for the successive displacement of the cutting element (41) from, first, an initial point (P1) and first height (H1) to, second, an initial point (P1) and second height (H2) to, third, an end point (P2) and second height (H2) to, fourth, an end point (P2) and first height (H1) and back to the initial point (P1) and first height (H1).

[0051] And more specifically the sequence of actions would be as follows:

i) the piece or construction element (1) exits the head (37);
ii) the blade or cutting element (41) is lowered while the moving carriage moves at the same speed as the extruded construction material (12);
iii) the blade or cutting element (41) passes through the clearance space between conveyor belts (61), both downward and upward;
iv) the blade or cutting element (41) continues downwards to a second height (H2), while the ejection conveyor belt (61) and the rapid conveyor belt (61) remove the formed construction element (1);
v) the blade or cutting element (41) reaches the bottom and rises at the other end or end point (P2), with the construction element (1) having already been removed;
vi) the blade or cutting element (41) returns upwards to the first height (H1), horizontally towards the first starting point (H1), while the moving carriage (7) returns to the first position (81);
vii) the blade or cutting element (41) is lowered again, cutting the piece or construction element again(1), as the construction material has now had time to move the corresponding distance to produce a construction element of a suitable, standard size(1).

[0052] The present invention also includes the method for producing the construction element (1) using the production system, comprising the following steps: i) introducing the construction material (12) into a hopper (2); ii) extruding the construction material (12) towards a nozzle (3); iii) actuating a piston (4) with a cutting element (41) when the presence of construction material is detected (12) at the outlet (32) of the nozzle (3); and iv) removing the construction element (1) using a conveyor belt (61).

[0053] As seen in Figures 1 to 6, the present invention also relates to the construction element (1) obtained by the production method, which comprises multiple rectangular prisms (11) joined together by at least a partial surface of one of their faces (11a), where the multiple rectangular prisms (11) are partially joined together by the largest of their faces (11a). According to a preferred embodiment, the constructive material (12) may be either mud or micro concrete.

[0054] It should be noted that, as can be seen in Figures 1 to 6, the multiple rectangular prisms (11) are partially offset from each other, vertically and/or horizontally.

[0055] More specifically, as can be seen in Figure 6, the multiple rectangular prisms (11) include at least one longitudinally through-hole (11b).

[0056] It should be noted that reference is made in the text to the following elements or components even though they do not appear differently in the figures, being either internal elements or integrated with other elements: leadscrew (21b), first motor (21c), second motor (21d), third motor (21e), controller(5).

[0057] Figure 1 shows a plan and profile view of the construction element (1), with several rectangular prisms (11) joined together along their largest faces(11a).

[0058] Figure 2 shows a perspective view of the construction element (1) in various embodiments, including two or more rectangular prisms (11) joined together along their largest faces(11a).

[0059] Figure 3 shows a perspective view of the construction element (1) with several rectangular prisms (11), in several orientations, both horizontal and vertical, as part of a floor assembly.

[0060] Figure 4 shows a perspective view of the construction element (1) as part of a wall construction.

[0061] Figure 5 shows a perspective view of the construction element (1) in various orientations, both horizontal and vertical, as part of a roof construction.

[0062] Figure 6 is a perspective view of the construction element (1) including three rectangular prisms (11) with their respective holes (11b), joined along their largest faces (11a).

[0063] Figure 7 is a perspective view of the production system including the construction element production device(1) and the conveyor belts (61). In particular, the figure shows the hopper (2) for introducing the construction material (12) and the extruder (21) which features a cavity (21a) and a leadscrew (21b) activated by a motor (21c). All this connects to the inlet (31) to a nozzle (3) which also includes an outlet (32) that connects to the corresponding head (37), according to a particular embodiment, a first rectangular section (33), a second rectangular section (34) and up to a third rectangular section (35), which include at least one side (36). The head (37) includes a mouth (38) with an inner wall (38a) and multiple rods (39), joined to the inner wall (38a) by means of a flat element (39a).

[0064] Furthermore, the production system includes a piston (4) with a cutting element (41), preferably a guillotine (41a). It also comprises a controller (5) with a sensor (51) at the outlet (32) of the nozzle (3), which is connected to the conveyor belt (61), which in the present embodiment includes a first level (61a), a second level (61b) and a third level (61c).

