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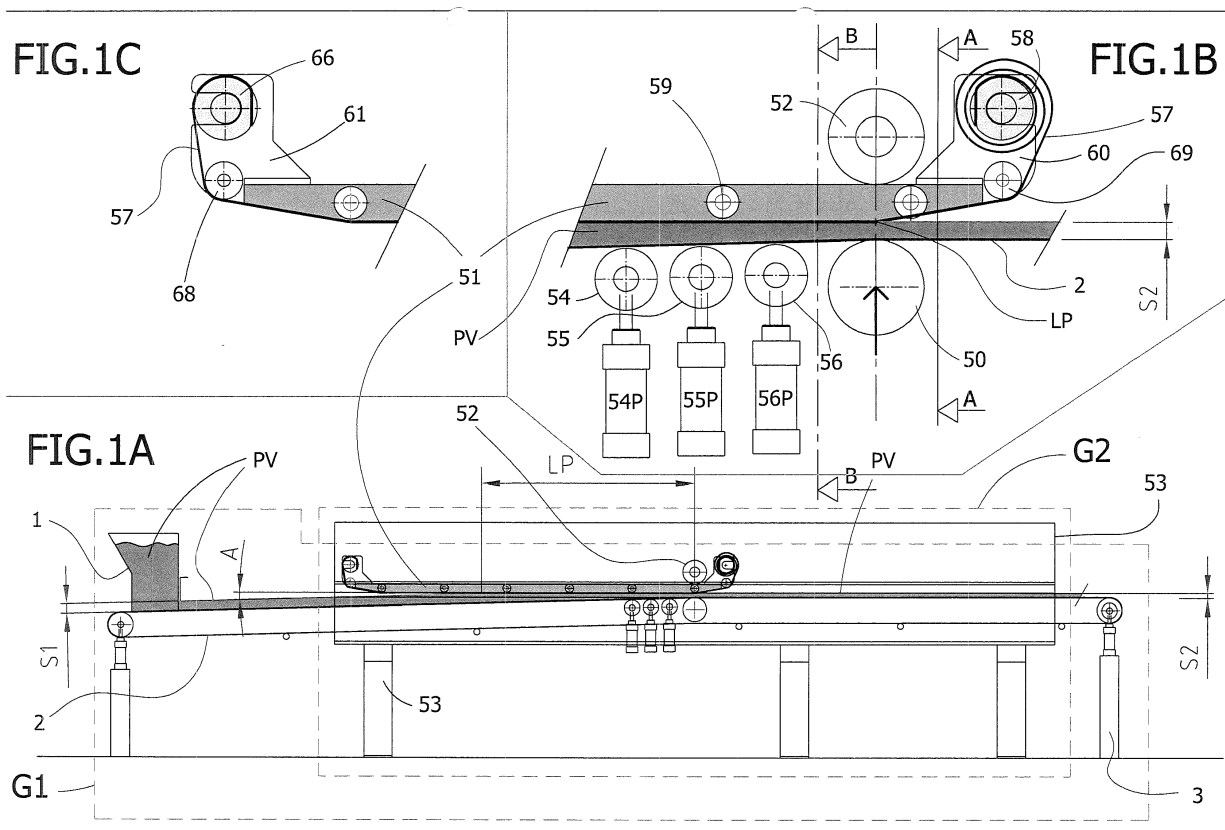
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(54) **A SYSTEM FOR PRESSING CERAMIC POWDERS BETWEEN A PLATE AND ROLLERS**

(57) The present invention relates to an apparatus for pressing ceramic tiles primarily consisting of a set of pressing rollers (50), (54), (55), (56) actuated by pistons placed under a rigid plate (51) which is slidably mounted within a structure (53); the powders to be pressed are conveyed by a belt (2) which is slidable between the roll-

ers and the plate.

The plate (51) is held in place by an upper idler roller (52) during the pressing step (due to the action of the lower rollers); under the plate there is a belt (57) acting as a powders separator element.



Description

INTRODUCTION

[0001] The present invention relates to a system for pressing ceramic powders on a belt interposed between a flat sliding plate and a set of pressing rollers.

[0002] According to the prior art, several belt pressing apparatuses are available at present which operating principles are based on different solutions however all referable to systems formed by rollers arranged in different ways above and below the carpet of powder to be pressed.

[0003] The pressing basically occurs as a lamination process, where a layer of material is forced into the passage between two rollers, where the passage light is thinner than the input thickness.

[0004] Such processing may result in irregularities (typically waviness) on pressed surfaces which may constitute serious cosmetic defects for ceramic products (namely, wall and floor tiles) with consequent deterioration in the quality of products, especially large format products, which are the most demanded on the market at present.

OBJECT, ADVANTAGES, DESCRIPTION

[0005] The technical task at the base of the present invention is to provide a pressing system with rollers mounted on a belt so as to avoid any surface irregularities regardless the format to be produced and the thickness of the layer to be compacted.

