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(54) **EQUIPMENT FOR THE MANUFACTURE OF SLABS OF CERAMIC MATERIAL**

(57) The equipment (1) comprises:
- one supporting surface (3) movable along a direction of forward movement (D);
- dispensing means (4) of a powdered ceramic material, configured to release a continuous slab (L) to be compacted on the supporting surface (3);
- pressing means (6) comprising one pressing element (7), adapted to press a portion (P) of the continuous slab (L) so as to obtain at least one compacted slab (C); and
- containment means (12) of the portion (P) comprising:
- one frame structure (13) defining a substantially closed perimeter; and
- a plurality of containment elements (14) associated with the frame structure (13) and arranged inside the closed perimeter, adapted to define with the supporting surface (3) one containment volume (16) of the portion (P), the pressing element (7) being adapted to fit inside the containment volume (16) during a pressing phase of the portion (P).

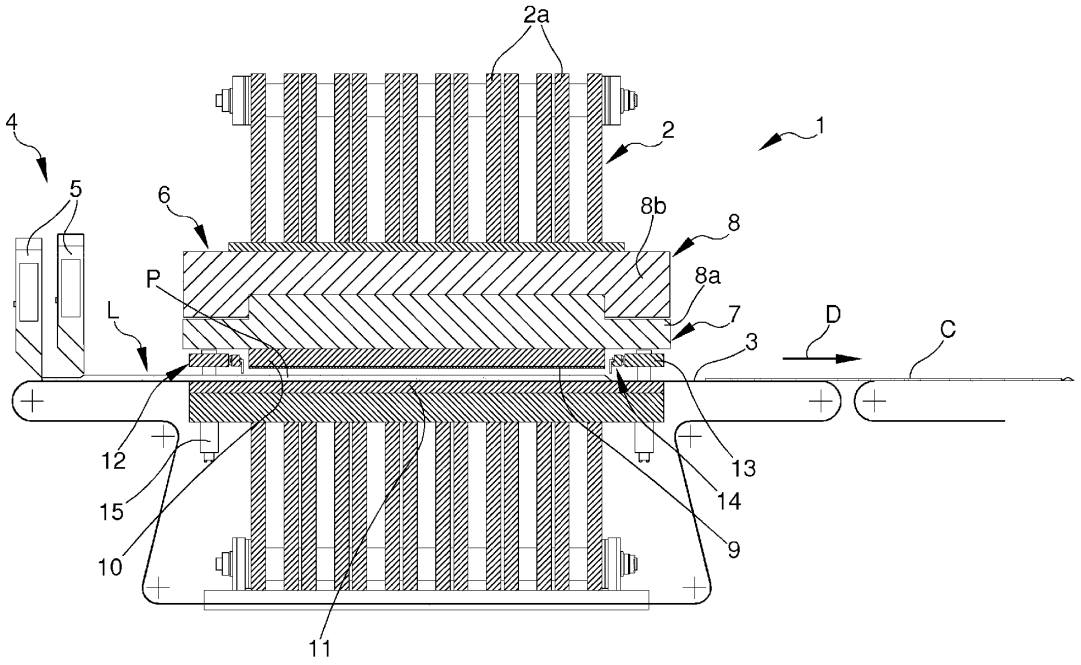


Fig.1

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## Description

### Technical Field

**[0001]** The present invention relates to a piece of equipment for the manufacture of slabs of ceramic material.

### Background Art

**[0002]** As is well known, the manufacture of slabs of ceramic material is generally carried out by preparing a predetermined amount of material to be compacted, placing this predetermined amount of material on a supporting surface and compacting it using suitable pressing means.

**[0003]** The traditional method of pressing, relative to the manufacture of small-medium sized products, provides that the ceramic material to be compacted is placed inside a cavity into which a relevant pressing pad is fitted. Once the pressing action is over, the material thus compacted is extracted from the cavity and made to move forward towards the subsequent drying or firing stations.

**[0004]** This pressing method is characterized by low production outputs due to the high discontinuity of the production process.

**[0005]** In the case of large-sized slabs, the supporting surface may be of the type of a belt, on which the ceramic material in powder form to be compacted is then positioned. The pressing of the material is achieved due to the superimposition of a further belt on the supporting surface carrying the material to be compacted and to the crushing action of these belts on the material positioned between them. The material compacted this way is then made to move forward from the same supporting surface towards the subsequent drying or firing stations.

**[0006]** Also in this case, the production output is limited because of the need to have a close correlation between the forward movement of the supporting surface and the pressing phase. In particular, the supporting surface must be made to move forward by the pitch corresponding to the size of the length of the material deposited thereon, so as to bring it exactly to the pressing means.

**[0007]** Moreover, the equipment of known type applying the aforementioned pressing methods do not allow obtaining slabs of defined dimensions and require subsequent edge finishing operations aimed at obtaining a slab having dimensions corresponding to those of the finished slab.

**[0008]** These finishing operations cause a lengthening of production times and, in addition, lead to the formation of huge amounts of processing waste that can hardly be reused for further processing.

### Description of the Invention

**[0009]** The main aim of the present invention is to devise a piece of equipment for the manufacture of slabs of ceramic material which allows overcoming the drawbacks of the prior art and, in particular, obtaining higher production output, while maintaining high quality characteristics of the compacted slab.

**[0010]** Within this aim, one object of the present invention is to minimize the downtime related to the forward movement and pressing phases of the ceramic material and, at the same time, to obtain high quality standards in terms of thickness, flatness and minimization of processing waste.

**[0011]** Another object of the present invention is to devise a piece of equipment for the manufacture of slabs of ceramic material which allows overcoming the aforementioned drawbacks of the prior art within a simple, rational, easy and effective to use and affordable solution.

**[0012]** The aforementioned objects are achieved by the present piece of equipment for the manufacture of slabs of ceramic material having the characteristics of claim 1.