[0065] Figure 8 is a perspective view of the production system including the construction element production device (1) and a moving carriage (7). Specifically, the construction element (1) is produced from the protruding construction material (12) using a cutting element (41) that moves on a moving carriage (7) in synchronization with the transport belt (61), both being driven by a second motor (21d), in the case of the moving carriage (7) on a first guide (71), and by a third motor (21e) on a second guide (72) in the case of the cutting element (41), whereby the sensor (51) determines the position of the construction element (1). In particular, the moving carriage (7) moves from a first position (81) to a second position (82), while the cutting element (41) moves vertically from a first height (H1) to a second height (H2) and horizontally from a starting point (P1) to a finishing point (P2).

[0066] The details, shapes, dimensions and other accessory elements, as well as the components used in the implementation of the construction element production device (1) and its associated system, method and element, may be replaced by others that are technically equivalent and do not depart from the essence of the invention or the scope defined by the claims that follow the list of numerical references.

List of numerical references:

[0067]

1	construction element
11	rectangular prism
11a	face
11b	orifice
12	construction material
2	hopper
21	extruder
21a	cavity
21b	leadscrew
21c	first motor
21d	second motor
21e	third motor3 nozzle
31	inlet
32	outlet
33	first rectangular section
34	second rectangular section
35	third rectangular section
36	side
37	head
38	mouth
38a	inner wall
39	stem
39a	flat element
4	piston
41	cutting element
41a	guillotine
5	controller
51	sensor
61	conveyor belt
61a	first level
61b	second level
61c	third level
7	moving carriage
71	first guide
72	second guide
81	first position

82 second position
H1 first height
H2 second height
P1 starting point
P2 finishing point

Claims

1. A construction element production device (1) comprising an inlet hopper (2) for feeding construction material (12) towards an extruder (21) that pushes said construction material (12) towards a nozzle (3) **characterized in that** comprises at least a first rectangular section (33) and a second rectangular section (34), laterally displaced from each other and at least partially joined on one side(36).

2. A construction element production device (1), according to Claim 1, wherein the nozzle (3) comprises a third rectangular section (35) parallel to the first rectangular section (33), and symmetrical with respect to the second rectangular section (34), where the first rectangular section (33), and the third rectangular section (35) are partially below the second rectangular section (34).

3. A construction element production device (1), according to any of the preceding claims, **characterized in that** comprises a piston (4) with a cutting element (41).

4. A construction element production device (1), according to Claim 1, wherein the extruder (21) comprises a cavity (21a) with a leadscrew (21b) that pushes the construction material (12) towards the nozzle (3), whereby the leadscrew (21b) is actuated by a first motor (21c), and the nozzle (3) comprises an inlet (31), attached to the cavity (21a) of the extruder (21), and an outlet (32).

5. A construction element production device (1), according to Claim 4, wherein the outlet (32) comprises a replaceable head (37) which comprises at least one hole (38) through which the construction material (12) passes.

6. A construction element production device (1), according to Claim 5, wherein the mouth (38) comprises at least one inner wall (38a) and at least one horizontal rod (39).

7. A construction element production device (1), according to Claim 6, wherein the horizontal rod (39) is fixed to the inner wall (38a) of the mouth (38) by means of a flat element (39a).

8. A constructive element production device (1), according to any of Claims 4 to 7, **characterized in that** includes a sensor (51) at the outlet (32) of the nozzle (3), connected to a controller (5) so that when the sensor (51) detects the presence of constructive material (12), the controller (5) stops the extruder (21) and actuates the piston (4).

9. A construction element production system (1) comprising a production device according to any of Claims 4 to 7, **characterized in that** comprises a conveyor belt (61) at the outlet (32) of the nozzle (3).

10. A construction element production system (1), according to Claim 9, wherein the conveyor belt (61) comprises a first level (61a) aligned with the first rectangular section (33) of the nozzle (3), and a second level (61b) aligned with the second rectangular section (34) of the nozzle (3).

11. A construction element production system (1), according to Claim 10, **characterized in that** includes a moving carriage (7) with a cutting element (41), wherein the moving carriage (7) comprises at least one second motor (21d) for movement along at least one first guide (71) parallel to the conveyor belt (61), from a first position (81) to a second position (82).

