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(54) Process and apparatus for transport of panels made of mineral wool or other insulation material

(57) A process and apparatus for the transport of panels made of mineral wool or other insulation material on to a production line or assembly line for further manufacturing comprises the sub-processes of transporting, reloading, cross pushing, pivoting reloading, tilted transporting, and exiting from the apparatus to the production line.

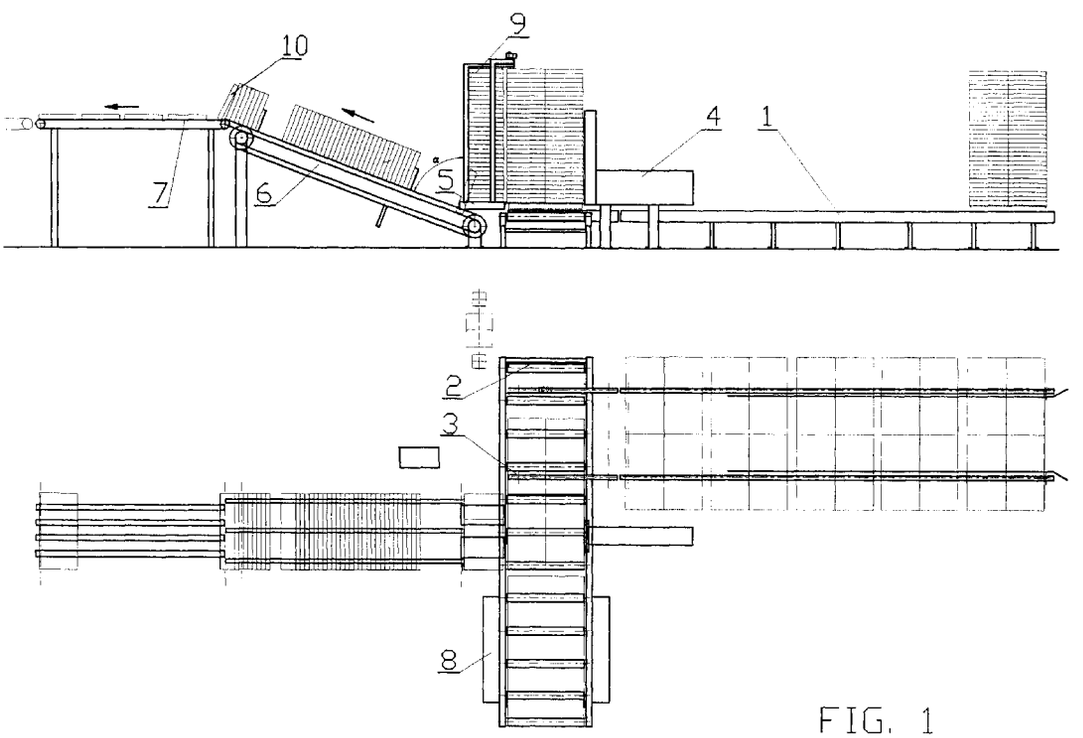

FIG. 1

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Description

Technical field

[0001] This invention relates to a process and apparatus for transport of panels made of mineral wool or other insulation material on to a production line or assembly line for further manufacturing. Several partial solutions were necessary to address the above described single technical problem. The general field of the invention lies in transporters, and the transport of panels.

Technical problem to be solved

[0002] The technical problem which is addressed by the present invention is the optimization of the transport of panels made of mineral wool or other insulation material in panel or plate or slab form on to a production (assembly) line on which said panels are further used. Said technical problem can be further broken down into sub-problems, as follows:

- the continuous loading of panels on to production line for further manufacturing;
- synchronization of the speed of transport of said panels with said production line;
- the individual transport of said panels whereby the displacement ofsaid panel from the desired position should be reduced to a minimum;
- prevention of contact between workers and harmful material (e.g. glass wool particles);
- the automated stacking of pallets (platforms on which the panels were delivered) to a desired height for stocking.

State of the art

[0003] Transport apparata are well known, however not transport mechanisms for the transport of mineral wool in form of the mineral wool panels whereby said panels are stacked on to pallets, and said panels should be put on to conveyer belts by yanking (pulling) an individual panel from the stack of said panels.