### Brief Description of the Drawings

**[0013]** Other characteristics and advantages of the present invention will become more apparent from the description of a preferred, but not exclusive, embodiment of a piece of equipment for the manufacture of slabs of ceramic material, illustrated by way of an indicative, yet non-limiting example, in the accompanying tables of drawings wherein:

Figure 1 is a side cross-sectional view of a piece of equipment according to the invention, in a first embodiment;

Figure 2 is a view from the top of the containment means of the equipment according to the invention, according to the first embodiment;

Figure 3 is a detailed view of the equipment in Figure 1, with the frame structure in the operating position;

Figure 4 is a detailed view of the equipment in Figure 1, during the pressing of the portion of continuous slab;

Figure 5 is a view from the top of the containment means of the equipment according to the invention, according to a second embodiment;

Figure 6 is a detailed view of the equipment in Figure 5, with the frame structure in the operating position;

Figure 7 is a detailed view of the equipment in Figure 5, during the pressing of the portion of continuous slab.

### Embodiments of the Invention

**[0014]** With particular reference to such figures, reference numeral 1 globally indicates a piece of equipment for the manufacture of slabs of ceramic material.

**[0015]** The equipment 1 according to the invention comprises a load-bearing structure 2, at least one sup-

porting surface 3 associated with the load-bearing structure 2 and movable along a direction of forward movement D, dispensing means 4 of a powdered ceramic material on the supporting surface 3 and pressing means 6 of the ceramic material.

**[0016]** The ceramic material is of the type of powdered ceramic material.

**[0017]** In the embodiment shown in the figures, the supporting surface 3 is of the type of a continuous belt wound around a plurality of motorized pulleys.

**[0018]** The dispensing means 4 are configured to release a continuous slab L to be compacted on the supporting surface 3.

**[0019]** The dispensing means 4 comprise one or more hoppers 5 arranged above the supporting surface 3. In the embodiment shown in the figures, the dispensing means 4 comprise a plurality of hoppers 5 arranged in succession with each other along the direction of forward movement D.

**[0020]** The hoppers 5 are adapted to dispense a plurality of different ceramic materials in order to give the final slab a particular aesthetic effect.

**[0021]** The pressing means 6 are associated with the load-bearing structure 2. Conveniently, the load-bearing structure 2 comprises a plurality of sheet metal elements 2a, called ribs, adapted to bear the pressing load, which are packconnected to each other to provide high stiffness of the load-bearing structure itself.

**[0022]** In particular, the pressing means 6 are arranged downstream of the dispensing means 4 with respect to the direction of forward movement D. Advantageously, the stretch of the supporting surface 3 extending between the dispensing means 4 and the pressing means 6 is seamless, it being understood by this definition that the supporting surface 3 is uninterrupted.

**[0023]** The pressing means 6 comprise at least one pressing element 7 movable with respect to the supporting surface 3 and adapted to press a portion P of the continuous slab L so as to obtain a compacted slab C of predefined dimensions separate from the continuous slab itself.

**[0024]** In more detail, the pressing element 7 is intended to contact the ceramic material to be compacted arranged above the supporting surface 3 and is movable close to/away from the supporting surface itself.

**[0025]** In the embodiment shown in the figures, the pressing means 6 comprise a fluid-operated cylinder 8 provided with a piston 8a, movable with respect to the body 8b of the fluid-operated cylinder itself close to/away from the supporting surface 3, and with which a pressing pad 9 is associated, made e.g. of a resinous material, intended to contact the ceramic material to be compacted. The piston 8a and the pressing pad 9 define the pressing element 7.

**[0026]** Appropriately, the pad 9 is magnetically associated with the piston 8a, e.g. by means of a magnetic plate 10 positioned between them.

**[0027]** The pressing means 6 also comprise an abutment element 11, which is arranged below the supporting surface 3 and adapted to operate as a stop to the force exerted by the pressing element 7. The abutment element 11 is locked together, e.g. magnetically, with the load-bearing structure 2.

**[0028]** Advantageously, the supporting surface 3 and the pressing means 6 are operable intermittently and alternately with each other. In other words, activation of one of the two corresponds to interruption of the other, i.e., when the supporting surface 3 is moved along the direction of forward movement D, the pressing means 6 are stationary, and when the pressing means 6 are active, the supporting surface 3 is stationary.

**[0029]** As a result of the compaction of the portion P, the movement of the supporting surface 3 leads to the forward movement of the compacted slab C thus obtained, which is then moved downstream of the pressing means 6, and the simultaneous positioning of a further portion P of the continuous slab L below the pressing means 6.

**[0030]** Furthermore, the equipment 1 comprises containment means 12 of the portion P of the continuous slab L.

**[0031]** The containment means 12 have the function of containing the ceramic material during pressing and allow obtaining a compacted slab with defined edges that does not require further finishing operations.

**[0032]** The containment means 12 comprise at least one frame structure 13 associated with the load-bearing structure 2 and defining a substantially closed perimeter. The term "substantially closed" means that the frame structure 13 extends in a perimeter fashion without interruption.

**[0033]** The frame structure 13 is made in a single body piece.

**[0034]** The containment means 12 also comprise a plurality of containment elements 14 associated with the frame structure 13 and arranged inside the closed perimeter.

**[0035]** In more detail, the containment elements 14 are arranged along the inner perimeter of the frame structure and face each other.

**[0036]** The containment elements 14 comprise at least one pair of lateral containment elements 14a arranged parallel to the direction of forward movement D and at least one pair of frontal containment elements 14b arranged transverse to the direction of forward movement D.

**[0037]** The frame structure 13 extends in a substantially horizontal plane parallel to the supporting surface 3.

**[0038]** The frame structure 13 is movable between a home position, wherein it is moved away from the supporting surface 3 and allows the continuous slab L to move forward along the direction of forward movement D, and an operating position, wherein it is moved close to the supporting surface 3.

**[0039]** In more detail, the frame structure 13 is movable along a direction of sliding S substantially perpendicular

to the supporting surface 3.

**[0040]** The containment means 12 comprise a movement assembly of the frame structure 13 between the home position and the operating position.