LIST OF DRAWINGS

[0006] The present invention and advantages thereof will be better described and illustrated according to the following figures showing a non-limiting example of the embodiment wherein:

- Figure 1A is a simplified side view of the whole apparatus of the present invention;
- Figures 1B and 1C are enlarged details of Figure 1 A;
- Figure 2A is a simplified front view according to the sections A-A of Figure 1 B;
- Figure 2B is a simplified front view of a detail according to section B-B of Figure 1 B;
- Figures 3A and 3B are side views of the sole movable upper part of the apparatus disclosed by the present invention according to two possible construction solutions;
- Figure 3C is a simplified front view of a detail according to section A-A of Figure 1 B;
- Figures 4A and 4B are respectively a side view and a top plan view of the sole lower part of the apparatus object of the present invention (G1);
- Figures 5A and 5B are respectively a side view and a top plan view of the sole upper part of the apparatus

of the present invention (G2);

- Figures 6A, 6B and 6C show operation sequences of the apparatus herein disclosed.

DESCRIPTION OF THE COMPONENTS OF THE INVENTION

[0007] Figure 1A shows the entire apparatus where the contours (G1) and (G2) define the two main units also shown individually in the set of Figures 4 and 5. For better distinguish the components of the two units, numbers below 50 were assigned to the components referred to with (G1), whereas numbers above 50 were allotted to the ones referred to with (G2).

Description of the unit (G1), see primarily Figures 1A, 4A and 4B:

[0008] For the sake of clear disclosure, in Figure 1A of the unit (G1) the belt and supports thereof only are shown without relevant supporting structure (4).

[0009] This apparatus section has the main function to convey the powders from the discharge hopper to the forming zone and comprises the following:

- a set of supports (3) each of which exhibit a lifting piston (5) at the top thereof, connected to the supporting frame (4) showing a special shape in its central section in order for the pressure rollers of the unit (G2) to be inserted therein; the initial section of said structure (4) is slightly inclined by an angle (A) so as to compact the moving forward powders (PV) gradually;
- a hopper (1) with an adjustment damper for adjusting the height of powders layers (PV);
- a belt (2) wound on the end rollers (10) and (11), which rollers (10) and (11) are mounted within the structure (4);
- the planes (4A) and (4B) being part of the structure (4) for supporting the upper part of the belt (2);
- a set of idle rollers (6) for supporting the lower part of the belt.

Description of the unit (G2):

[0010] The unit (G2) includes the various pressing devices inserted in a separate structure from the previous one which is part of the unit (G1), see primarily Figure 1A, Figure 1B, Figure 1C, Figure 2A and Figure 5B, and in particular:

- a supporting frame (53) provided with a pair of guides (64) within which the idle rollers (59) supporting the sliding upper pressing plate (51), are slidable.
- a plate unit, see also Figure 3A, primarily comprising the plate (51), the wheels (59), the idle rollers (68), (69) and the motorised rollers (58) and (66) for winding the belt (57); the rollers are connected to the plate

by the structures (60) and (61); within the plate (51) two guides (70) are inserted made up of partially deformable material for lateral containment of the powders during the pressing, see Figure 3C.

- an upper motorised roller (52) pressing on the plate (51); said roller and motor being constrained to the frame (53);
- a second lower motorised roller (50) which is driven vertically by a pair of pistons (62) supplied with stems slidable inside the guides (53C), which guides (53C) are fixed to the frame (53);
- a unit for pre-compaction of the powders comprising a plurality of idler rollers (54), (55) and (56), as shown by way of example in the various figures, each of which rollers can be pushed vertically by a pair of pistons (56P), one on each side, fixed on the frame (53) - see Figure 2B.

[0011] In Figure 3B a second constructive solution of the plate unit is shown, comprising a belt (70) which in this case forms a closed ring held in position by the rollers (71), one (or more) of which is motorised; this solution is the obvious alternative to the one referred to in Figure 3A taken as a reference in the description of the patent herein; both Figures 3B and 3A illustrate components maintaining same features and operational functions.

[0012] Figure 5A shows both units (G1) and (G2) as assembled within the apparatus in a simplified top view; to better distinguish the two units, (G1) is illustrated with dotted lighter lines.

DESCRIPTION OF APPARATUS OPERATION

[0013] It is described the apparatus operation of the invention herein by the following figures: Figure 6A (A-CYCLE START), Figure 6B (B-PRESSING PHASE) and Figure 6C (C-RESET TO INITIAL POSITION).

A - CYCLE START

[0014] Figure 6A shows the apparatus in the early stage of a cycle with production already started; in this phase the various devices appear as follows:

- the belt for conveying powders (2) and the plate unit (51) are stationary;
- the position of the plate unit is such that the point (LP) which delimits the flat part thereof is aligned to (or slightly beyond) the axis of the rollers (50) and (52), see also Fig. 1B;
- the lower belt unit (G1) is in its "lifted" position via the pistons (5), so that the powders (PV) are in contact with the upper belt (57);
- the pressing rollers (50), (54), (55), (56) are being pushed by the pistons thereof;
- the powders (PV) which are stationary on the belt, are at the end of the earlier pressing cycle namely: in section (P1) the thickness soft layer (S1) is present

which is determined by the opening of the hopper damper; section (P2) shows the powders having a decreasing height between (S1) and (S2), while from section (P3) onwards, the powders are pressed, thereby forming a continuous carpet, said powders being now ready for the following processing performed on the conveyor belt (NT) onwards.