Description of the invention

[0004] For convenience, the following general description includes reference numerals which match those used in the drawings, which are described in more detail later.

[0005] Standardized pallets hereinafter 'pallets') should be used for transport and stocking. The process and apparatus according to invention perform their function is such a way that a transporter (1) performing a function of transporting is loaded by means of a fork lift performing a function of loading. The load comprises a pallet with stacked mineral wool panels or panels of other insulation material (hereinafter 'panels'). The transporter (1) can be of chain, belt or some other type and can carry one or more pallets. The content of a particular pallet can provide an assembly line with an appropriate number of panels depending on the assembly line speed. To automate the process the transporter (1) should be equipped with several control apparata for controlling parameters such as the final position of the pallet, the removal of pallets, the next free position, engagement. Engagement in this patent application is a general term meaning that a particular position is not free, but engaged (full).

[0006] A reloader (2) performs the function of transporting the pallets from the transporter (1) to a roller transporter (3). It can be of chain, belt or any other type. Reloader (2) takes over a particular pallet from the transporter (1) after a previous pallet has been reloaded. Reloader (2) can feature similar control sensors as the transporter (1). After taking the pallet from the transporter (1) the reloader (2) positions itself at the level of roller transporter (3) and reloads the pallet on to said roller transporter (3). After this task has been accomplished, it returns again to the level of transporter (1) to repeat the procedure.

[0007] The roller transporter (3) which co-performs the function oftransporting the pallet or a plurality thereof then transports the pallet to a cross pusher (4) which empties the pallet. Said empty pallet is then transported by the roller transporter (3) to a palletizer (8) which stacks empty pallets to be ready for removal (transport). Said roller transporter (3) can be equipped with control sensors, e.g. at the location of the cross pusher (4) to control parameters such as: position of the pallet, removal of the pallet, engagement, and control ofnext free position. It can be also equipped with control sensors at the location of the palletizer (8) for controlling parameters such as: final position of pallet, removal (transport) of pallets, and engagement.

[0008] The transporter (1), the reloader (2), the roller transporter (3), and the palletizer (8) perform the function of transport.

[0009] The cross pusher (4) which performs the function of pushing a stack of panels from the pallet onto a pivoting reloader (5) to be described hereunder has one or several positions from which it performs its function, so-called pushing positions. The number of these pushing positions corresponds to the number of panel columns (9) on a particular pallet. The number of panels stacked in a particular panel column (9) is limited only by the mechanical characteristics of the particular panels; however, in the preferred embodiment between 25 and 35 panels are foreseen. The cross pusher (4) performs its function by pushing the panel column (9) from its position on the roller transporter (3) on to the pivoting reloader (5). Said pivoting reloader (5) changes the orientation of said panel column (9) from upright to slanted whereby the slanted position is described by an angle a formed by collinear normals of planes (surfaces) of said panels stacked into said panel column (9) and the

vertical. Said angle a is arbitrary, however it should be approximately equal to an angle formed by a vertical line and the direction of a tilted transporter (6) movement. The pivoting reloader (5) reloads the panel column (9) by a pivoting movement on to the tilted transporter (6). Said reloading action can be performed at any time, however, the optimum is achieved when there is enough room for a whole panel column (9) on the tilted transporter (6). The tilted transporter (6) facilitates the movement of the panel column (9) by means of forks which push the panel column (9) along the tilted transporter's (6) surface toward a production line conveyer (7). As soon as the panel column rests on the forks of said tilted transporter (6) the pivoting reloader (5) returns to the original position and awaits the next panel column (9). If there are more panel columns (9) in a transverse direction (i.e. a direction perpendicular to the roller transporter (3) movement) on the same pallet, the cross pusher (4) in the preferred embodiment pushes exactly one panel column (9) on to the pivoting reloader (9) each time the pivoting reloader (5) completes its movement. If there are several panel columns (9) on the same pallet in a longitudinal direction (i.e. a direction parallel with the roller transporter (3) movement), said roller transporter (3) in a preferred embodiment moves the pallet essentially for the width of said panel column (9) so the cross pusher (4) and pivoting reloader (5) perform their function and dispose of all panel columns (9) populating the pallet on to the tilted transporter (6) and then onto production line conveyer (7). As soon as the pallet is empty the next, full, pallet is delivered by the roller transporter (3) to the cross pusher (4), said empty pallet being transported to the palletizer (8) whose function is to stack empty pallets for removal and/or transportation. The pivoting reloader (5) can be additionally equipped with at least one side guide/railing/holder of panel column (9), said device being used to ensure that the panel column does not shift uncontrollably.