**[0041]** The movement assembly comprises a plurality of actuators 15 of the fluid-operated or electrical type, arranged at the corners of the frame structure 13. The containment elements 14 are locked together with the frame structure 13 in the displacement thereof along the direction of sliding S.

**[0042]** In other words, the actuators 15 displace the containment elements 14 at the same time as the frame structure 13 moves.

**[0043]** Specifically, with the frame structure 13 in the home position, the containment elements 14 are also moved away from the supporting surface 3, while with the frame structure 13 in the operating position, the containment elements 14 are moved close to the supporting surface itself.

**[0044]** In particular, with the frame structure 13 in the operating position, the containment elements 14 are adapted to define with the supporting surface 3 at least one containment volume 16 of the portion P.

**[0045]** Conveniently, when the frame structure is in the operating position, the supporting surface 3 is stationary.

**[0046]** The containment volume 16 is closed around the perimeter thereof, is delimited inferiorly by the supporting surface 3, and is open superiorly.

**[0047]** As shown in the figures, the frame structure 13 surrounds the pressing means 6, and the containment elements 14 are positioned between the frame structure 13 and the pressing means 6.

**[0048]** The pressing element 7 is adapted to fit inside the containment volume 16 during a pressing phase of the portion P.

**[0049]** Specifically, the pressing element 7 is adapted to fit inside the containment volume 16, as a result of its movement close to the supporting surface 3.

**[0050]** More particularly, the pad 9 is defined so as to fit to size inside the containment volume 16.

**[0051]** Conveniently, each of the containment elements 14 comprises at least one abutment portion 17 adapted to interact with the supporting surface 3, with the frame structure 13 in the operating position, and adapted to delimit the containment volume 16.

**[0052]** In detail, with the frame structure 13 in the operating position, the abutment portion 17 is substantially in contact with the supporting surface 3 and is intended to laterally contact the ceramic material of the portion P and to contain it during pressing.

**[0053]** Advantageously, the abutment portion 17 of the containment elements 14 is movable with respect to the frame structure 13 along a direction of adjustment R.

**[0054]** The direction of adjustment R is transverse to the direction of sliding S. In detail, the direction of adjustment R is substantially horizontal and perpendicular to the direction of sliding S.

**[0055]** The abutment portion 17 is movable between a release configuration and a containment configuration, wherein it is moved away from the frame structure 13 with respect to the release configuration so as to define the containment volume 16.

**[0056]** In the containment configuration, the abutment portions 17 of the containment elements 14 are moved close to each other.

**[0057]** Conveniently, the equipment 1 comprises movement means 18 of the abutment portion 17 between the release configuration and the containment configuration. According to a first embodiment shown in Figures 1 to 4, the containment elements 14 are associated in a movable manner with the frame structure 13 along the respective directions of adjustment R to bring the abutment portions 17 between the release configuration and the containment configuration.

**[0058]** With reference to the first embodiment, the abutment portion 17 is made of a rigid material so as to counteract the pressing force exerted by the ceramic material during pressing.

**[0059]** The movement means 18 are of the mechanical type and comprise at least one fluid-operated actuator 19.

**[0060]** The fluid-operated actuator 19 is positioned between the frame structure 13 and the containment element 14.

**[0061]** Preferably, the fluid-operated actuator 19 is of the pneumatic type.

**[0062]** The movement means 18 comprise a plurality of fluid-operated actuators 19 positioned between the containment element 14 and the frame structure 13. Advantageously, the fluid-operated actuators 19 are operated synchronously so as to simultaneously move the containment elements 14.

**[0063]** The movement means 18 also comprise at least one guidance element 20 extending along the respective direction of adjustment R and adapted to guide and support the containment element 14 between the release configuration and the containment configuration.

**[0064]** According to a second embodiment shown in Figures 5 to 7, the abutment portion 17 is of the expandable type.

**[0065]** In actual facts, in such an embodiment, the containment element is locked together with the frame structure 13 and the abutment portion 17 is expanded to delimit the containment volume 16.

**[0066]** In more detail, the abutment portion 17 is retracted in the release configuration and expanded in the containment configuration.

**[0067]** Appropriately, the abutment portion 17 is made of an elastically deformable material.

**[0068]** Conveniently, the abutment portion 17 comprises a chamber 21 that can be supplied with a working fluid under pressure to move it from the release configuration to the containment configuration.

**[0069]** In this embodiment, the movement means 18 are of the fluid-operated type and are adapted to inject the working fluid inside the chamber 21.

**[0070]** Specifically, the movement means 18 are adapted to deliver the working fluid at a pressure such that it counteracts the pressure force exerted by the ceramic material during pressing.

**[0071]** The operation of the equipment 1 according to the invention is as follows.

**[0072]** The dispensing means 4 dispense the ceramic material onto the supporting surface 3 so as to form the continuous slab L to be compacted.

**[0073]** In more detail, the hoppers 5 release the powdered ceramic material on the supporting surface 3 during the movement of the latter along the direction of forward movement D.

**[0074]** The continuous slab L is moved along the direction of forward movement D. At the pressing means 6, the supporting surface 3 stops so as to allow the portion P to be pressed.

**[0075]** For this purpose, the frame structure 13 is brought to the operating position, wherein it is brought close to the supporting surface 3.

**[0076]** The abutment portions 17 are moved to the containment configuration to delimit the containment volume 16.

**[0077]** In more detail, with reference to the first embodiment shown in Figures 1 to 4, the containment elements 14 are moved along the direction of adjustment R to move the abutment portions 17 mutually close to each other.

**[0078]** With reference to the second embodiment shown in Figures 5 to 7, the chamber 21 of the abutment portion 17 is filled with a working fluid under pressure so as to expand the abutment portion itself.

**[0079]** Next, the pressing operation is carried out and the pressing element 7 is moved close to the supporting surface 3 by crushing, with a force of predefined intensity, the portion P.

**[0080]** The pressing element 7 in its movement towards the supporting surface 3 fits inside the containment volume 16.

**[0081]** At the end of pressing, the pressing element 7 and the frame structure 13 move away from the supporting surface 3 to allow the compacted slab C to be released.