B-PRESSING PHASE

[0015] Based on the above, (see Fig. 6B where the main movements of the various devices are indicated by the arrows), the pressing phase can start as follows:

- powders belt (2) and plate unit (51) simultaneously move forward at the same speed; the belt (57) remains stationary so that the powders layer (PV) is shifted between the plate unit and the lower belt without relative movements;
- from this point on, the powders entering the section (P2) are gradually pressed in three distinct phases: the first one is concerned with compaction due to the approaching movement of the two belts (2) and (57) resulting from the inclination (A) of the lower belt; the second step occurs owing to the action of the rollers (54), (55) and (56), and finally the third step implies the action of the pressing roller (50) against the plate which is kept in position by the upper roller (52), to be considered in all respects as a second contrast presser (50) despite being stationary;
- following the pressing of the section (P3) the layer is sufficiently compact for undergoing subsequent processings (not shown) which will primarily include cutting operations, possible decorations and so on.

[0016] The two-way forward modes of the plate unit shown in the figures, occur due to frictional rolling contact between the roller (52) and the plate itself, although forward mode systems based on typical mechanical couplings such as pinions, racks, chains etc. are also possible.

[0017] In Figure 6B the plate unit is shown in its position of maximum displacement towards the right (LC), that is to say at the end of the pressing cycle.

C-RESET TO INITIAL POSITION

[0018] In Figure 6B, with (EC) it is indicated the maximum travel range of the plate unit which corresponds to the length of the layer pressed at each cycle; from this position the plate unit must return to the starting point (see Fig. 6C) according to the following procedure:

- the plate unit (51) and the belt (2) stop simultaneously at the point of maximum travel range (EC);
- all lower pressure rollers (50), etc., as well as the lower belt unit (G2) are lowered due to the action of the pistons (5); once the lowering occurred, the pow-

ders layer (PV) is no longer in contact with the belt (57), see portion (DR) in Figure 6C;

- the plate unit starts to move to the left; at this stage, if need be, the belt (57) can be wrapped completely around the roller (66) for cleaning operations.
- always in this phase one or more brushes (not shown in the figures) possibly clean the belt (57);
- the return and re-positioning of the plate unit comes to an end after a long shift (EC);
- subsequently the belt (2) is raised and the lower pressure roller reactivate the thrust of powders compression.

[0019] The belt (57) has therefore the sole function of preventing the lower part of the plate from getting dirty which inevitably would go to detriment of the regularity of the surface of the layer pressed which is an essential aspect of the invention herein.

[0020] The present description clearly shows how above pressing method makes it possible to obtain at least the top surface of the powder layer completely flat and free of defects which are typically found in the known art, this by virtue of the fact that during operation of the lower rollers the plate provides the support and reference surface for the powders.

[0021] The belt (57) could also exhibit proper cuts so as to reproduce by way of example imitation of natural unadjusted marbles and the like.

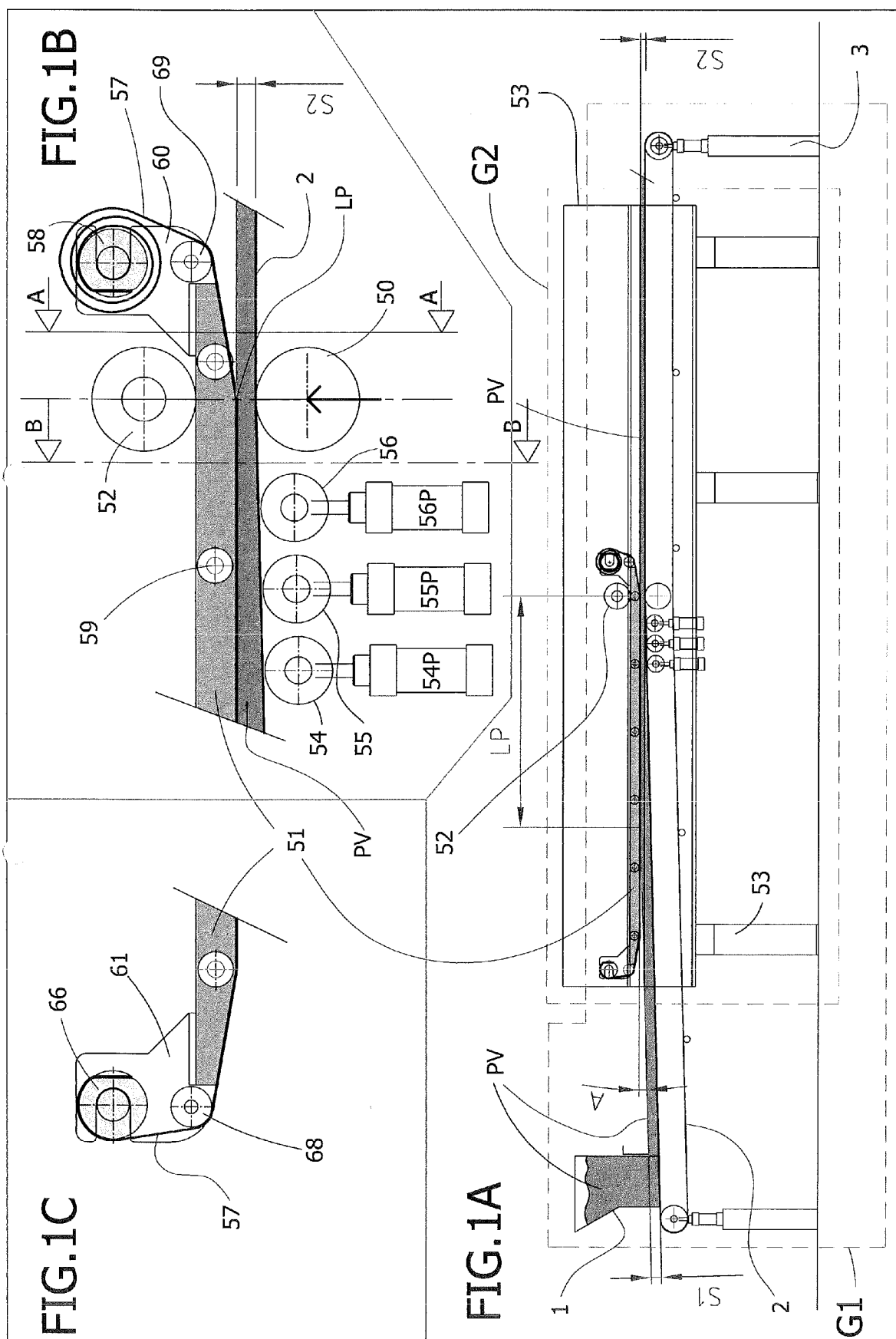
[0022] The invention thus conceived is susceptible to numerous modifications or variations, all of them falling within the scope of the invention ; furthermore all of the components can be replaced with other ones provided that they are technically equivalent.