12. A construction element production system (1), according to Claim 11, wherein, in the first position (81), the cutting element (41) makes a cutting movement from a first height (H1) to a second height (H2), and in the second position (82), the cutting element (41) returns from the second height (H2) to the first height (H1).

13. A construction element production system (1), according to Claim 12, wherein the moving carriage (7) comprises a second guide (72) driven by a third motor (21e) for the successive displacement of the cutting element (41) from, first, a starting point (P1) and first height (H1) to, second, a starting point (P1) and second height (H2) to, third, a finishing point (P2) and second height (H2) to, fourth, a finishing point (P2) and first height (H1) and back to the starting point (P1) and first height (H1).

14. A method of production for a construction element (1) using the production system according to any of Claims 9 to 13, comprising the following steps:

    i) introducing construction material (12) into a hopper (2);
    ii) extrusion of construction material (12) towards a nozzle (3);
    iii) actuation of a piston (4) with a cutting element (41) when the presence of construction material is detected (12) at the outlet (32) of the nozzle (3); and

iv) removing the construction element (1) using a conveyor belt (61).

15. A construction element (1) obtained through the production method according to Claim 14, comprising multiple rectangular prisms (11) joined together along at least a partial surface of one of their faces (11a), whereby the multiple rectangular prisms (11) are partially joined together along the largest of their faces (11a).