[0010] The cross pusher (4) can be equipped with control sensors for control of the steps of the cross pusher (4), the position of the pallet depending on the length of the panels, and engagement.

[0011] The pivoting reloader (5) can be equipped with sensors for control of its position, control of next free position, and control of the side guide/railing/holder of panel column (9). The tilted transporter (6) can be for example equipped with sensors for control of: position of forks, next free position, final position of each panel, and control counter of panel exit. The velocity of movement ofpanel column (9) on the tilted transporter (6) can be synchronized with production line conveyer (7) which takes over individual panels from the tilted transporter (6) and delivers individual panels to the production or assembly line for further manufacturing.

[0012] The tilted transporter (6) which performs the function of graded transportation comprises forks which push panel column (9) on the tilted transporter (6) surface, said tilted transporter (6) surface forming an angle α with the vertical until said panel column (9) is fully transported on to the production line conveyer (7). As soon as the lower edge of each current top panel (10) in panel column (9) reaches the moving surface of the production line conveyer (7) said current top panel (10) lower edge is yanked in the direction of said moving surface motion thereby causing said top panel (10) to lie with its base surface on the conveyer belt of the production line conveyer (7) which transports said panel to the production or assembly line thereby achieving the objective. In such a fashion the present invention achieves transport of individual panels despite possible attachment between surface fibers of two adjacent surfaces of two adjacent panels in the panel column (9). The velocity of the movement of the forks of said tilted transporter (6) and the velocity of the movement of the production line conveyer (7) should be adjusted to achieve a proper distance between individual panels when transported on said production line conveyer (7). Too fast a movement of the forks of tilted transporter (6) when compared to the speed of movement of the production line conveyer (7) causes too rapid a succession of individual panels on the surface of the production line conveyer (7) and probable collision between adjacent panels or double panels instead of individual ones. Too slow a movement of the forks oftilted transporter (6) when compared to the velocity of the production line conveyer (7) on the other hand causes too large a distance between individual panels on the production line conveyer (7) belt. Hence, with an appropriate difference in velocity between the tilted transporter (6) forks and the production line conveyer (7) belt an appropriate distance between adjacent individual panels on production line conveyer (7) belt is determined.

[0013] The cross pusher (4), pivoting reloader (5), and tilted transporter (6) perform the function of sorting, as described above.

[0014] The production line conveyer (7), which can be also called an exit conveyer if used for other means than for feeding the production or assembly line in a process of further manufacturing the panels, can have a belt as the transport or moving surface. The surface of the belt may be profiled in order to achieve better results at gripping and pulling on the lower edge of current top panel (10) as well as better holding of said panel when transported to its final destination (usually a production or assembly line). The driving mechanisms or engines of both tilted transporter (6) and/or production line conveyer (7) can be regulated by frequency to achieve appropriate velocities depending on the demands of the production or assembly line, said regulation being achieved by means ofa micro processor. The production line conveyer (7) can be for example equipped with sensors for control of the next free position and control of engagement.

[0015] The production line conveyer performs the function of exit from the apparatus of the invention.

[0016] Palletizer (8) stacks empty pallets into a column until said column reaches the desired height, in a

preferred embodiment 6 pallets. As soon as the desired height is achieved, a fork lift or other type of transporting device can remove or transport the pallets, thereby emptying the palletizer (8) and enabling successive pallets to be stacked. Palletizer (8) can be equipped with side guides/railings/holders for the pallet column, said device being used to ensure that the pallet column does not shift uncontrollably and can be for example equipped with control sensors for the lifting mechanism and the distance between side guides/railings/holders.

[0017] The above described transporter system can be equipped with a control panel, said panel being suitably equipped for controlling said system, particularly automated entry of the individual panels on to the production/assembly line. A similar result can be achieved by a control center enabling centralized control and regulation of the system depending on the automated entry of the individual panels on to the production/assembly line.

