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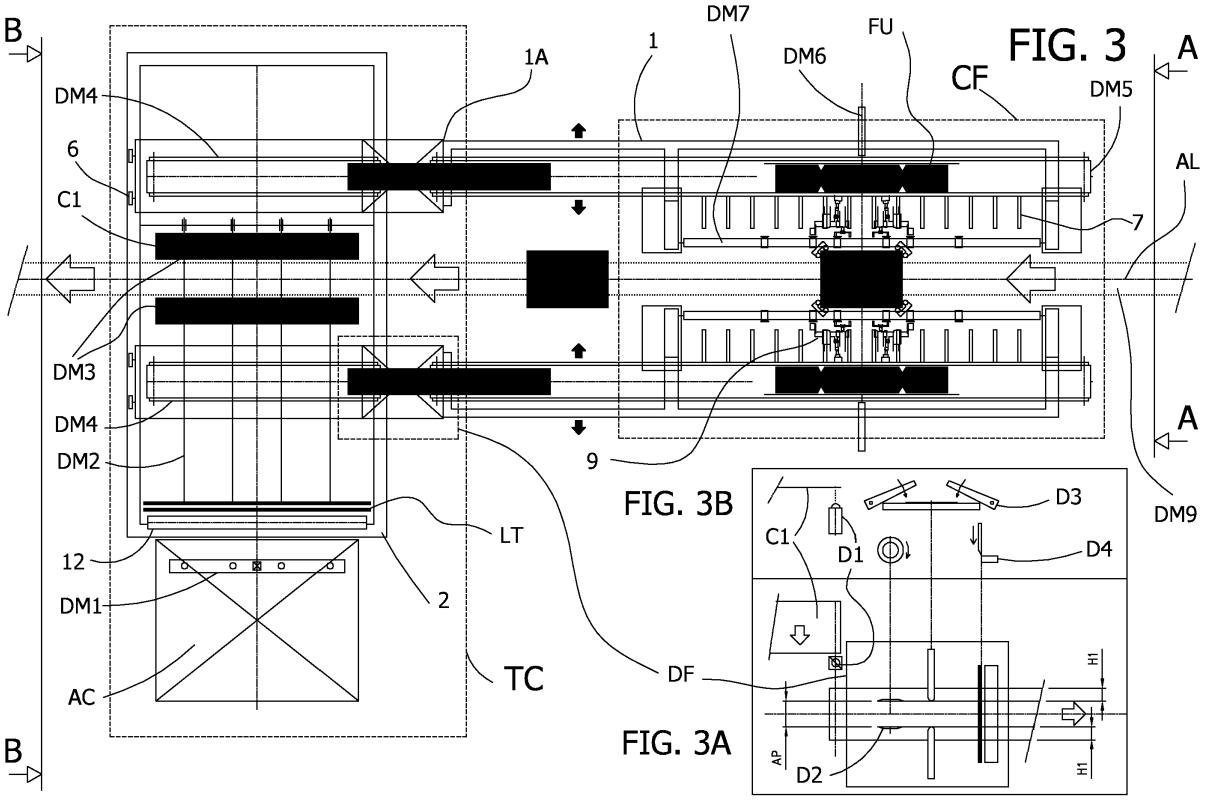
(54) **Apparatus for packing ceramic tiles in continuous operation**

(57) The present invention relates to an apparatus for packing stacks of tiles, consisting mainly of a part (TC) for transforming rectangular sheets of cardboard of a commercial type into blanks and a second one (CF) for packing the stack with the blanks coming from the preceding one. The apparatus consists mainly of a first cardboard cutting station (LT) and two lines or channels for feeding the packing part, in each of which there is a blanking station (DF) for forming the finished blanks (FU), the conveyor systems from (DM4) to (DM7) for positioning the blanks on the four manipulators (9) and a system for conveying the incoming packed stacks (P1) output by the systems from (DM9) to (DM13).



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Description

[0001] The present invention relates to an apparatus (set of various devices operating in a coordinated manner and with coordinated timing in a single structure) for packing stacks of ceramic tiles, optimized for medium-large sizes, starting from unprocessed cardboard in rectangular sheets such as are commercially available for generic uses.

[0002] The type of packing of the present invention will be of the wrap-around type, characterized in that it wraps around the perimeter sides of the stack, leaving the upper and lower faces partly exposed.

[0003] The wrap-around type of packing is more convenient for large sizes than the tray type, which represents the other method (in this case the stack is completely enclosed in cardboard), in which case there would be a considerable waste of cardboard and large complications in the handling of the sheets, which in some cases would have with lengths of over one metre.

[0004] The present invention achieves very important conditions, which make the packing apparatus and system of the present invention more flexible and economical compared to those according to the prior art, whose main limits are given by the impossibility of packing "square" formats of large size and those of the strip type (formats with sides of considerably different length, such as, for example the 10 x 100 cm strip) and the lack of automatic adjustments of internal devices in the event of stack size changes, with consequent downtimes and production losses.

[0005] The invention aims to remedy the above-mentioned limitations by providing a relatively simple and reliable packing apparatus whose internal parts are easily accessible and maintainable.

[0006] These and other objects are achieved by the apparatus of the present invention, which mainly comprises two sub-apparatus with different functions but joined and coordinated in their operations, the first of which is for transforming the commercial cardboard into blanks with proportions and dimensions that are suitable for the size of the stack to be packed and the second for manipulating the blanks coming from the first so as to wrap them around the stack according to a given final packing procedure.

[0007] The present packing system and the advantages thereof will be better described and illustrated with the aid of the following figures, which show a typical and non-exclusive embodiment.