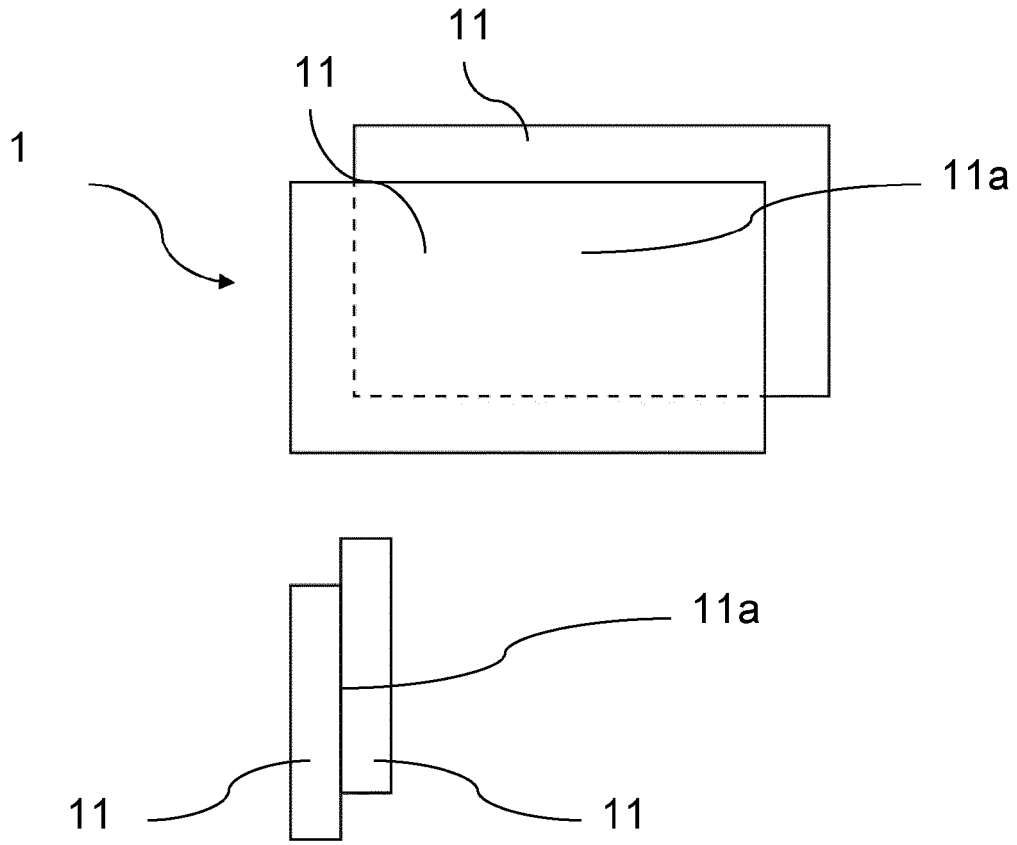


FIG 1

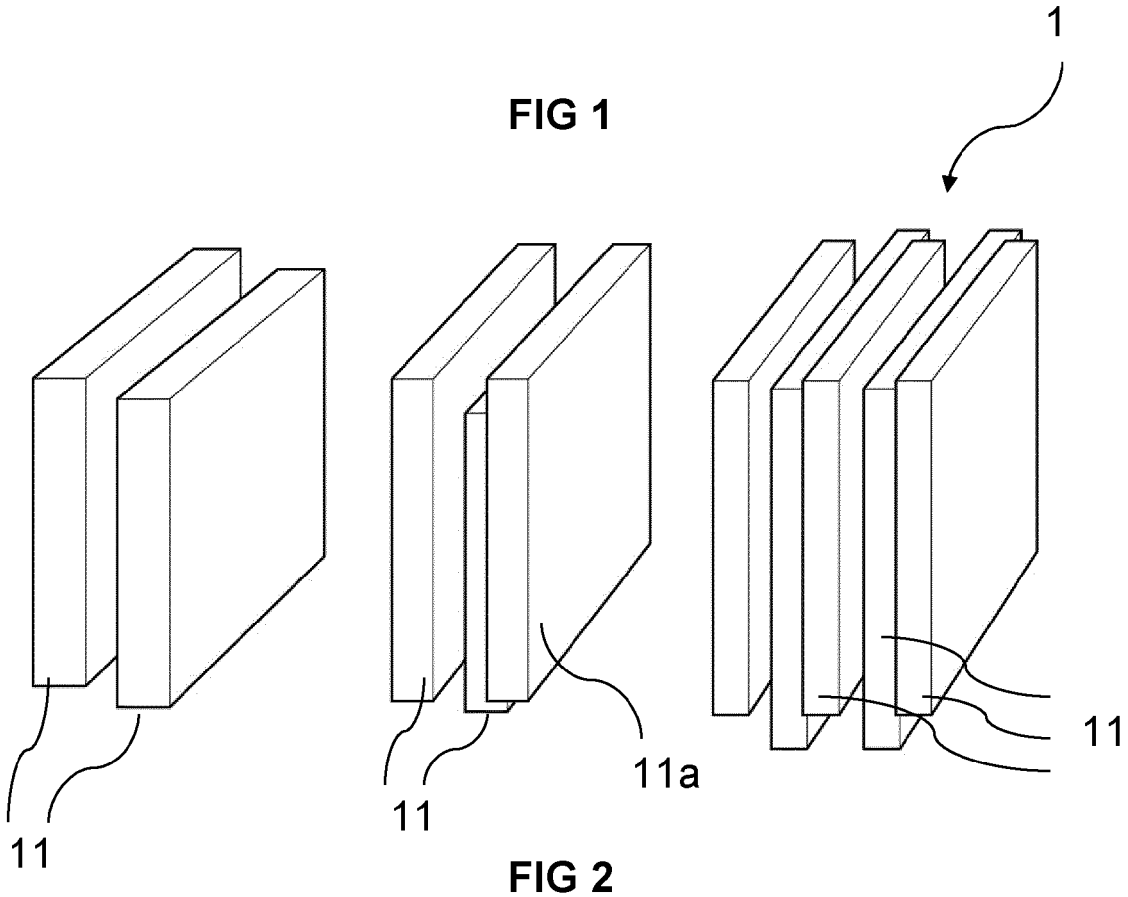