[0018] The subject of this invention is further described with help of embodiments presented below and by the accompanying exemplary drawings wherein the drawings are part of this patent application and in which:

[0019] Fig. 1 shows the subject of this invention with the transporter (1), the reloader (2), the roller transporter (3), the cross pusher of panel column (4), the pivoting reloader (5), the tilted transporter (6), the production line conveyer (7), the palletizer (8), the panel column (9), and the current top panel (10).

[0020] Fig. 2. shows a standardized pallet with its characteristics for transport of the panel columns (9).

[0021] In a preferred embodiment the subject of the invention is used for a system of automated feeding of panels made of mineral wool into a production or assembly line for manufacturing light building panels made of mineral wool.

[0022] The transporter (1) is of the chain type and is equipped with safety edge for fork lift. The capacity of said transporter (1) is 3 to 7 pallets which ensures a continuous supply to the production or assembly line for light building panels manufacturing. The reloader (2) is of the chain type and takes over the pallet from the transporter (1) as soon as it is vacated by the previous pallet. After taking over the pallet, the reloader (2) changes its level to that of the roller transporter (3) and reloads the pallet on to the roller transporter (3). The roller transporter (3) transports the pallet to the cross pusher (4) of panel columns (9) which empties (successfully) the pallet. Said empty pallet is then transported by said roller transporter (3) to the palletizer (8), said palletizer being equipped with side holders. Said cross pusher (4) pushes the panel column (9) on to the pivoting reloader (5). Said pivoting reloader (5) then reloads the panel column (9) on to the tilted transporter (6) as soon as there is enough space for the whole panel column on the tilted transporter's (6) surface. As soon as the reloaded panel column (9) is supported by the tilted transporter's (6) forks, said pivoting reloader(5) returns to the original position and awaits the next panel column (9) to be pushed on to it by the cross pusher(4).Should there be several panel columns on the pallet in the transverse direction the cross pusher pushes one panel column(9) on to the pivoting reloader (5) each time. Should there be several panel columns (9) on the pallet in the longitudinal direction (parallel to the direction of movement of the roller transporter (3)) the roller transporter (3) each time moves the pallet essentially for the width of said panel column (9) so the cross pusher (4) and pivoting reloader (5) perform their function and dispose of all panel columns (9) populating the pallet on to the tilted transporter (6) and then on to the production line conveyer (7). The number of repetitions of said operation of the cross pusher (4) etc. is determined on the control panel depending on the number of panel columns (9) in the transverse and longitudinal directions. As soon as the pallet is empty the next, full, pallet is delivered by the roller transporter (3) to the cross pusher (4), said empty pallet being transported to the palletizer (8). The velocity of movement of the panel column (9) on the tilted transporter (6) can be synchronized with the production line conveyer (7) which takes over the panels from the tilted transporter (6) by pulling the lower edge of the current top panel (10) in the direction of surface motion of said moving production line conveyer (7) thereby causing said top panel (10) to lie with its base surface on the conveyer belt of the production line conveyer (7). The surface of the belt features an appropriate profile in order to achieve better results at gripping and yanking (pulling) of the lower edge of the current top panel (10). The driving mechanisms or engines of both the tilted transporter (6) and/or production line conveyer (7) are regulated by frequency to achieve appropriate velocities depending on the demands of the production or assembly line. Palletizer (8) stacks empty pallets into a column in such a fashion that the empty pallets are raised to the height of the side holders, said holders holding the pallet under its edge. Each pallet during the elevation takes over the weight of all previous pallets until the column reaches the desired height. After the desired height has been reached, the pallets are transported using the lift fork or other type of transporting mechanism to an appropriate storage place. The whole system is controlled by the control panel which is suitably equipped to control and regulate the described system.