Fig.1: perspective view of the movements and processing of the cardboard sheets and blanks during the packing cycle of the present invention;
Fig.2: simplified side view of the entire packing apparatus of the present invention;
Fig.3: simplified plan view from above of the entire packing apparatus of the present invention;
Fig.3A and Fig.3B: details of Fig.3 in simplified form;
Fig.4: A-A view of Fig. 3;
Fig.4A: detail of Fig.4;
Fig.4B: enlarged detail of Fig.4;
Fig.5: B-B view of Fig. 3;
Fig.6: simplified perspective view of several internal details of the apparatus of the present invention;
Sequence from Fig.7A to Fig.7C: main movements of the blank manipulator during the stack packing step;
Fig.8A : blank with forms suitable for the present invention;
Fig.8B and Fig.8C: perspective view of two blanks during the packing cycle;
Fig.9: side view of the apparatus according to a possible embodiment.
Fig.10: plan view from above of a pair of manipulators operating on a strip-type format.

[0008] The entire apparatus (shown in Fig.2 and Fig.3) can be divided into two parts, the first indicated by the box (TC) mainly comprising all the means suitable for transforming a commercial cardboard sheet (C) into two blanks as per Fig.8A, and a second (CF) for packing the stack using the blanks formed by the part that precedes it; the blanks are conveyed between the two parts by the belts (DM4) and (DM5) .

[0009] The various figures show, in simplified form, the general structure and various internal devices understood as being constructed according to known techniques, except for the blank manipulators (9) according to patent application MO2013A000063 filed on 12.03.2013 under the name of the same applicant.

[0010] The part (TC) for preparing the cardboard mainly comprises:

- a vertically mobile (11) cardboard accumulation platform (AC) ;
- a device (DM1) for picking up and moving the upper sheet of cardboard on the accumulator between the pressing rollers (12);
- a cutting device (LT);
- a device for conveying cut cardboard sheets (DM2);
- two devices for lifting the cardboard sheets (DM3) from (DM2) to the belts (DM4);
- two belts (DM4) supported at one end by idler wheels (6) sliding on top of guides (2G) fixed to the weight-bearing frame (2);
- a series of glue spraying heads (D1), see Fig. 3A and Fig.3B;
- two cardboard processing stations (DF), each composed of a pair of bead forming rollers (D2), a cutting device for blanking (D2) and a second cutting device (D4), see Fig. 3A and Fig.3B;

[0011] The packing part (CF) mainly comprises (the first five in the list are symmetrically arranged in pairs relative to the longitudinal axis (AL) of the apparatus):

- two belts (DM5) adjacent to the preceding ones (DM4);
- two pushers (DM6) for horizontally moving the cardboard sheets from the belts (DM5) to the projecting rods (7);
- two devices (DM7) for picking up cardboard blanks from the rods (7) to the underlying manipulators (9);
- four cardboard manipulators (9), also indicated as (DM8) in other drawings;
- four tile aligners (8);
- a central conveyor (DM9) of stacks arriving from upstream systems;
- a stack lifting device (DM10);
- two carriage-mounted grippers (DM11);
- a device for depositing, with vertical movements, packed stacks (DM12) from the grippers (DM11);
- a conveyor for evacuating packed stacks (DM13) from the apparatus.

Description of the operation of the sub-apparatus (TC) dedicated to cutting and transforming the cardboard.

[0012] The packing cycle starts off from unprocessed cardboard of a commercial type (AC), in sheets of about one metre by one metre in size, accumulated on a vertically mobile platform (11), see preferably Fig.5.

[0013] Positioned above said accumulation platform is the device (DM1) for picking up a single sheet of cardboard from the accumulator and to the pressing rollers (12), which, by rotation, force the entry thereof into the cutting device (LT) that will perform cuts at a pitch (AP) equivalent to the height of the blank programmed for that format, see also Fig.1 and Fig.8A. The cardboard sheets thus cut will be positioned at the centre in pairs by a conveyor system (DM2), and then picked up by lifting devices (DM3) and made to overlap the preceding cardboard sheets already present on the belts (DM4) by an amount (S); during this movement, glue will be sprayed by the heads (D1) on the lower part of the cardboard and in the front position, so that the two glued overlapping cardboard sheets will become a single body during forward conveyance and to avoid scraps, see preferably Fig.3A and Fig.3B .

[0014] Subsequently, the new cardboard sheet made to overlap and glued to the preceding one will continue moving forward inside the box (DF) containing the creasing (D2), blanking (D3) and cutting (D4) devices so that on the outlet side there will be a shaped cardboard sheet with dimensions depending on the stack to be packed.

Description of the operation of the sub-apparatus (CF) dedicated to packing the stacks with the cardboard prepared in the preceding station.

[0015] In the upper part there are the two belts (DM5) adjacent to the preceding ones (DM4), symmetrically arranged in pairs relative to the longitudinal axis of the machine (AL), and these bring the cardboard blanks into a central position as shown in Fig.2 and Fig.3; the exact positioning of the blanks is monitored by sensors (typically photocells), not shown in the figures.

[0016] Subsequently, the two cardboard blanks will be placed on the brackets (9C) of the manipulator devices (9) according to the sequence (see Fig.4, Fig.4A, Fig.4B and Fig.6):

- the pushers (DM6) move the cardboard blanks inside, from the belt (DM5) to the projecting rods (7), in such a way that the suction cup arms (20) have no obstacles in the contact from below with the same;
- the shafts belonging to (DM7) rotate, bringing the suction cups (20) into contact with the cardboard;
- said shafts are lowered with suitable rotations and vertical movements and deposit the cardboard on the brackets (9C) of the manipulators;
- during the lowering phase, some heads (10) spray glue in suitable points of the blanks;
- the grips between the suction cups (20) are exchanged with those inserted in the brackets (9V);
- the shafts of the unit (DM7) are brought back into the initial position with suitable rotations and vertical movements.