FIG 2

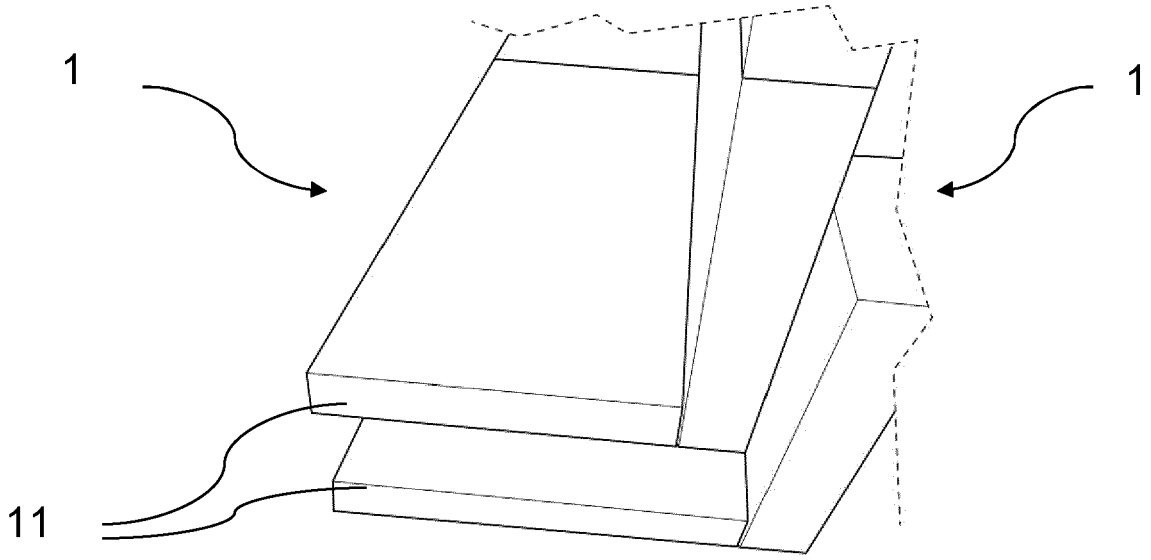


FIG 3