**[0082]** The supporting surface 3 is operated so as to simultaneously move the compacted slab C and the continuous slab L along the direction of forward movement D.

**[0083]** In particular, the compacted slab C, which is therefore distinct and separate from the remaining part of the continuous slab L, is moved downstream of the pressing means 6, while a new portion P of the continuous slab L is arranged at the pressing means themselves so as to proceed with a further pressing phase.

**[0084]** It has in practice been ascertained that the described invention achieves the intended objects, and in particular the fact is emphasized that the process and the equipment to which the present invention relates, allow optimizing the supply and pressing phases of the ceramic material, minimizing the downtime and increasing the output compared to the process and the equipment of known type.

**[0085]** In particular, the supply of the material so as to obtain a continuous slab reaching, without any interruption, the pressing means, allows reducing to a minimum the time necessary for the preparation of the material to be pressed, the amount of which is determined by the working area of the pressing means themselves.

**[0086]** Moreover, the presence of the containment means makes it possible to simplify the management of the material to be pressed, by carrying out a partial or total compartmentalization of a portion of the continuous slab which is intermittently supplied at the pressing means.

## Claims

1. Equipment (1) for the manufacture of slabs of ceramic material, **characterized by** the fact that it comprises:

   - a load-bearing structure (2);
   - at least one supporting surface (3) associated with said load-bearing structure (2) and movable along a direction of forward movement (D);
   - dispensing means (4) of a powdered ceramic material, configured to release a continuous slab (L) to be compacted on said supporting surface (3);
   - pressing means (6) associated with said load-bearing structure (2) and comprising at least one pressing element (7), movable with respect to said supporting surface (3) and adapted to press a portion (P) of said continuous slab (L) so as to obtain at least one compacted slab (C) of predefined dimensions, separate from said continuous slab (L); and
   - containment means (12) of said portion (P) comprising:

     - at least one frame structure (13) associated with said load-bearing structure (2) and defining a substantially closed perimeter, said frame structure (13) being movable between a home position, wherein it is moved away from said supporting surface (3) and allows the forward movement of said continuous slab (L) along said direction of forward movement (D), and an operating position, wherein it is moved close to said supporting surface (3); and
     - a plurality of containment elements (14) associated with said frame structure (13) and arranged inside said closed perimeter, said containment elements (14) being adapted, with said frame structure (13) in operating position, to define with said supporting surface (3) at least one containment

volume (16) of said portion (P), said pressing element (7) being adapted to fit inside said containment volume (16) during a pressing phase of said portion (P).

**2.** Equipment (1) according to claim 1, **characterized by** the fact that said frame structure (13) is movable along a direction of sliding (S) substantially perpendicular to said supporting surface (3).

**3.** Equipment (1) according to one or more of the preceding claims, **characterized by** the fact that said frame structure (13) is made in a single body piece.

**4.** Equipment (1) according to one or more of the preceding claims, **characterized by** the fact that said containment elements (14) are locked together with said frame structure (13) in the displacement thereof along said direction of sliding (S).

**5.** Equipment (1) according to one or more of the preceding claims, **characterized by** the fact that said containment elements (14) comprise at least one pair of lateral containment elements (14a) arranged parallel to said direction of forward movement (D) and at least one pair of frontal containment elements (14b) arranged transverse to said direction of forward movement (D).

**6.** Equipment (1) according to one or more of the preceding claims, **characterized by** the fact that each of said containment elements (14) comprises at least one abutment portion (17) adapted to interact, with said frame structure (13) in operating position, with said supporting surface (3) in order to delimit said containment volume (16).

**7.** Equipment (1) according to one or more of the preceding claims, **characterized by** the fact that said abutment portion (17) of the containment elements (14) is movable with respect to said frame structure (13) along a direction of adjustment (R), transverse to said direction of sliding (S), between a release configuration and a containment configuration, wherein it is moved away from said frame structure (13) with respect to said release configuration so as to define said containment volume (16).

**8.** Equipment (1) according to claim 7, **characterized by** the fact that it comprises movement means (18) of said abutment portion (17) between said release configuration and said containment configuration.

**9.** Equipment (1) according to one or more of the preceding claims, **characterized by** the fact that said abutment portion (17) is made of a rigid material.

**10.** Equipment (1) according to claims 8 and 9, **characterized by** the fact that said movement means (18) comprise at least one fluid-operated actuator.

**11.** Equipment (1) according to one or more of claims 6 to 8, **characterized by** the fact that said abutment portion (17) is of expandable type, said abutment portion (17) being retracted in said release configuration and being expanded in said containment configuration.

**12.** Equipment (1) according to claim 11, **characterized by** the fact that said abutment portion (17) is made of an elastically deformable material.

**13.** Equipment (1) according to claim 11 or 12, **characterized by** the fact that said abutment portion (17) comprises a chamber (21) that can be supplied with a working fluid under pressure to move it from the release configuration to the containment configuration and by the fact that said movement means (18) are of the fluid-operated type.