[0023] The whole system as described in this preferred embodiment can be and is equipped with the following control points:

- the transporter (1)
  - * control of final position of pallet
  - * control of removal of pallets
  - * control of engagement
  - * control of next free position
- the reloader (2)

* control of final position of pallet
* control of removal of pallets
* control of engagement
* control of next free position

- the roller transporter (3) at the cross pusher (4)

  * control of final position of pallet
  * control of removal of pallets
  * control of engagement
  * control of next free position

- the roller transporter (3) at the palletizer (8)

  * control of final position of pallet
  * control of removal of pallets
  * control of engagement

- the cross pusher (4)

  * control of steps of cross pusher (4)
  * control of position of pallet depending on insulation panel length
  * control of engagement

- the pivoting reloader (5)

  * control of position
  * control of next free position
  * control of side holders of the panel column (9)

- the tilted transporter (6)

  * control of position of the tilted transporter (6) forks
  * control of next free position

[0024] The control points are equipped with standard equipment in form elements such as photo cells or other types of position sensors, these elements being well known to the person skill in the automation and control of transport system art and comprised in the state of said art.

[0025] It is self evident that the above described invention can be also used in other particular forms without changing the substance of the invention.

Claims

1. Process for the transport of panels made of mineral wool or other insulation material on to a production line or assembly line for further manufacturing, **characterized in that** it comprises:

   (a) transport, comprising loading, transporting, reloading, palleting;
   (b) sorting, comprising cross pushing, pivotal reloading, tilted transporting;
   (c) exiting from an apparatus.

2. Process for the transport of panels made of mineral wool or other insulation material on to a production line or assembly line for further manufacturing, **characterized in that** during transition from a tilted transporter (6) to a production line conveyer (7) a difference in direction and velocity of movements of edges of current top panel (10) exists, prompting yanking of said current top panel (10) lower edge and positioning of said current top panel (10) with a base surface flat on moving surface of said production line conveyer (7).

3. Invention according to claims 1 and/or 2, **characterized in that** at least one of the following characteristics exist:

   (a) transport of a pallet with loaded panels from an initial point to a reloading point;
   (b) reloading of said pallet on to a device which enables further transport;
   (c) further transport comprising at least one of the following functions: transport of said pallet until it reaches a cross pushing device whereby said pallet is emptied, further transport of said pallet until it reaches a palleting device;
   (d) palleting, comprising stacking of empty pallets into a pallet column of arbitrary height;
   (e) cross pushing panels on to a tilted transportation device;
   (f) tilted transport toward an exiting device;
   (g) the process comprises at least one of the following functions: pulling of the panel, positioning of the panel on to a moving surface of the exiting device, both due to relative velocity between the tilted transport device and the exiting device;
   (h) exiting;

   whereby said processes can be ordered in any desired order.

4. Apparatus for transport of panels made of mineral wool or other insulation material on to a production line or assembly line for further manufacturing, **characterized in that** it comprises at least one of the following elements:

   (a) a transporter (1) performing a transporting function;
   (b) a reloader (2) performing reloading between the transporter (1) and a roller transporter (3);
   (c) the roller transporter (3) co-performing a transporting function to a cross pusher (4) and a palletizer (8);
   (d) the cross pusher (4) performing a function

of cross pushing a panel column (9) from a pallet to a pivoting reloader (5);
(e) the pivoting reloader (5) performing a pivoted reloading function to a tilted transporter (6);
(f) the tilted transporter (6) performing a tilted transporting function to a production line conveyer (7);
(g) the production line conveyer (7) performing an exiting function from the apparatus;
(h) the palletizer performing the function of stocking emptied pallets into columns of arbitrary height.

5. Apparatus according to claim 4, **characterized in that** the transporter (1) comprises at least one of the following characteristics: is of chain or belt type; has capacity of 3 to 7 pallets; is equipped with a safety edge for a fork lift; is equipped with control devices for monitoring control parameters comprising end position of the pallet, removal of the pallet, engagement, and next free position.

6. Apparatus to claim 4, **characterized in that** the reloader (2) comprises at least one of the following characteristics: is of chain or belt type; takes over the pallet from the transporter (1) as soon as it is vacated by a previous pallet, and reloads it on to the roller transporter (3); it comprises control sensors.

7. Apparatus according to claim 4, **characterized in that** the roller transporter (3) comprises at least one of the following characteristic: it transports the pallet to the cross pusher (4); at the point of cross pusher (4) it comprises control sensors; at the point of palletizer (8) it comprises control sensors; if there are several panel columns (9) on the pallet in a longitudinal direction it moves the pallet essentially for the width of said panel column (9) following each return of the cross pusher (4).