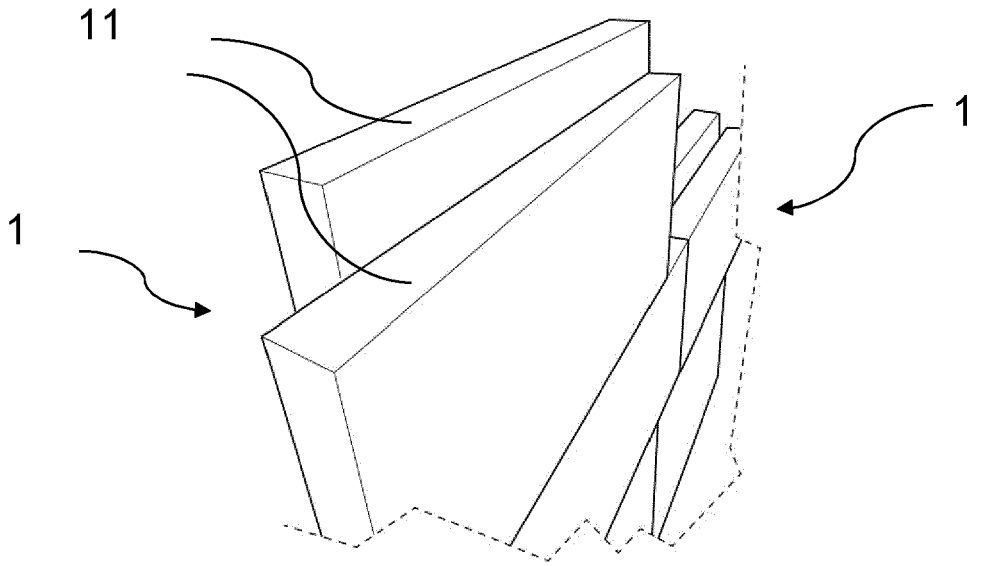


FIG 4

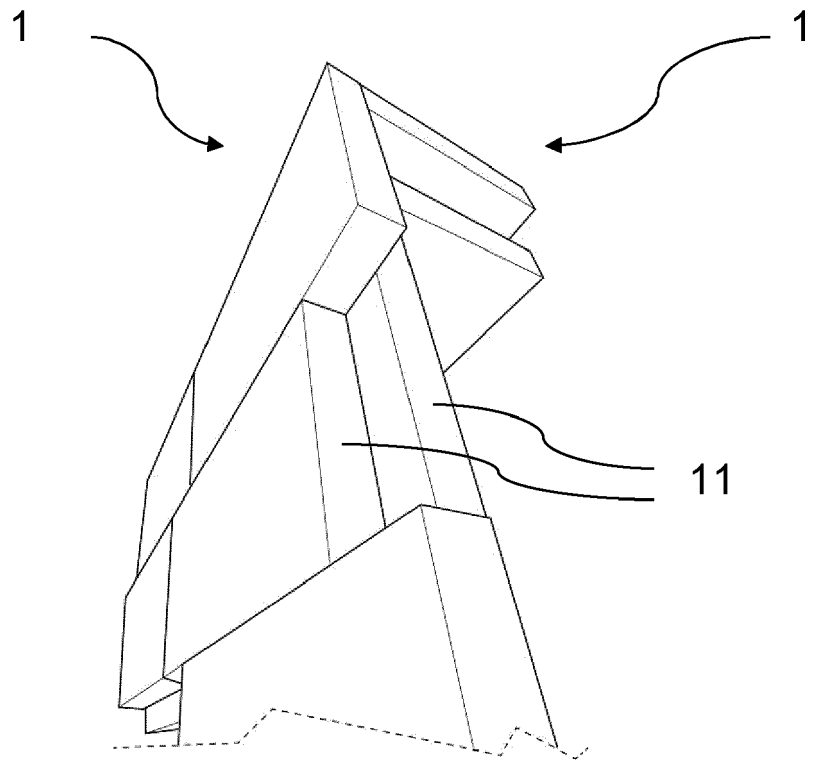


FIG 5