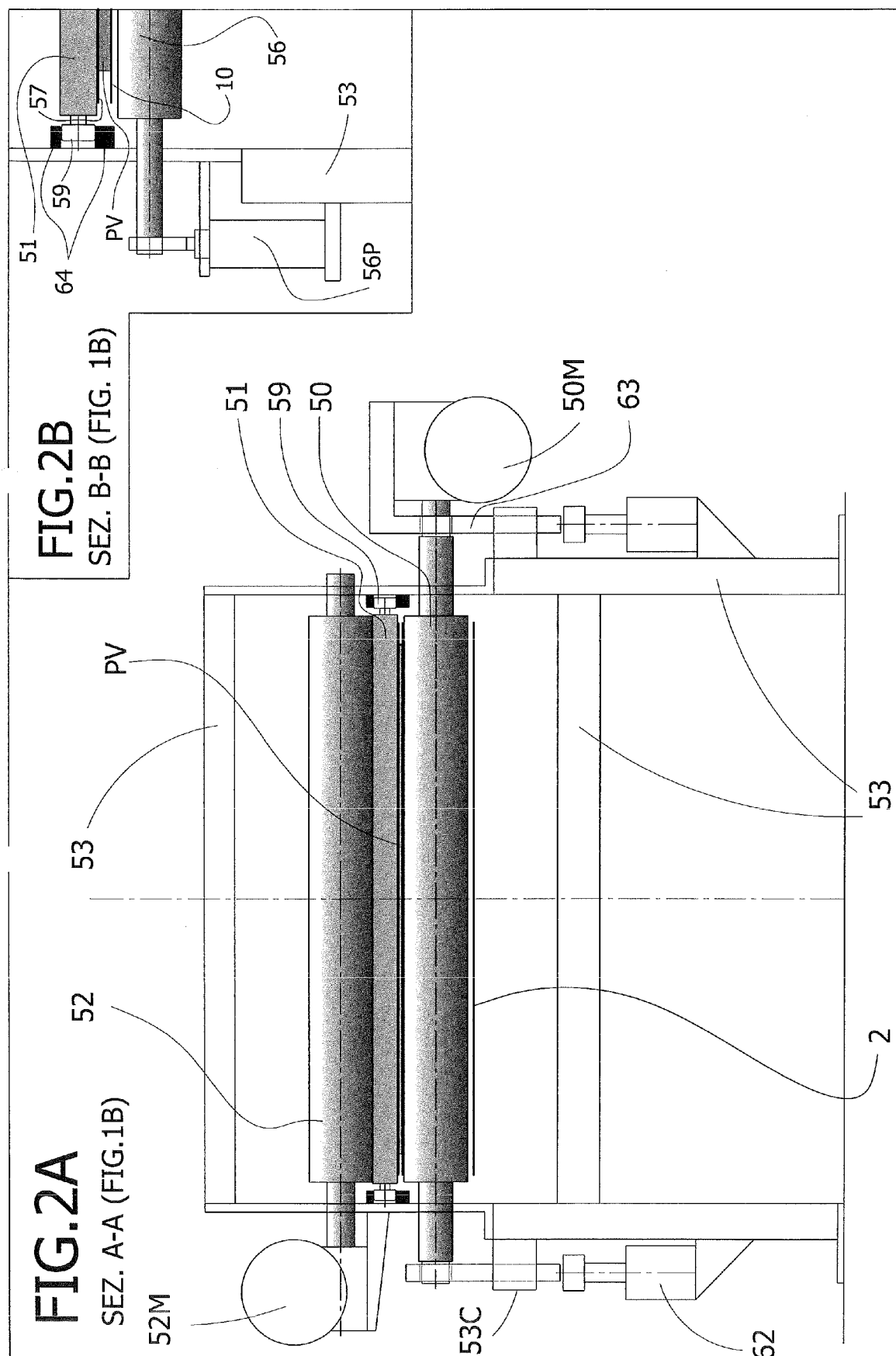
Claims

1. An apparatus for pressing ceramic powders, principally comprising a conveyor belt for conveying powders (2), a rigid upper plate (51) that is slidable horizontally above said belt, a lower pressing roller (50) mounted at the ends on pistons (62), a motorised roller (52) pressing on the upper part of the plate (51), a second belt (57) protecting the lower part of the plate.
2. The apparatus according to claim 1, **characterised in that** the belt (2) and relative accessoires are mounted in a structure (4) that can be lifted by pistons (5).
3. The apparatus according to claim 2, **characterised in that** the first part of the structure (4) is inclined by an angle (A) for pre-compaction of the powders.
4. The apparatus according to claim 1, **characterised in that** the plate (51) has two rollers (58) and (66) at the ends thereof for winding the belt (57) and laterally

has a set of wheels (59) that are slidable within the guides (64) of the structure (53).

5. The apparatus according to claim 1, **characterised in that** a set of pre-compacting rollers (54), (55) and (56) can be inserted before the pressing roller (50), said rollers being activated at the ends thereof by lifting pistons.
6. The apparatus according to claim 1, **characterised in that** the plate (51) can incorporate guides (70) for lateral containment of the powders during the pressing stage.
7. The apparatus according to claim 1, **characterised in that** the horizontal movement of the plate (51) can be achieved solely by friction with the roller (50) or using mechanical couplings (racks, pinions etc.) between the roller and the plate.
8. The apparatus according to claim 4, **characterised in that** the belt of the plate unit could consist of a loop (70) wound to end rollers (71) in such a manner as to enable movement of the belt in only one direction.