[0017] From this moment, the two blanks are ready in the right position, waiting for the stack to be packed.

[0018] In parallel, stacks (P1) conveyed by the device (DM9) enter from machines situated upstream (typically the system of choice); they are secured at the centre of the lifting device (DM10) in a completely lowered position; at this moment the aligners (8) intervene, one for each corner of the stack, and, by means of a diagonal pushing action, simultaneously align the various pieces as shown in Fig.6; in the sequence in Fig.7 the stacks are already aligned.

[0019] As soon as said operation is completed, the lifting device (DM10) intervenes to position the stack at the correct position in height in front of the four manipulators (9), see also Fig.4A .

[0020] The packing sequence of the four manipulators (9) is shown in the Fig.7A, Fig.7B and Fig.7C.

[0021] Only two manipulators are shown in said figures, the ones on the same side of the apparatus, since the other pair simultaneously performs the same actions on the other blank.

[0022] The manipulators are shown in simplified form, only with the parts that intervene in contact with the blank; the packing cycle takes place as follows:

- Fig.7A: the two manipulators are in front of the stack and the blanks are maintained adherent to the brackets (9C) by the suction of the suction cups (9V);
- Fig.7B: the two manipulators move towards the stack in such a way that the pair of wheels (9B) fold the two central (L1) flaps of the blank, causing them to adhere to the top and bottom faces of the stack;
- Fig.7C: the two groups of wheels (9A) and the brack-

ets (9C) rotate by 90°, repeating the previous operation also for the flaps (L2) of the lateral parts of the blanks, see also Fig.8B and Fig.8C;
- with reverse movements, the manipulators go back into their initial position.

[0023] Greater details of this sequence and further particulars of these devices are described in the previously cited patent.

[0024] Now the stack (PC) is packed and subsequently picked up by the gripper unit (DM11), which by moving horizontally places them back on the device (DM12) adjacent to the outfeed belt (DM13); simultaneously with the pickup of the grippers, the device (DM10) is lowered to receive the next stack to be packaged and so as not to interfere with the movement of the grippers.

[0025] The (DM12) is substantially a small set of rollers endowed with vertical movements so as to be able to accumulate several stacks and thereby speed up the evacuation thereof.

[0026] The conveyor (DM13) has a section with a variable inclination so as not to create discontinuities in height between the downstream machine (typically a palletizer) and the preceding one (DM12), see Fig.2.

[0027] The pair of grippers constituting the moving device (DM10) also have the function of pressing the overlapping sides (S) of the blanks on which glue was previously applied, see points (CL) in Fig.8B and Fig.8C, in such a way as to make the final pack more robust.

[0028] The packing process is also shown in the scheme of Fig.1, which indicates the various movements of the cardboard sheets from (M1) to (M13), in the various steps already described corresponding to the devices (DM1) to (DM13); for the sake of clarity, only those on one side of the machine are shown in the upper part; in the figure the point (X) indicates the stack packing position.

[0029] The elements of the apparatus which implement the inventive concept of the packing process of the present invention are mainly:

I- the division of the already cut cardboard sheets into two independent channels;
II- movements of manipulating the blanks around the stacks performed by four devices, each acting upon a corner of the stack with independent but coordinated movements.

[0030] The first inventive concept is implemented through the devices from (DM4) to (DM7), one series for every side of the apparatus, incorporated in a mobile structure (1) with the possibility of transverse movements in order to adapt to the sizes of the stacks to be packed (see arrows (ST) and wheels (1 R) in Fig.4).

[0031] The components for driving said transverse movements (motors, racks, worm screws, etc.) will be typically housed in the structure of the apparatus (CF), whilst the part consisting of the devices (DM4) and (DF) in the apparatus (TC), and which is fixed to the preceding part in the flange (1 A), is driven as shown in Fig.5 by the idler wheels (RF) sliding on the guides (2G) fixed to the structure (2) of the same part (TC).

[0032] The second inventive concept is implemented by manipulator devices of a shape and size that are sufficiently compact to be adapted also to strip tiles, which, as already mentioned, typically have sides with large dimensional differences, for example 10 x 100 cm; Fug. 10 shows a pair of manipulators on the same side of the apparatus during packing with this type of format.

[0033] The packing process of the present invention also requires a pair of blanks of the same dimensions, configured as in Fig.8A, and mainly characterized by:

- a central part (LP) as long as the longitudinal side of the stack;
- two lateral parts of a length (L2) that, added together, is slightly greater than the transverse side and can overlap (those of the second blank) by an amount (S) as per Fig.8C;
- the application of suitable glue spots (CL) by means of the heads (10) in order to fix the flaps of the blanks.

[0034] The invention thus conceived is susceptible of numerous modifications or variants, all falling within the scope of the inventive concept; furthermore, all of the details can be replaced by other technically equivalent elements.

Claims

1. A system for packing stacks of ceramic tiles, optimized for medium-large sizes, starting from unprocessed cardboard of a commercial type in rectangular sheets, **characterized in that** it comprises two apparatus with independent but coordinated operation consisting of:

   - a first cardboard cutting apparatus (TC), from which blanks (FU) with sizes and shapes suited to the format to be packed exit in two parallel lines;
   - a second apparatus (CF) for packing and conveying the stacks with blanks coming from the preceding one.