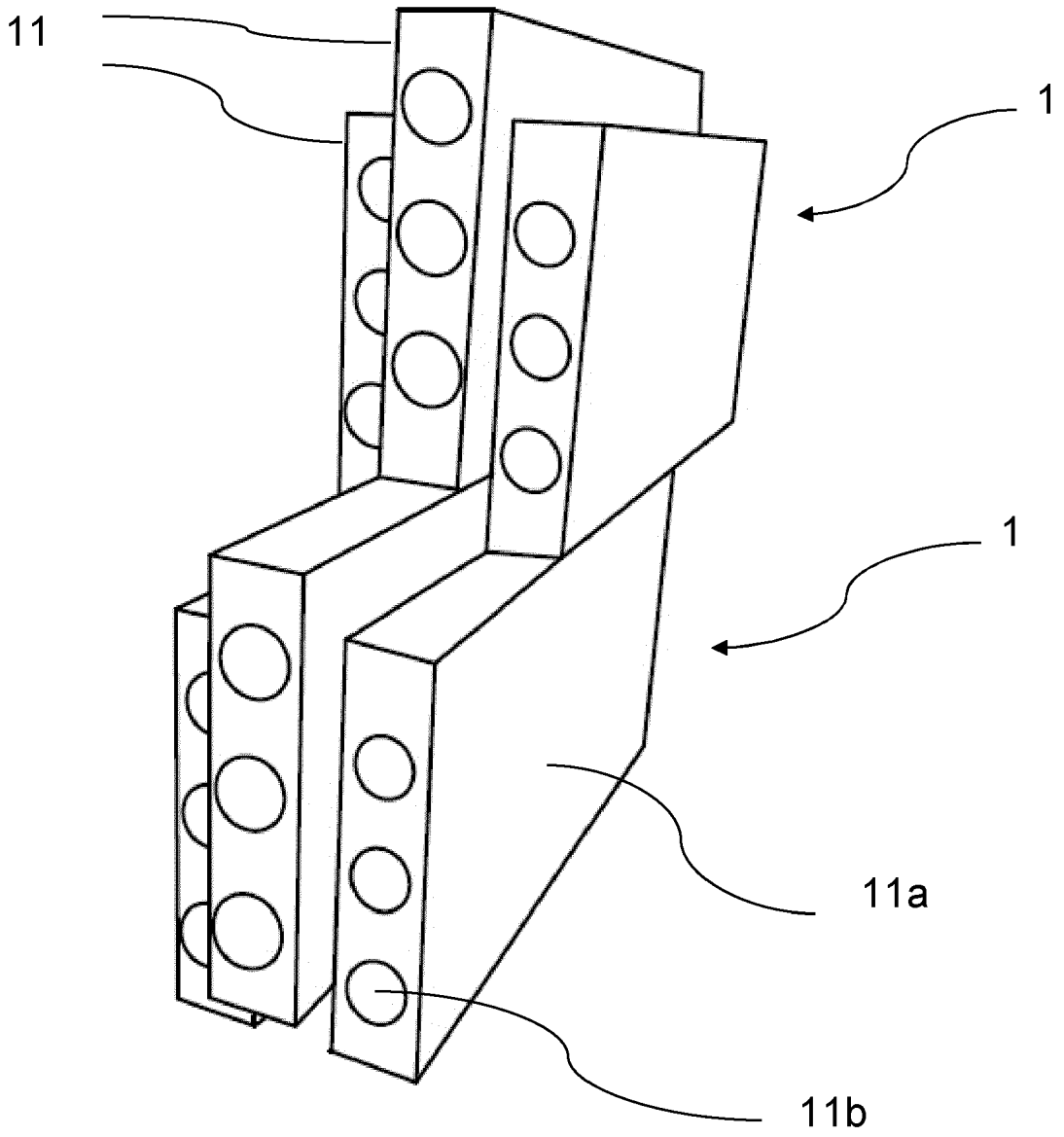
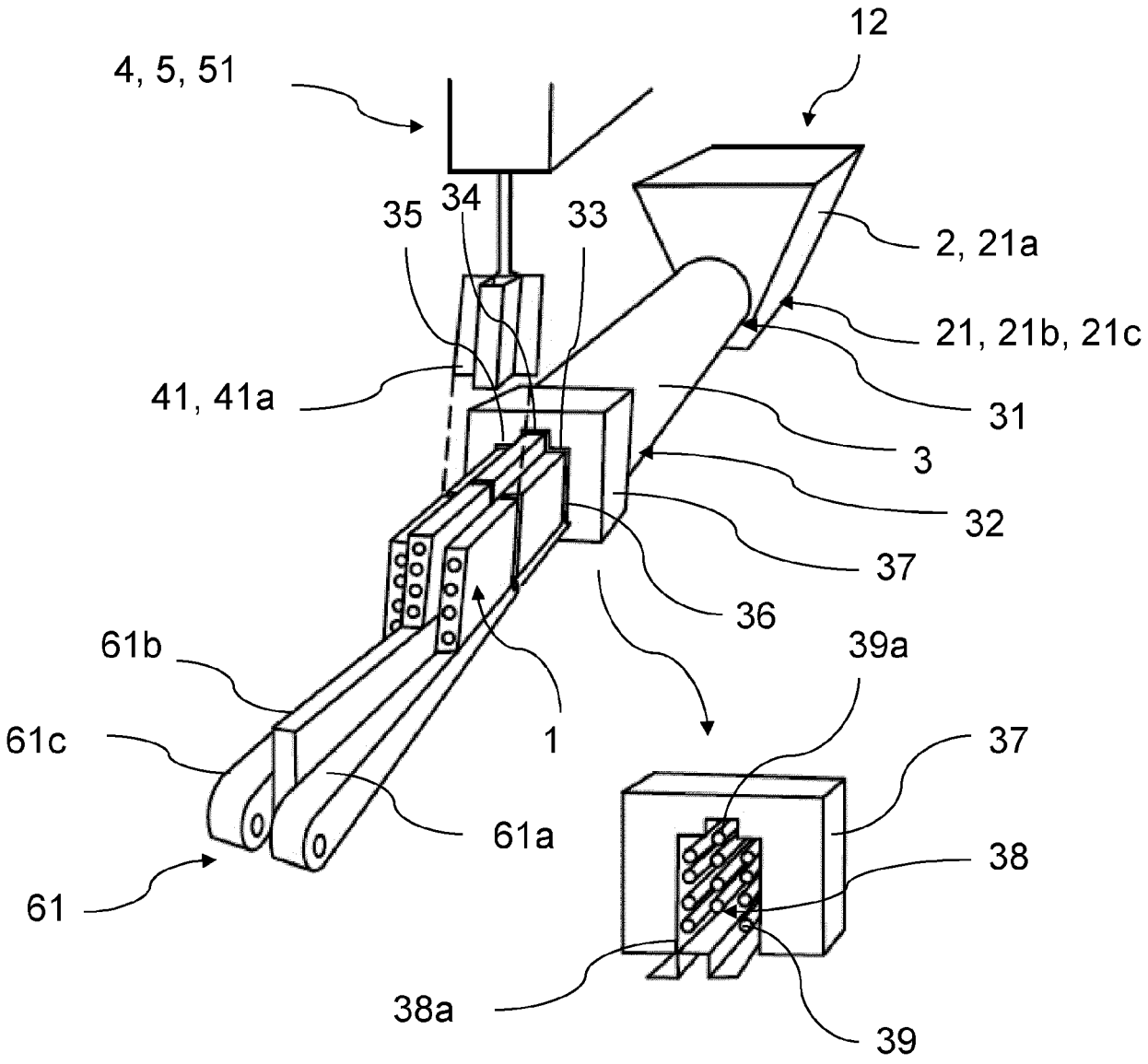