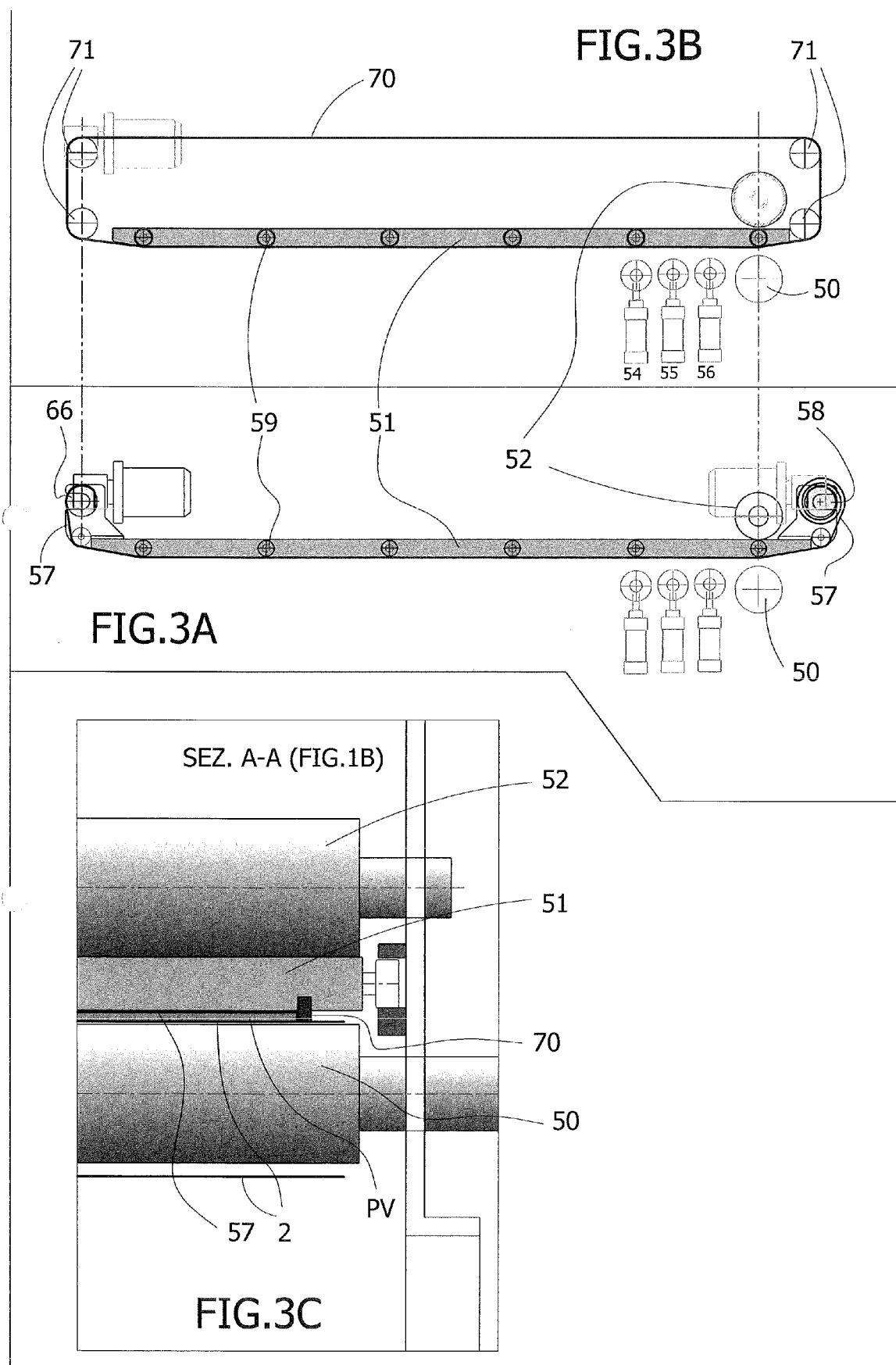


FIG.4B

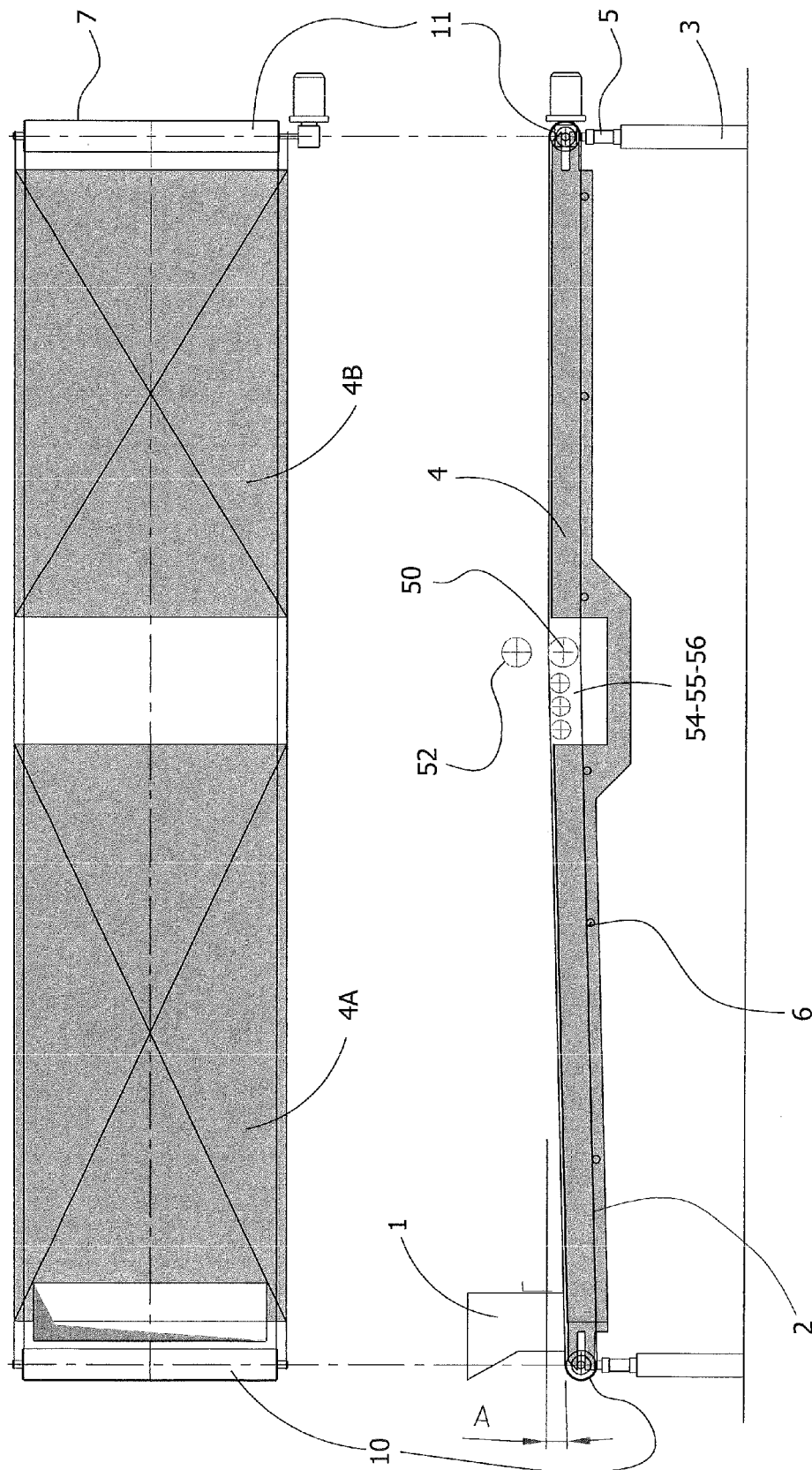


FIG.4A

FIG.5A

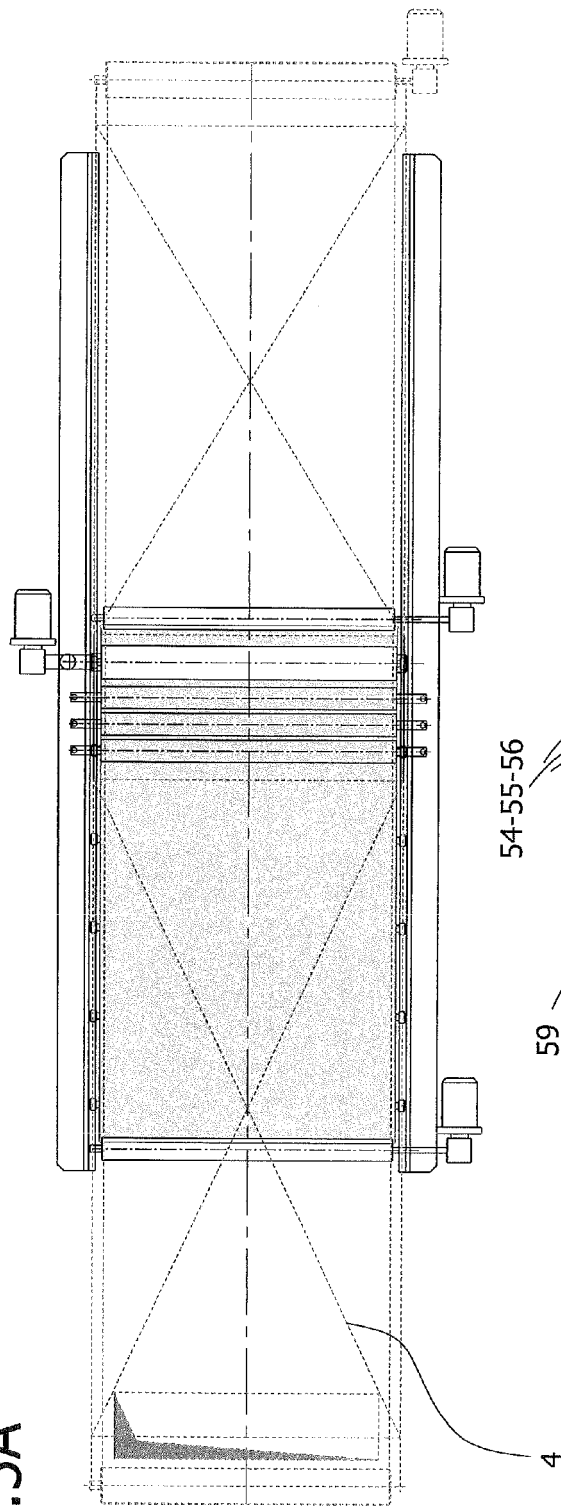
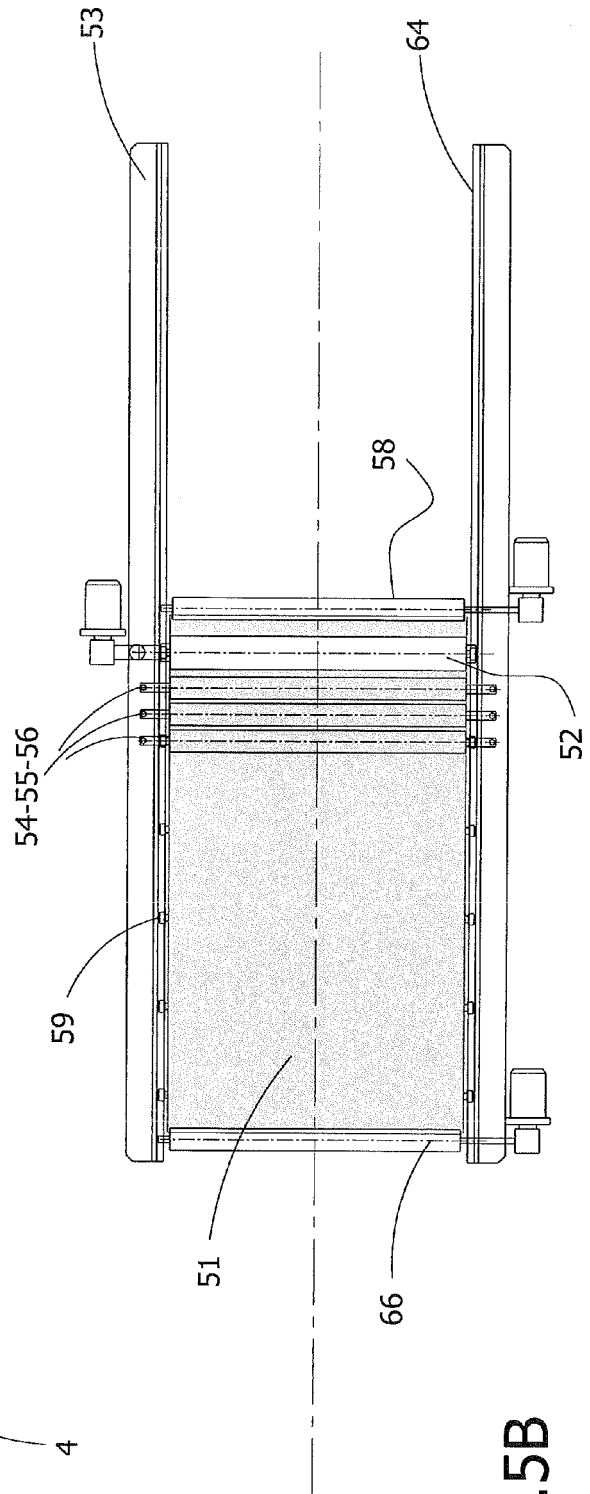
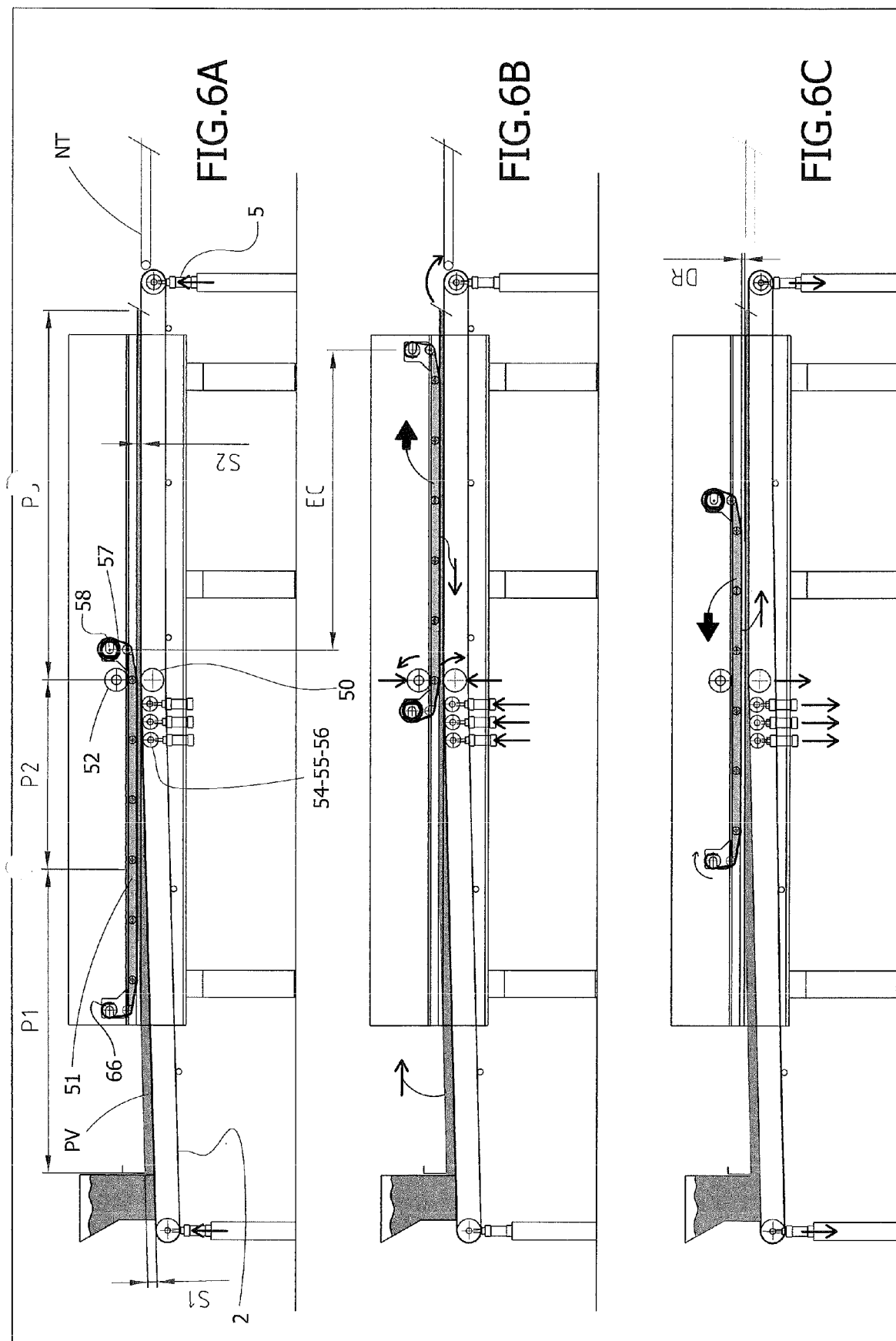


FIG.5B







EUROPEAN SEARCH REPORT

 Application Number
EP 15 16 2494

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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	DE 29 28 530 A1 (SIEMPELKAMP GMBH & CO) 22 January 1981 (1981-01-22) * page 8 - page 12; figures *	1-8	INV. B28B3/12 B30B5/06
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			TECHNICAL FIELDS SEARCHED (IPC)
			B30B B28B B27N
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 29 June 2015	Examiner Orij, Jack
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 16 2494

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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29-06-2015

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