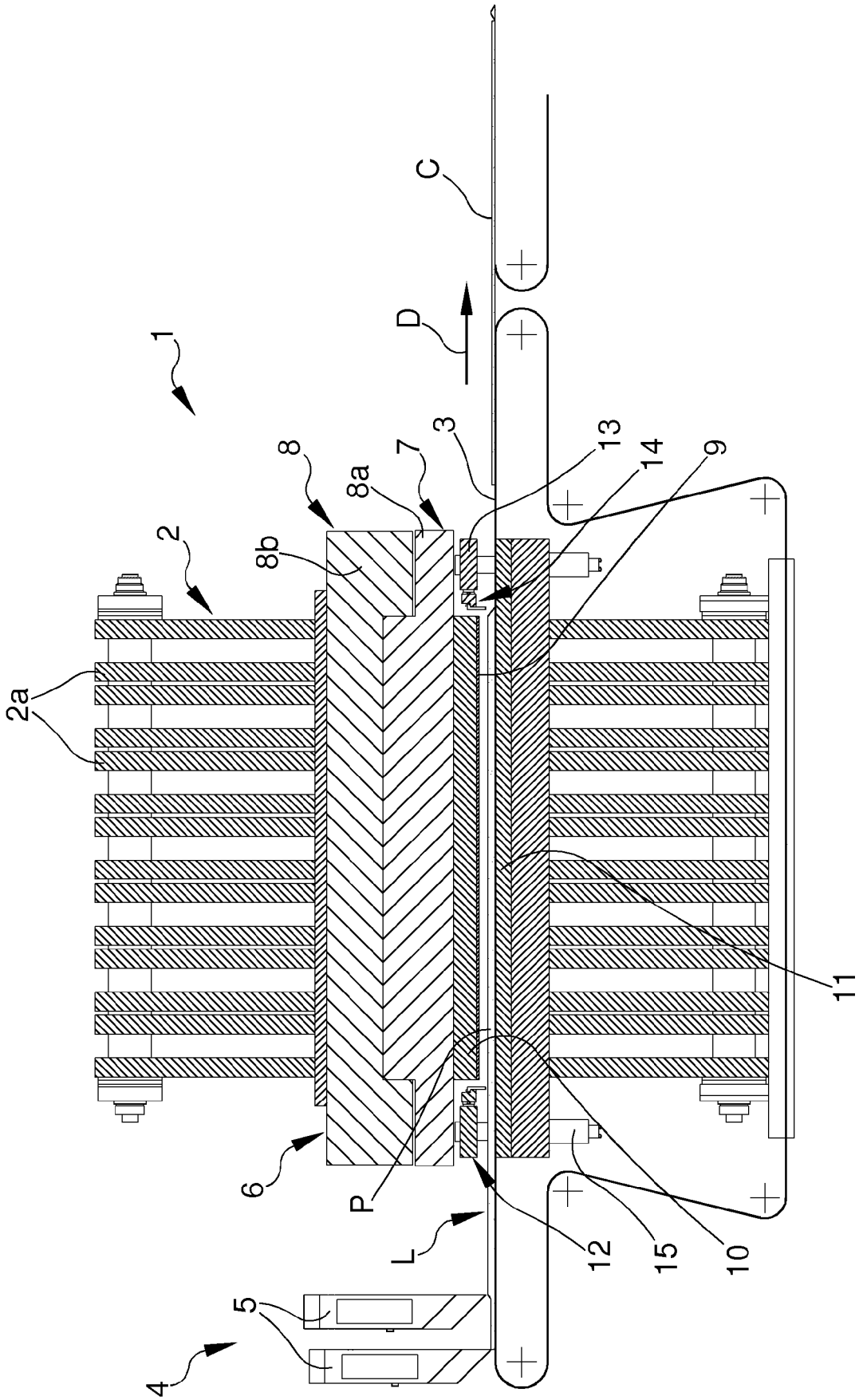


Fig.1

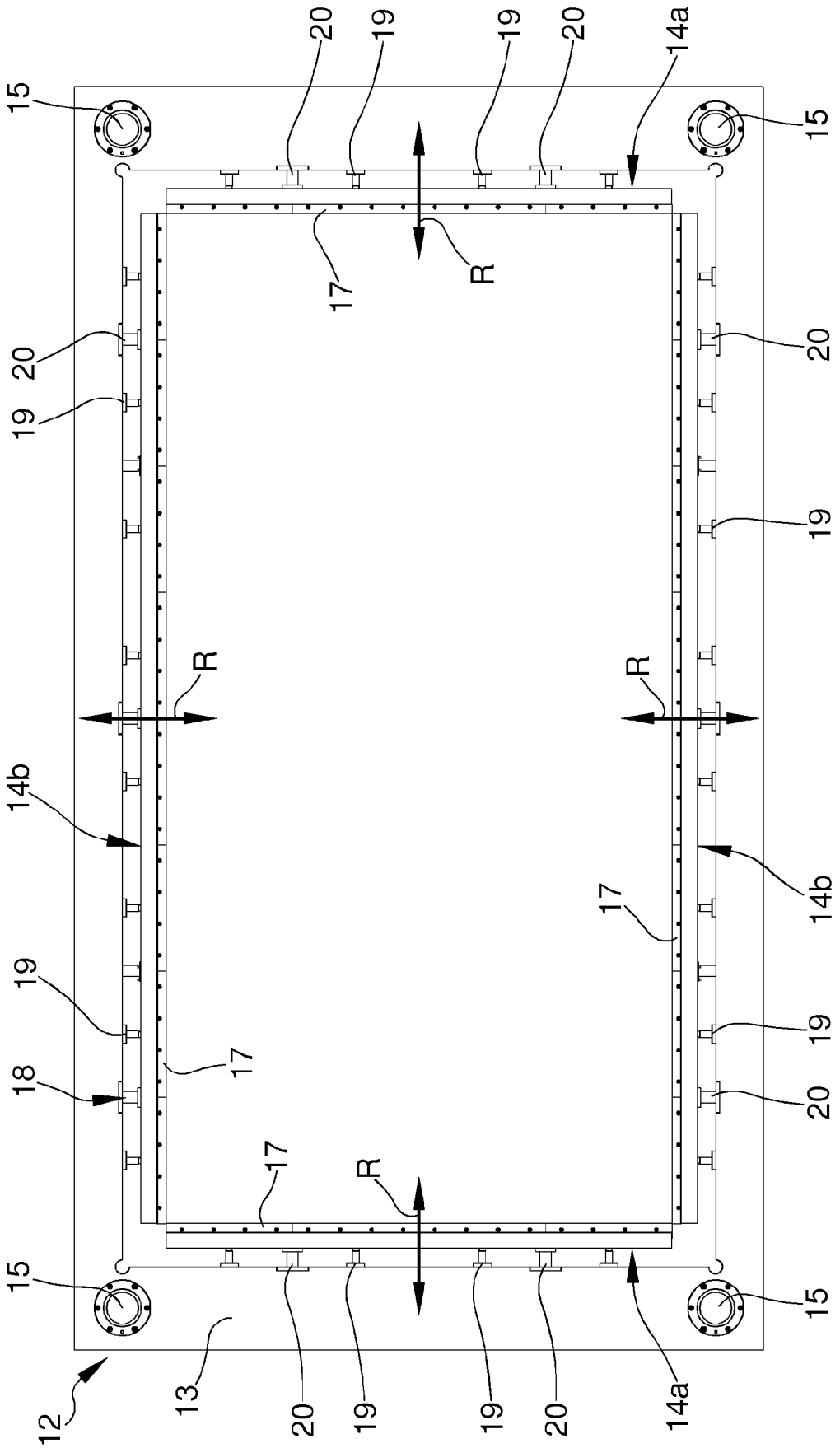
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Fig.2