2. The packing system according to claim 1, **characterized in that** the first apparatus (TC) is mainly composed of:

   - a lifting system (11) for lifting accumulated cardboard sheets (AC);
   - a lifting and translation device (DM1) for inserting the upper sheet of accumulated cardboard between two pressing rollers (12);
   - a cardboard cutting device (LT) for forming

parts of a length (AP) equivalent to the height of the packing (central part and flaps);
- a conveyor device (DM2) for placing pairs of cut cardboard sheets in a central position;
- two cardboard gripping devices (DM3) for placing the cardboard sheets from the conveyor (DM2) above the two belts (DM4);
- two stations (DF) in which the cut cardboard sheets are transformed into blanks (FU) by means of processing performed by the creasing (D2), blanking (D3), cutting (D4) and gluing (D1) devices.

3. The packing system according to claim 1, **characterized in that** the second apparatus (CF) is mainly composed of the following pairs of devices symmetrically arranged relative to the longitudinal axis:

- two blank conveyor systems (DM5) adjacent to the preceding ones (DM4);
- two pushers (DM6) for pushing the blanks from the belts (DM5) to projecting rods (7);
- two conveyor systems (DM7) for conveying the blanks from the projecting rods (7) to the brackets of the manipulators (9C);
- a blank manipulation system for packing the stacks, composed of four devices (9), each operating on a corner of the stack;
- sprayer heads (10) for spraying glue in suitable points of the blanks during lowering of the device (DM7);
- a conveyor system (DM9) for conveying incoming stacks prior to packing;
- a lifting device (DM10) for lifting stacks from the conveyor (DM9) to the manipulators (9);
- a gripper unit (DM11) for picking up the packed stack from the lifting device (DM10) to the conveyor (DM12);
- a vertically mobile device (DM12) for conveying one or more superimposed stacks to the conveyor (DM13) connected with the downstream machines.

4. The packing system according to claim 1, **characterized in that** the channels or lines consisting of the devices (DM4), (DM5), (DM6), (DM7), (DF), (9) are assembled in two independent structures (1), with the possibility of transverse movements in order to be adapted to the width of the stack.

5. The packing system according to claim 3, **characterized in that** there are four devices (8) for aligning the tiles of the stack.