8. Apparatus according to claim 4, **characterized in that** the cross pusher (4) comprises at least one of the following characteristics: number of positions of pushing corresponds to the number of the panel columns (9) in the transverse direction so by each movement of the cross pusher (4) one panel column (9) is pushed on to the pivoting reloader (5); it is used for emptying the pallet by pushing the panel column (9) not to the pivoting reloader (5); it is equipped with control sensors.

9. Apparatus according to claim 4, **characterized in that** the pivoting reloader (5) comprises at least one of the following characteristics: the pivoting reloader (5) pivots the panel column (9) from an essentially vertical to tilted position described by an angle α wherein the angle α formed between a normal of the tilted panel and the vertical is arbitrary and approximately equal to an angle formed by a surface of the tilted transporter (6) and the vertical; the pivoting reloader (5) during each movement reloads at least one panel column (9) on to the tilted transporter (6); the pivoting reloader comprises ate least one of the following control sensors for control of: position, next free position, side holder of the panel column (9); the pivoting reloader (5) is equipped with at least one side holder of the panel column (9).

10. Apparatus according to claim 4, **characterized in that** the tilted transporter (6) comprises at least one of the following characteristics: it has forks for pushing the panel column (9) toward the production line conveyer (7); a plane in which the forks move and in which at least one of the tilted transporter's (6) sliding surfaces lies forms the angle α with the vertical; the distance between the panels on the production line conveyer (7) is controlled by the difference in velocities of the tilted transporter (6) forks and the production line conveyer (7) belt; it comprises control sensors for control of at least one of the following: position of the forks, next free position, final position of the panel; it is equipped with a counter for the exiting panels.

11. Apparatus according to claim 4, **characterized in that** the production line conveyer (7) comprises at least one of the following characteristics: it features a belt as a transporting surface; the belt is profiled to better perform its function of pulling the current top panel (10) and/or holding said panel (10); a driving mechanism or engine for the tilted transporter (6) and/or the production line conveyer (7) is regulated by frequency and/or controlled by a microprocessor; the production line conveyer comprises sensors for control of the next free position and/or engagement.

12. Apparatus according to claim 4, **characterized in that** the palletizer (8) comprises at least one of the following characteristics: stacks empty pallets into a column until it reaches a desired height; is equipped with side holders for pallets; is equipped with control for an elevating mechanism and/or the distance between side holders.

13. A process or apparatus according to any of the previous claims, **characterized in that** the transport of individual panels from the panel column (9) is achieved by pushing the panel column (9) along the tilted surface forming an angle a with the vertical of the tilted transporter (6) on to the production line conveyer (7) by pulling of the current top panel (10) lower edge in the direction of said moving production line conveyer (7) surface motion thereby causing said top panel (10) to position itself with its base

surface on the conveyer belt of the production line conveyer (7).

14. Apparatus according to any of the previous claims, **characterized in that** it comprises elements performing in at least one of the following devices at least one of the following functions:

(a) within the transporter (1) device at least one of the following functions: control of final position of pallet, control of removal of pallets, control of engagement, control of next free position;
(b) within the reloader (2) device at least one of the following functions: control of final position of pallet, control of removal of pallets, control of engagement, control of next free position;
(c) within the roller transporter (3) at the cross pusher (4) device at least one of the following functions: control of final position of pallet, control of removal of pallets, control of engagement, control of next free position;
(d) within the roller transporter (3) at the palletizer (8) device at least one of the following functions: control of final position of pallet, control of removal of pallets, control of engagement;
(e) within the cross pusher (4) device at least one of the following functions: control of steps of cross pusher (4), control of position of pallet depending on insulation panel length, control of engagement;
(f) within the pivoting reloader (5) device at least one of the following functions: control ofposition, control ofnext free position, control of side holders of the panel column (9);
(g) within the tilted transporter (6) device at least one of the following functions: control of position of the tilted transporter (6) forks, control of next free position;

whereby the devices (a) through (g) may be ordered in any desired order.