Fig.3

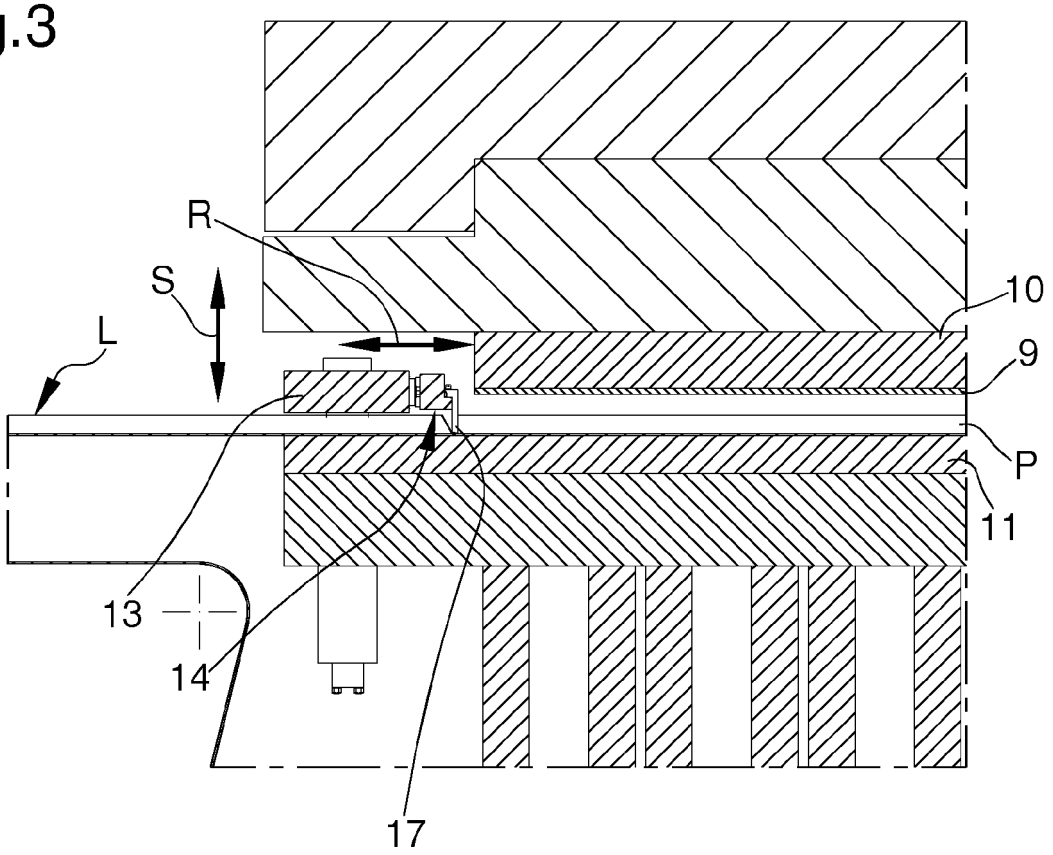
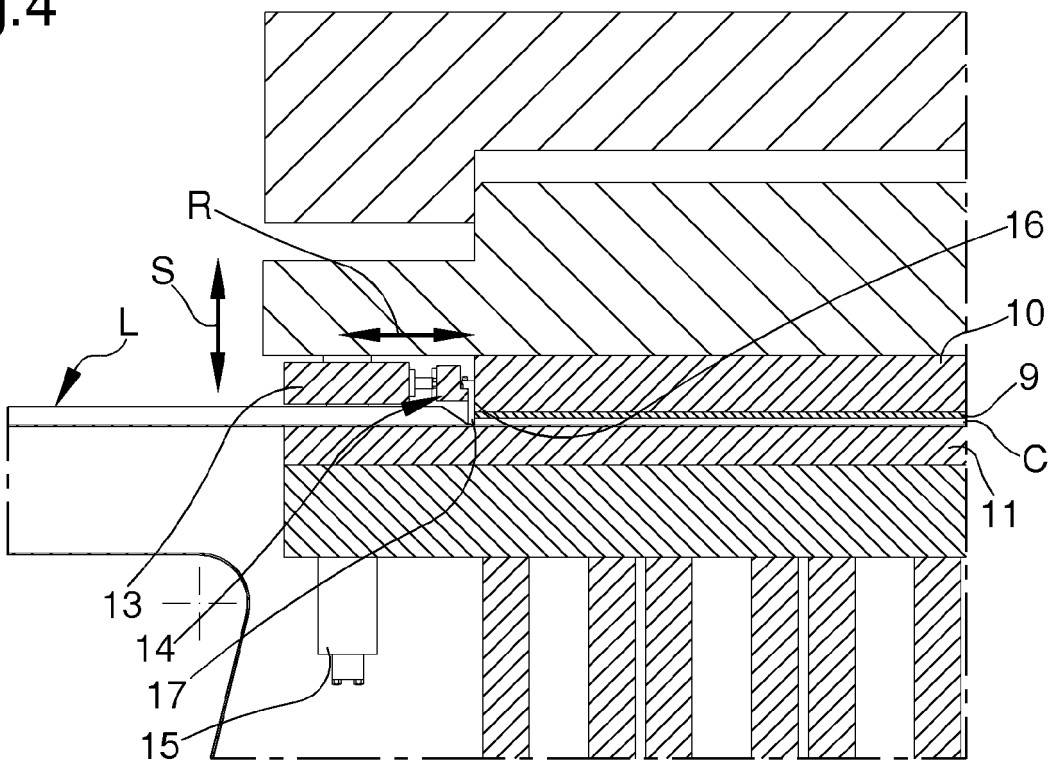