FIG. 1

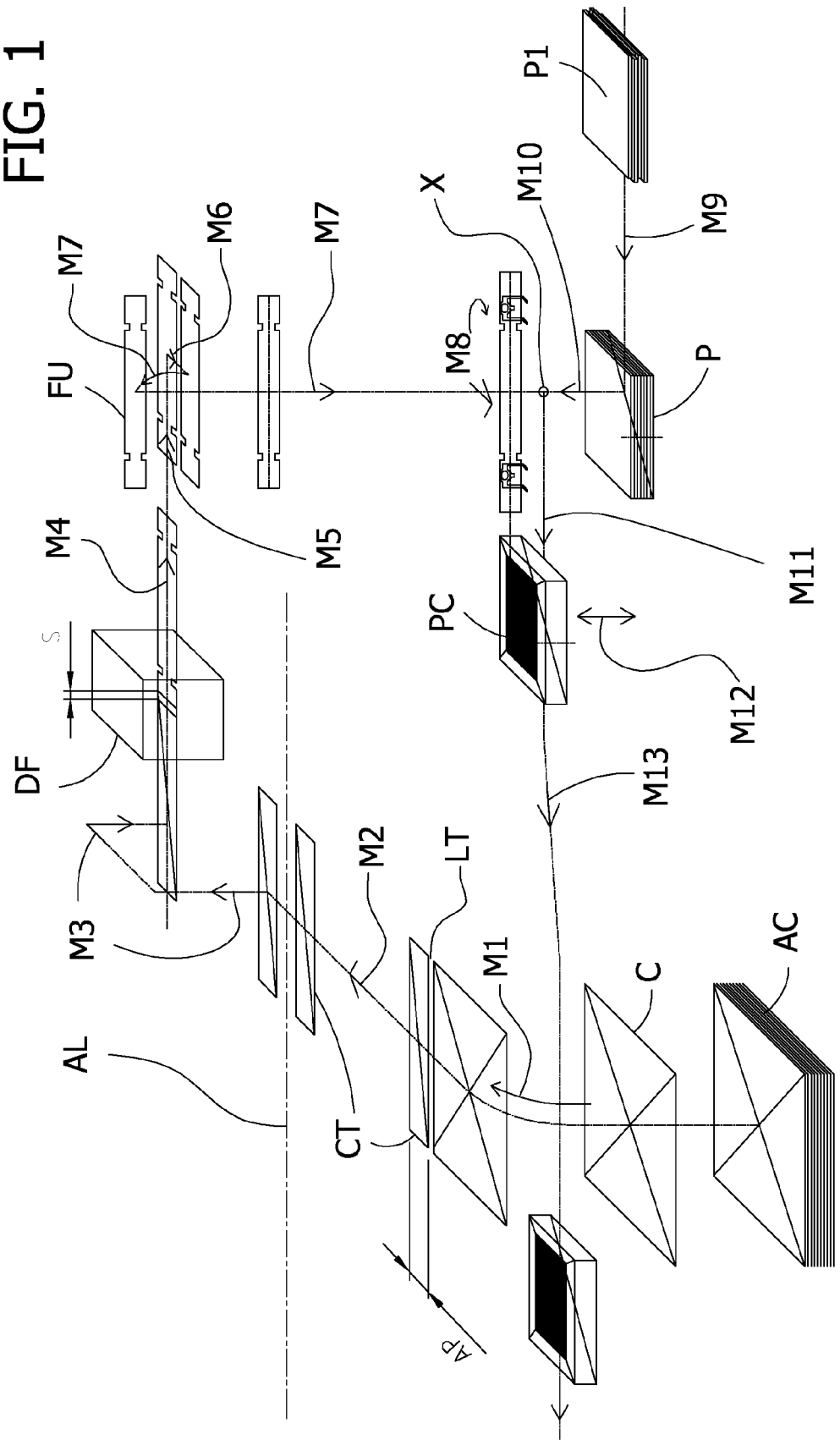
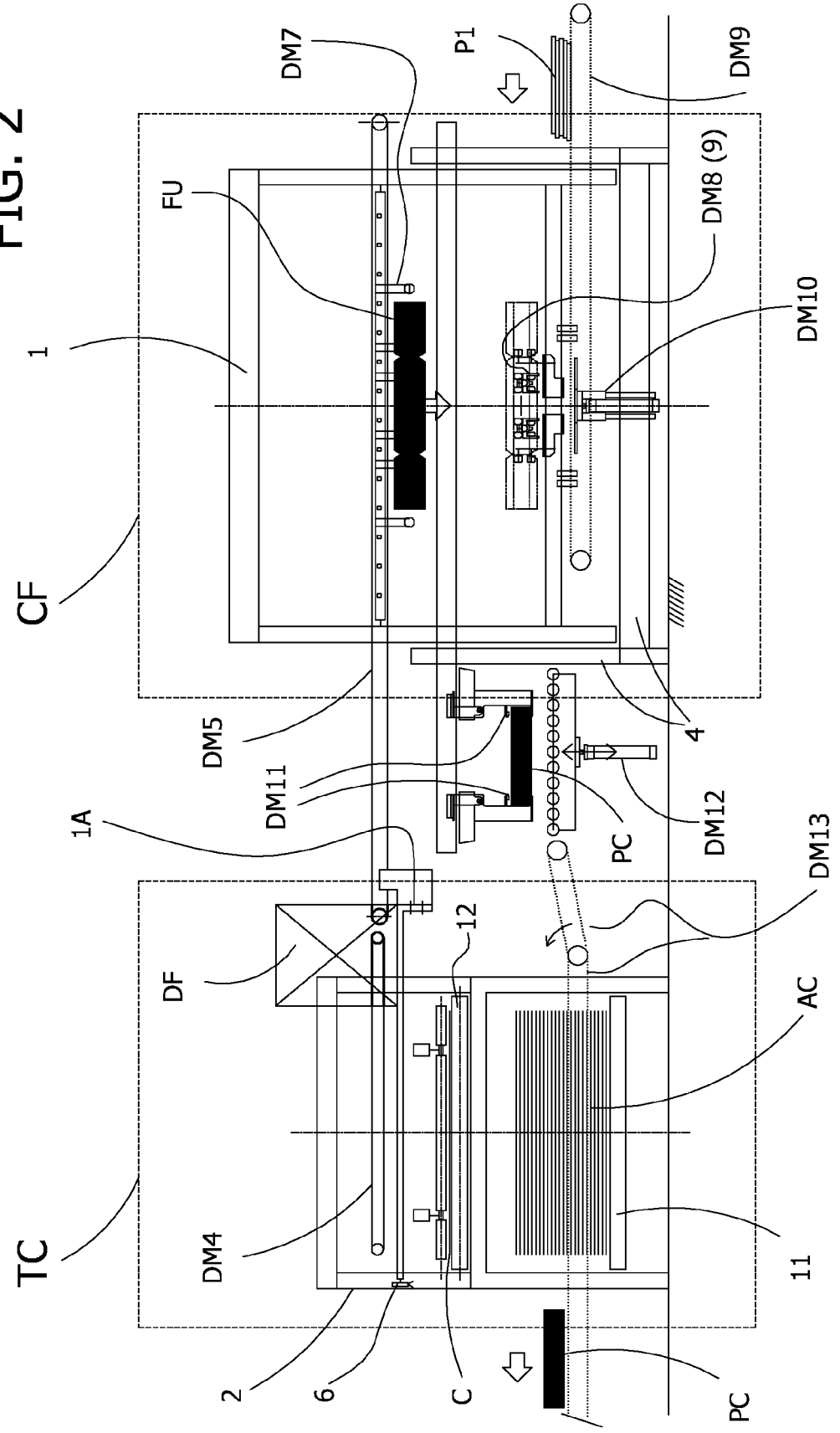