15. A process or apparatus according to any of the previous claims, **characterized in that** the system comprises a control center enabling centralized regulation and control of automated entry of said panels into the production line.

16. A process or apparatus according to any of the previous claims, **characterized in that** standardized pallets are used in the process.

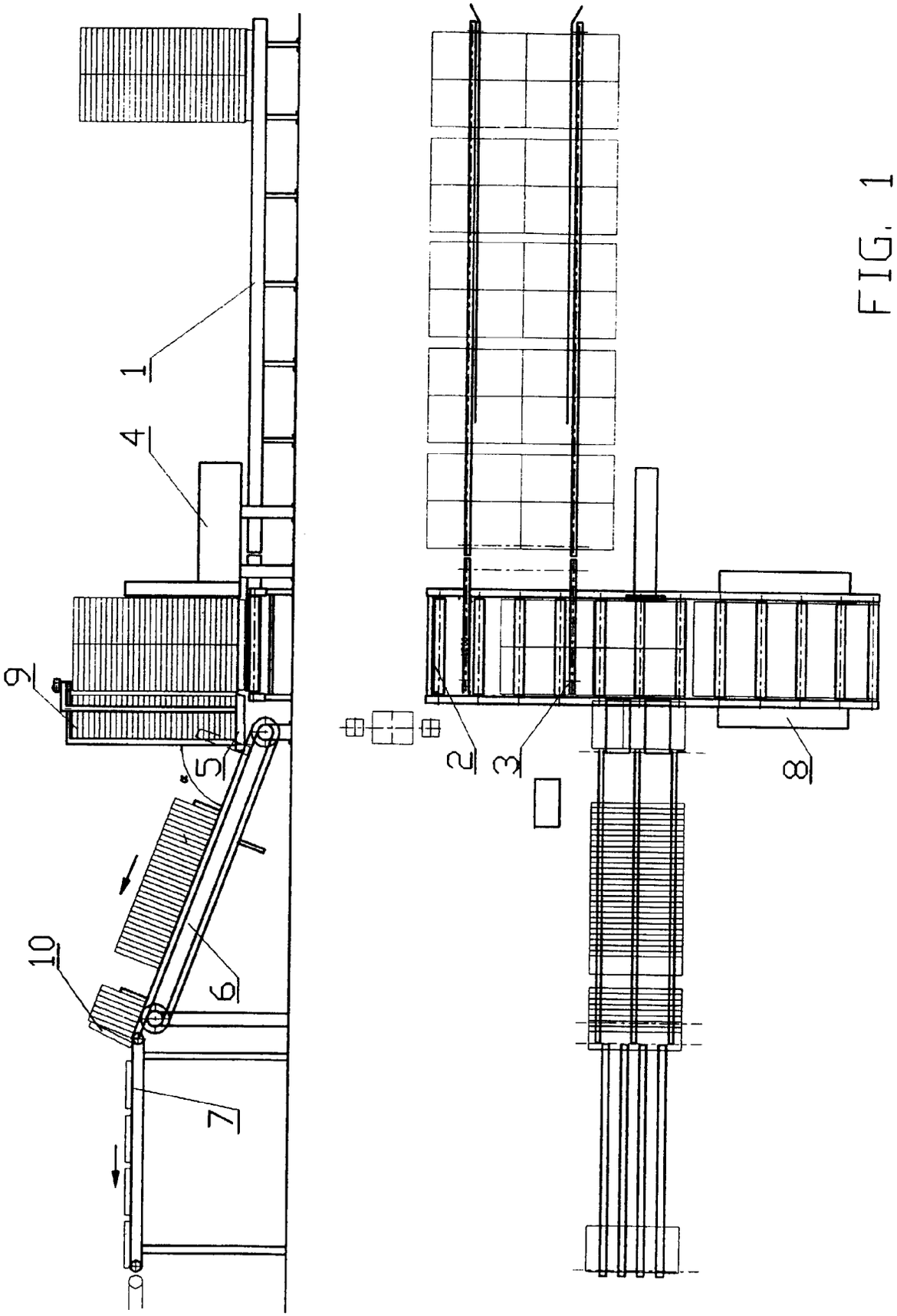

FIG. 1

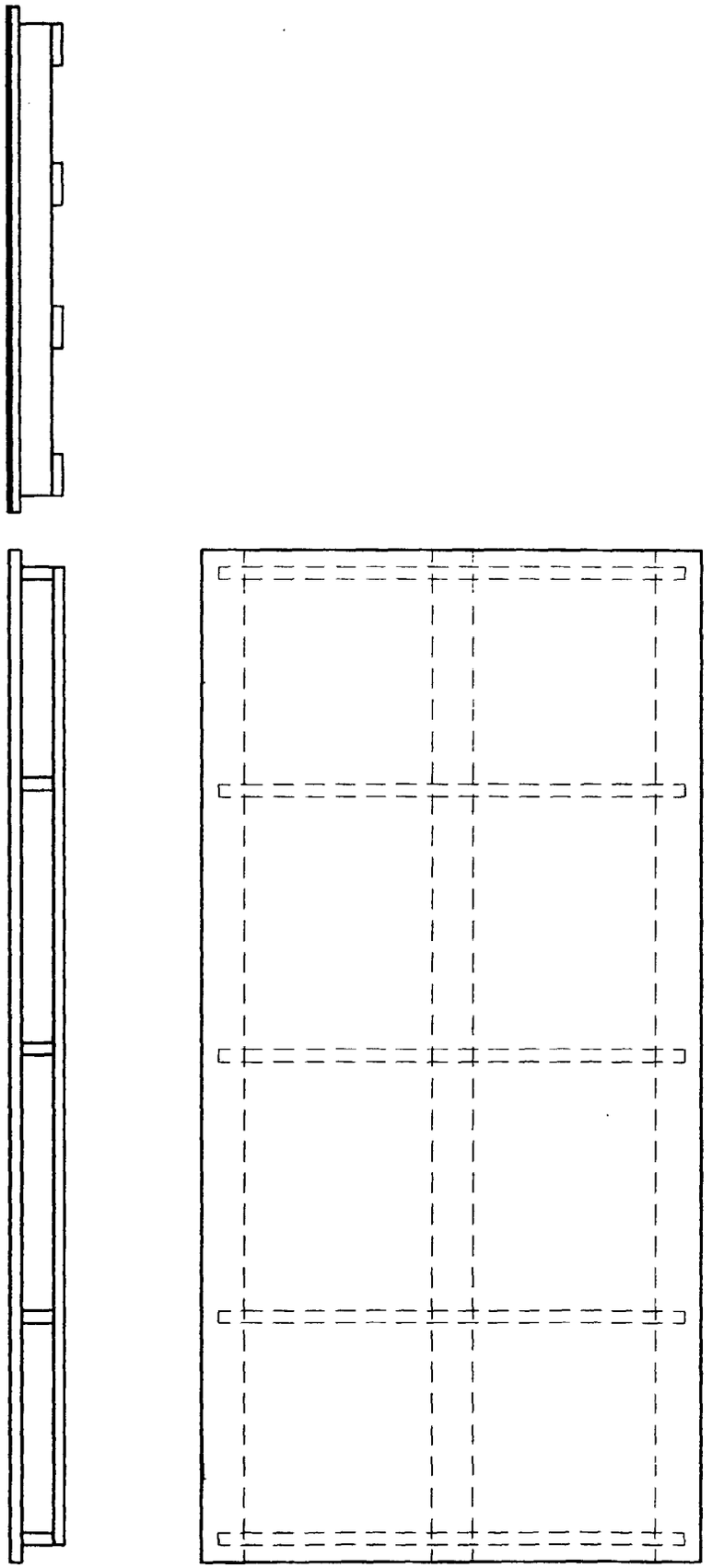

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 30 0245

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X A	EP 0 510 287 A (CORRADI S A) 28 October 1992 * page 3, column 4, line 41 - page 4, column 6, line 42; figures 1-6 *	1 2-16	B65H1/30 B65H15/02
X A	EP 0 742 166 A (PROFINISH S A) 13 November 1996 * page 5, column 7, line 34 - page 6, column 10, line 5; figures 1-3 *	1 2-16	
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TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65H
B65G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 April 1999	Henningsen, O

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 30 0245

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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27-04-1999

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