Fig.4



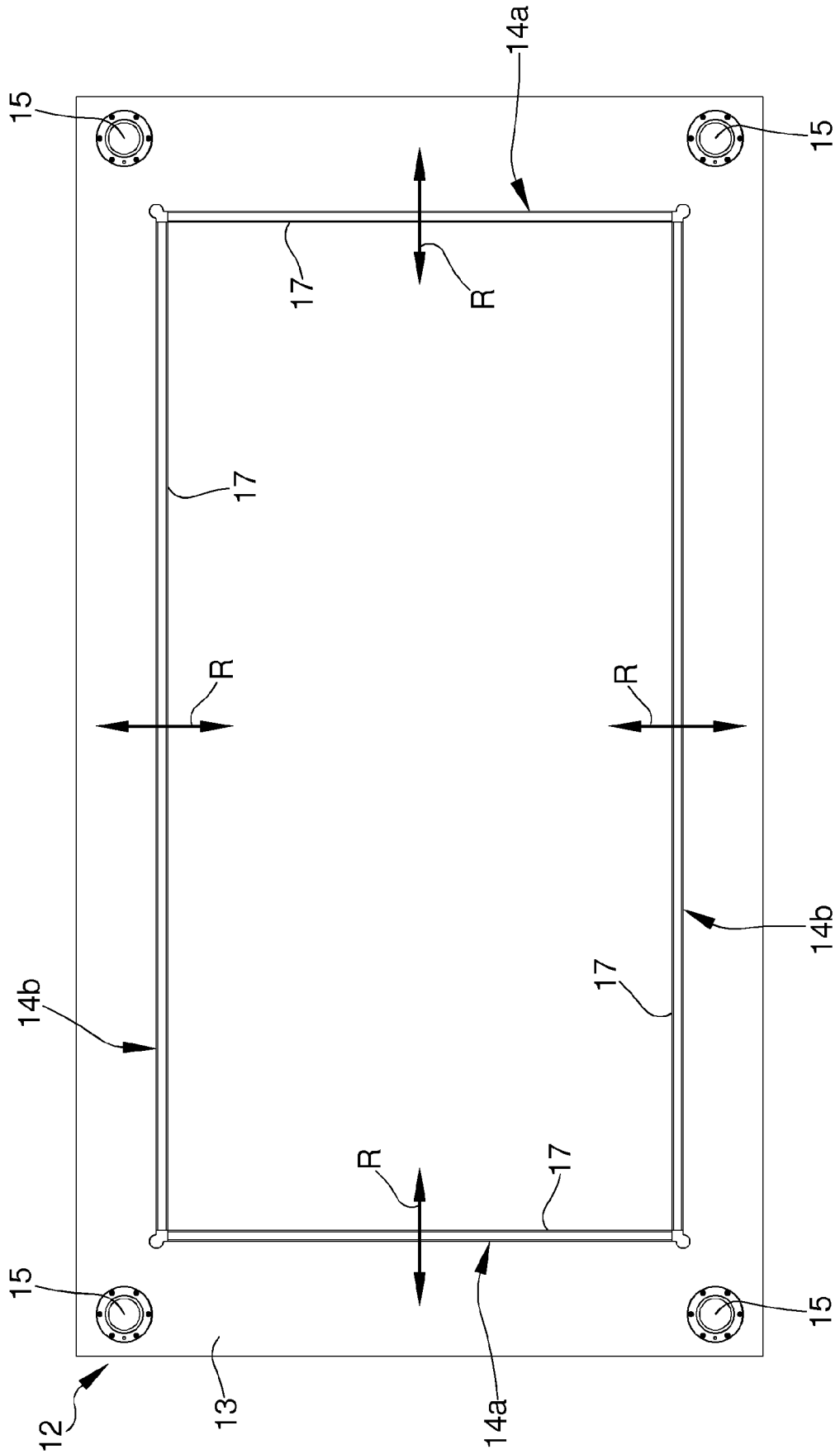



Fig.5

Fig.6

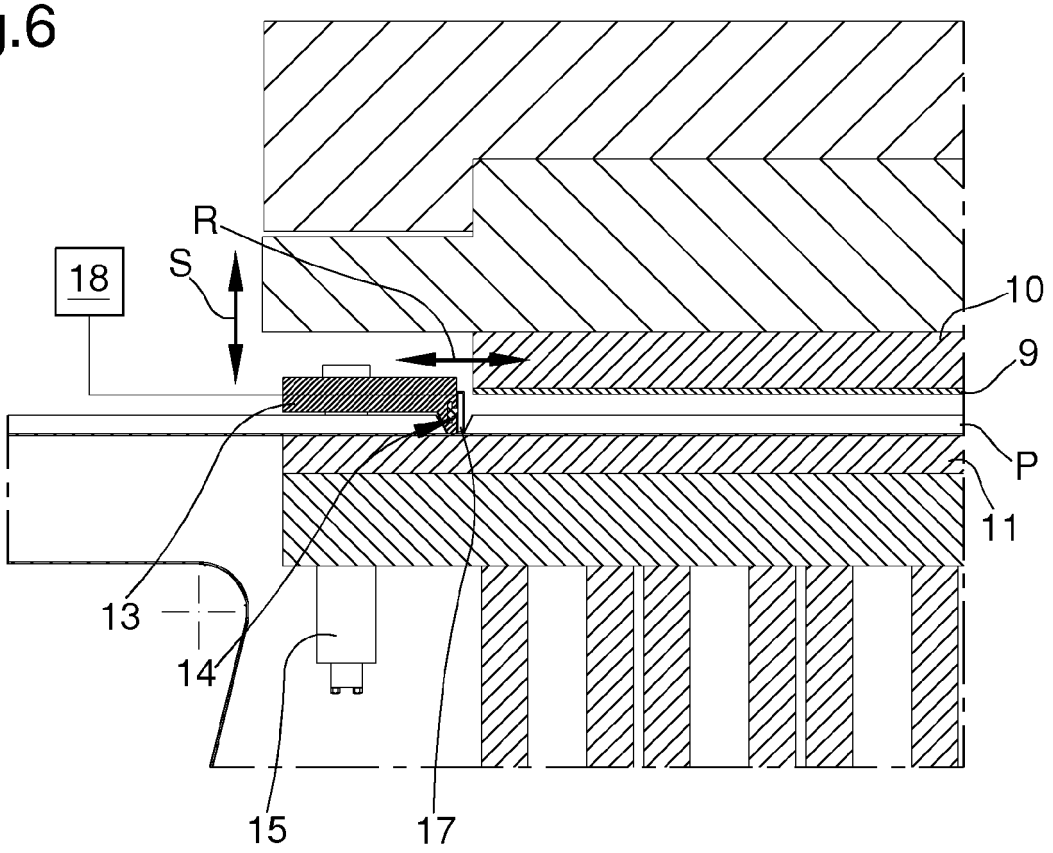
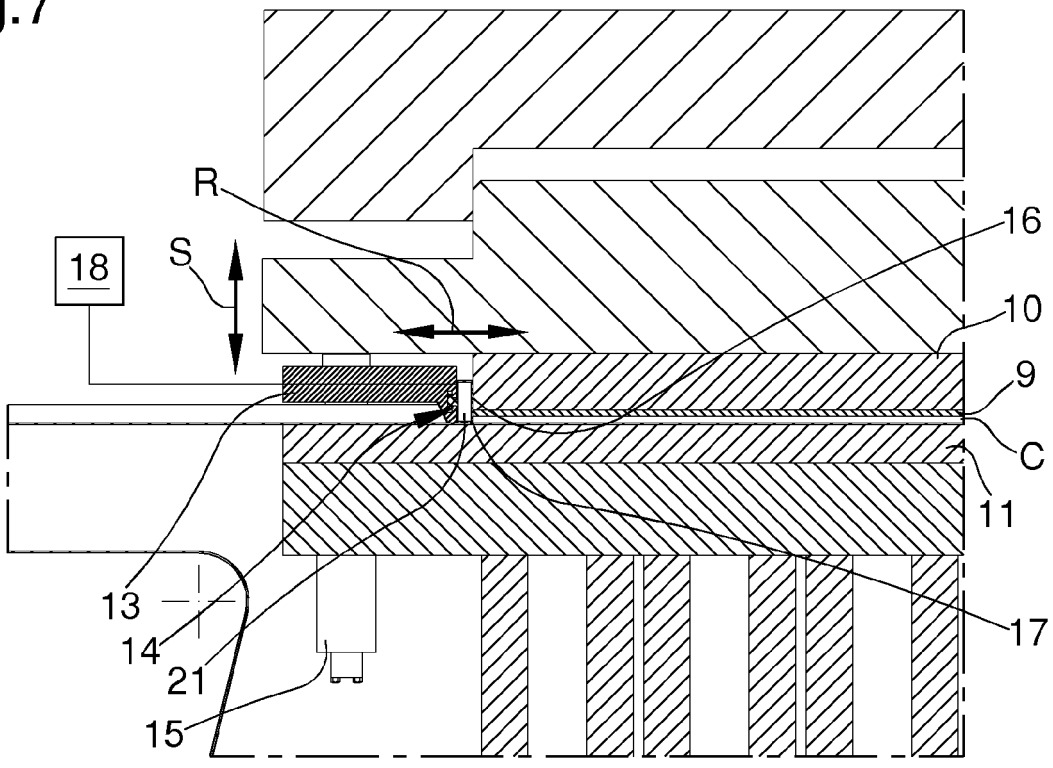



Fig.7



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# EUROPEAN SEARCH REPORT

Application Number
EP 21 17 5624

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X<br>Y | WO 2017/158571 A1 (SITI - B&T GROUP S P A [IT]) 21 September 2017 (2017-09-21)<br>* page 5, lines 11-21 *<br>* page 6, lines 1-9, 15-24, 30 *<br>* page 7, lines 1-2, 20-30 *<br>* page 8, lines 1, 5-16 *<br>* page 9, lines 6-18 *<br>* page 10, lines 12-20 *<br>* page 11, lines 28-30 *<br>* page 12, lines 1, 11-18 *<br>* page 14, lines 3-28 *<br>* page 15, lines 2-8, 13-30 *<br>* page 16, lines 1-4 *<br>* figures 1, 2, 5-10 * | 1,2,4-10<br>11-13 | INV.<br>B28B5/02<br>B28B3/04 |
| Y | US 4 133 626 A (SCHUBART ROLF E R) 9 January 1979 (1979-01-09)<br>* column 1, lines 5-7 *<br>* column 2, lines 40-53 *<br>* figures 1, 1a, 2, 2a * | 11-13 | |
| Y | FR 2 190 046 A5 (KOLPISHON ANNA [SU]) 25 January 1974 (1974-01-25)<br>* page 2, lines 34-36 *<br>* page 3, lines 9-15, 18-19, 26-28, 31-34 *<br>* page 4, lines 1-5 *<br>* figures 1, 2 * | 11-13 | TECHNICAL FIELDS SEARCHED (IPC)<br>B28B |
| X | EP 0 793 565 A1 (CAMORANI CARLO ANTONIO [IT]; ALGERI MARIS [IT]) 10 September 1997 (1997-09-10)<br>* paragraphs [0001], [0038], [0039], [0041] *<br>* paragraphs [0047], [0055], [0056], [0092] *<br>* figures 1-5, 25 * | 1-6,9 | |

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The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 8 October 2021 | Papakostas, Ioannis |

CATEGORY OF CITED DOCUMENTS

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# EUROPEAN SEARCH REPORT

Application Number
EP 21 17 5624

## DOCUMENTS CONSIDERED TO BE RELEVANT

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