P1
M9
M10
X
M7
M6
M7
M8
P
FU
M4
M5
M11
PC
M12
S
DF
M13
M3
M2
LT
M1
C
AC
AL
CT
Δp

FIG. 2


DM7
P1
DM9
FU
DM8 (9)
DM10
1
CF
DM5
4
DM11
DM12
PC
1A
DM13
12
DF
AC
TC
DM4
11
2
6
C
PC

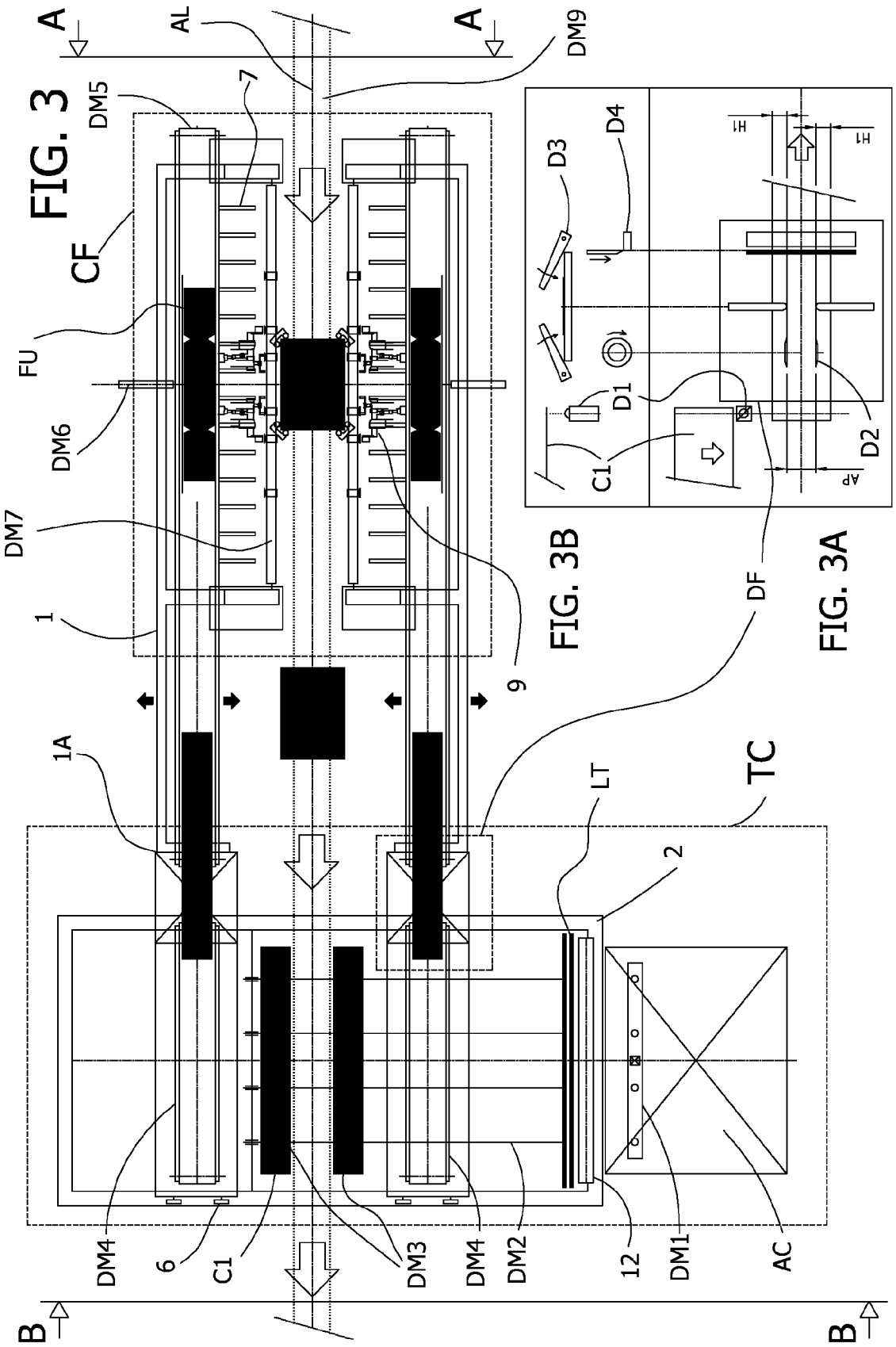


FIG. 3

FIG. 3B

FIG. 3A

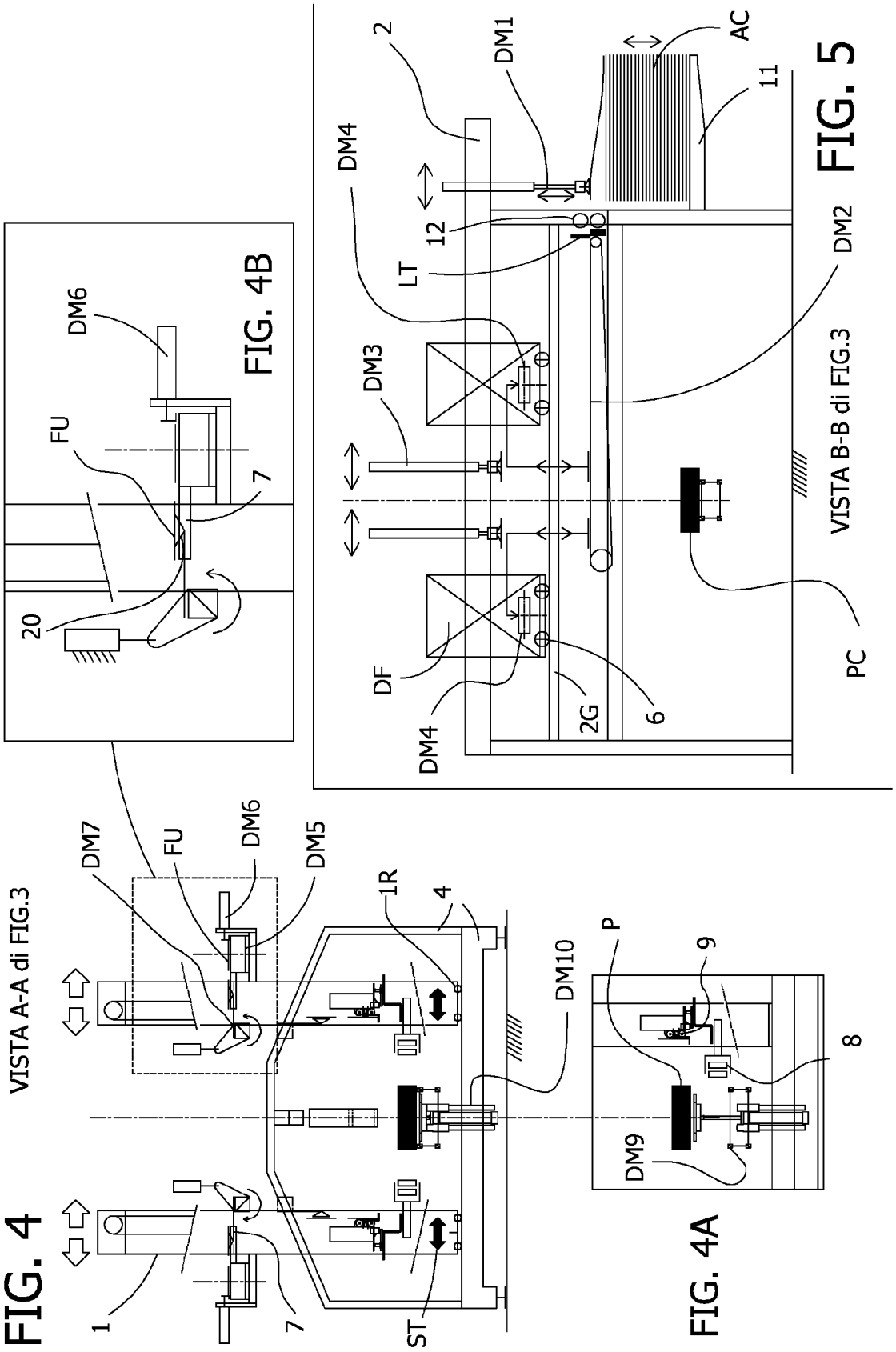


FIG. 4
VISTA A-A di FIG.3
DM7
FU
DM6
DM5
1R
4
DM10
1
7
ST
FIG. 4A
P
9
8
DM9
FIG. 4B
DM6
FU
7
20
FIG. 5
2
DM1
AC
11
DM4
12
LT
DM2
DM3
VISTA B-B di FIG.3
DF
DM4
2G
6
PC