FIG 6


12
4, 5, 51
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34
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2, 21a
21, 21b, 21c
41, 41a
31
3
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37
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61b
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61c
1
37
61a
38
61
38a
39

FIG. 7

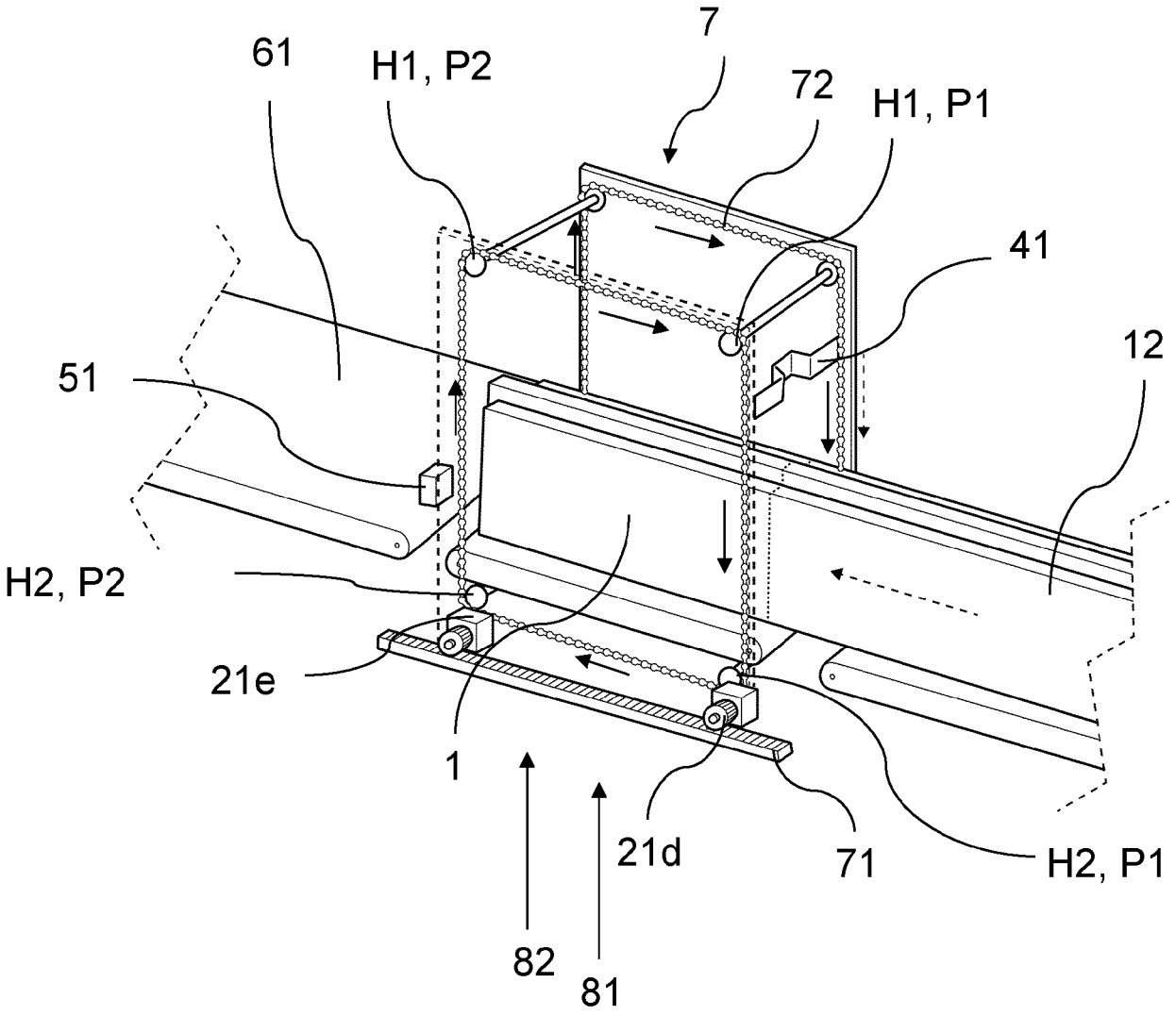

FIG. 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- CN 215857496 **[0004]**
- CN 215848732 **[0005]**