FIG. 6

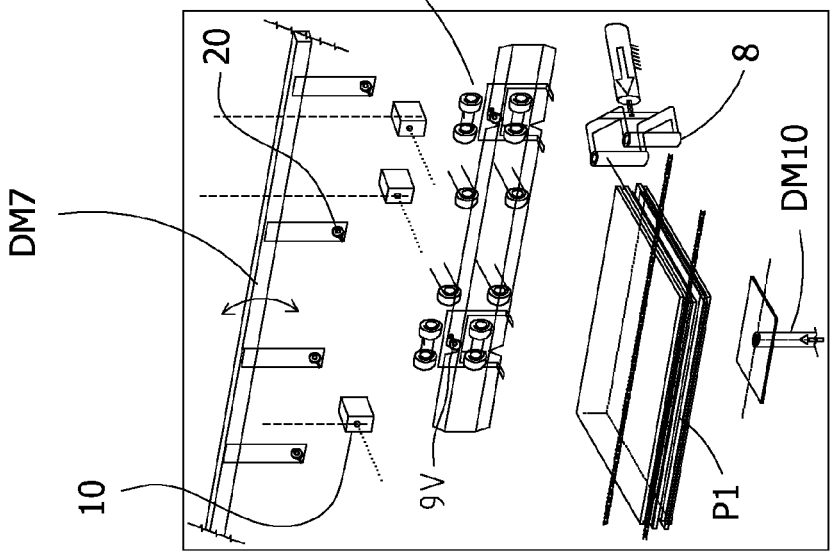


FIG. 7A

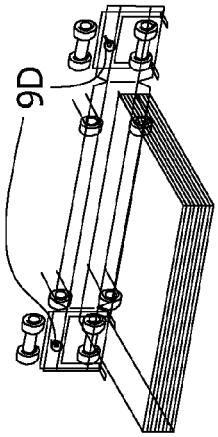


FIG. 7B

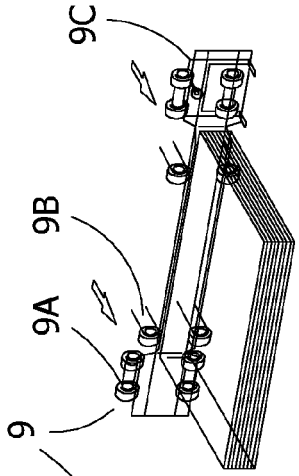


FIG. 7C

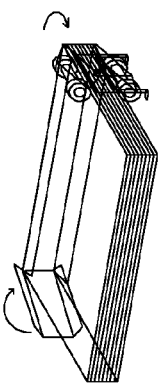


FIG. 8A

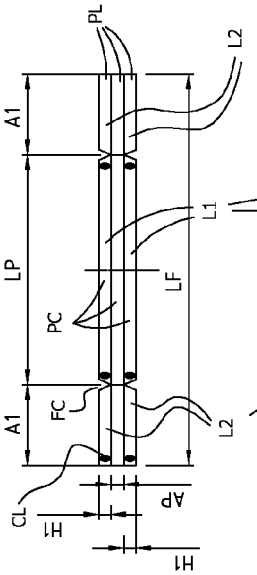


FIG. 8B

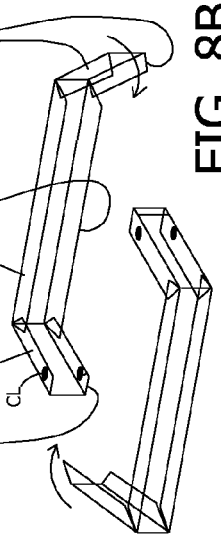


FIG. 8C

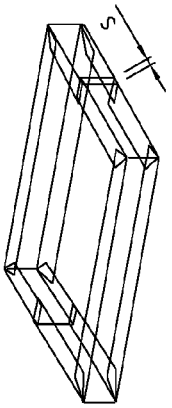


FIG. 9

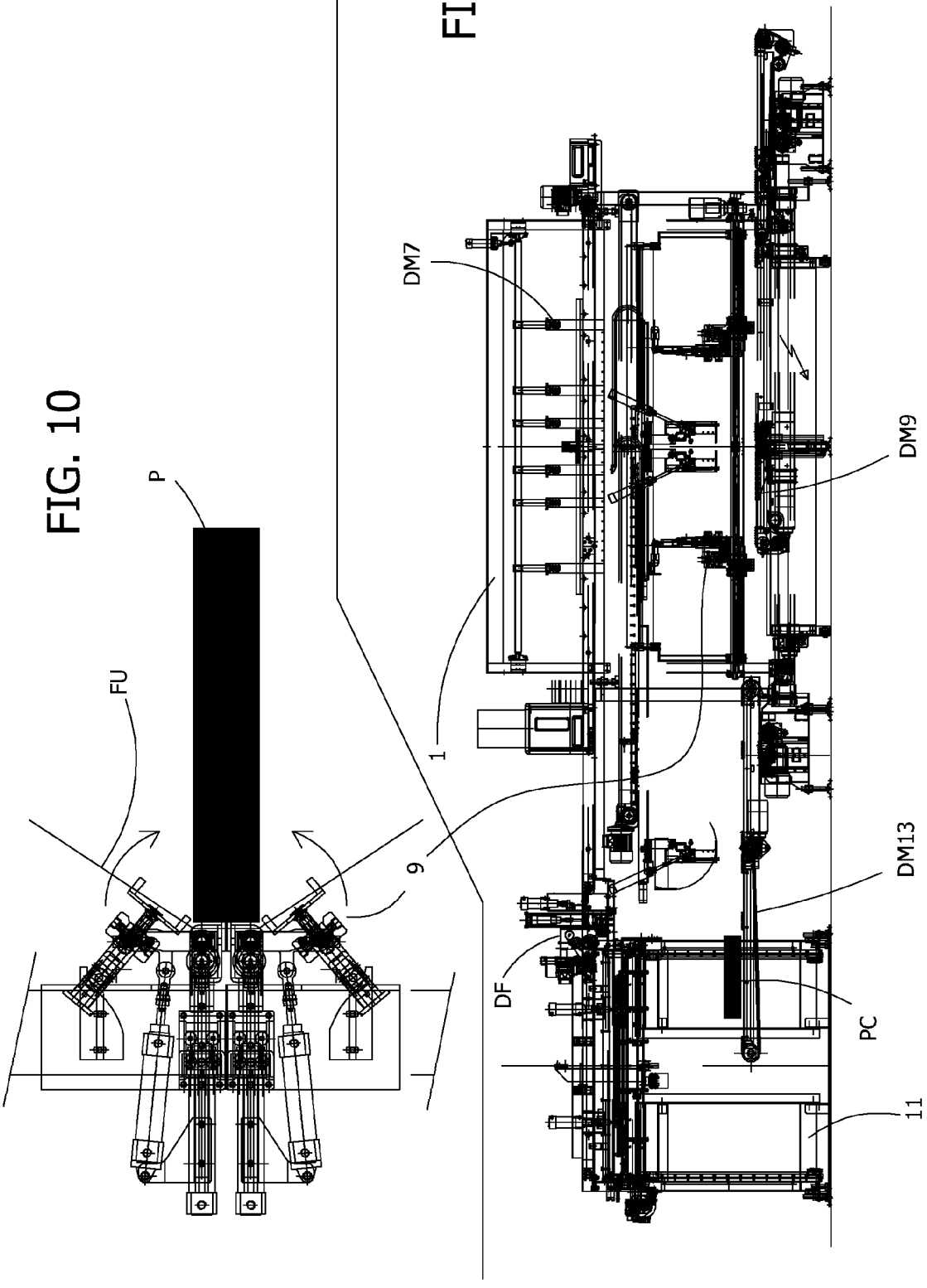


FIG. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 1104

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 Y	WO 2007/148183 A1 (F T P AUTOMAZIONI S P A [IT]; TORO ANDREA [IT]) 27 December 2007 (2007-12-27) * page 7, lines 11-13; figures 1-4 * * page 9, lines 3-5 * * page 11, lines 1-5 * * page 13, line 26 - page 13, line 11 *	1 2	INV. B65B11/58 B65B23/20 B65B49/08 B65B59/04 B65H35/00
Y A	US 3 844 201 A (EGGERT R ET AL) 29 October 1974 (1974-10-29) * column 31, line 5 - column 32, line 11; figures 4,35-37 *	1,2 3-5	
Y A	EP 0 994 028 A1 (GOMES TECHNOLOGY S P A [IT]) 19 April 2000 (2000-04-19) * abstract; figures 1-6 *	1,2 3-5	
A	EP 0 216 235 A1 (GOMES SPA [IT]) 1 April 1987 (1987-04-01) * abstract; figures 3-14 *	1,2	
A	US 3 658 220 A (NORTON ROBERT K) 25 April 1972 (1972-04-25) * abstract; figures 1-3 *	1,2	TECHNICAL FIELDS SEARCHED (IPC) B65B B26D B31B B31D B31F B65H
A	WO 2010/061312 A2 (SACMI [IT]; CARNEVALI FABIO [IT]; STEFANI ROBERTO [IT]; SAVORANI GIOVA) 3 June 2010 (2010-06-03) * page 9; figures 1-14 *	3-5	
A	WO 2013/171680 A1 (NUOVA SIMA S P A [IT]) 21 November 2013 (2013-11-21) * abstract; figures 1-9 *	3-5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 January 2015	Garlati, Timea

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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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 03.82 (P04C01)

Europäisches Patentamt
European Patent Office
Office européen des brevets

Application Number
EP 14 17 1104

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 14 17 1104

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1, 2

   A system according to claim 1 comprising blanking and cutting devices according to claim 2.

   ---

2. claims: 3-5

   A system according to claim 1 comprising wrapping devices according to claim 3.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 17 1104

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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26-01-2015

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