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(54) **Plant for the production of metal sections**

(57) A plant for the production of metal sections comprises an area (36) for treatment of layers, provided with at least one oven (38) for ageing of the sections. Said oven (38) comprises racks (40) incorporated in the structure of said oven and defining a plurality of support surfaces (42) arranged at different heights inside the oven in order to receive the layers of sections. The support surfaces (42) are formed by means of comb-like supports. A trolley (44) is also envisaged, said trolley being

able to receive the layer, transport it to the oven, raise it to the desired height and insert it inside the oven on the respective shelf (42). The trolley (44) comprises a top surface (44a) provided with a series of rollers on which the layer is able to travel in a feeding direction (A5). The trolley (44) is able to travel on rails (45) and comprises movable arms (46) which can extend from both sides of the trolley (44). A platform (47) brings the layers to the desired height corresponding to the height of the shelf (42) of the rack (40).

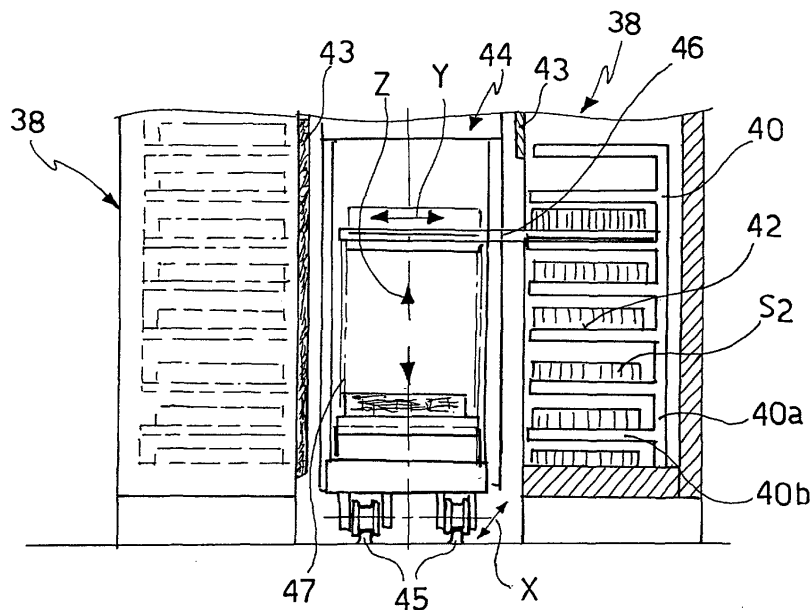


FIG. 7

Description

[0001] The present invention relates to a plant for the production of metal sections.

[0002] As is known in the sector, plants for the production of metal sections basically comprise one or more presses for obtaining the section, means for cutting it to the desired length and means for performing heat treatment which allows the desired mechanical properties to be achieved.

[0003] The above mentioned heat treatment is generally performed in ovens into which containers supporting the sections arranged next to each other so as to form layers are introduced. It is therefore obvious that the known plants require a large number of containers inside which the layers of sections are positioned. These containers must be moved into and out of the oven and, in the stationary condition, during the treatment of other sections, require a lot of space, long handling times and a large amount of labour.

[0004] The object of the present invention is that of devising and providing a plant for the production of metal sections which is able to overcome the drawbacks mentioned above in connection with the known art.

[0005] This object is achieved by means of a plant for the production of metal sections in accordance with Claim 1.

[0006] Further characteristic features and advantages of the plant according to the invention will emerge from the following description of a preferred example of embodiment thereof provided by way of a nonlimiting example, with reference to the accompanying figures in which:

[0007] Figure 1 shows a top plan view of the layout of a plant according to the present invention;

[0008] Figure 2 shows a top plan view of the detail II in Figure 1;

[0009] Figure 3 shows a cross-sectional view of the detail in Figure 2 along the line III-III;

[0010] Figure 4 shows a top plan view of the detail IV in Figure 1;

[0011] Figure 5 shows a side view of the detail according to Figure 4;

[0012] Figure 6 shows a top plan view of the detail VI in Figure 1;

[0013] Figure 7 shows a partially sectioned front view of the detail according to Figure 6;

[0014] Figure 7A shows a front view of a detail according to Figure 7;

[0015] Figure 7B shows a side view of the detail according to Figure 7A;

[0016] Figure 7C shows a front view of the detail according to Figure 7A in a different operating condition;

[0017] Figure 7D shows a side view of the detail according to Figure 7C;

[0018] Figure 8 shows a side view of the detail VIII in Figure 1;

[0019] Figure 9 shows a front view of the detail IX in

Figure 1;

[0020] Figure 10 shows a side view of the detail X in Figure 1;

[0021] Figure 11 shows a front view, in the direction XI, of a portion of the detail according to Figure 10 in which some elements have been omitted;

[0022] Figure 12 shows a front view of the detail XII in Figure 1;

[0023] Figure 13 shows a top plan view of the detail XIII in Figure 1;

[0024] Figure 14 shows a cross-sectional view along the line XIV-XIV of the detail according to Figure 13;

[0025] Figure 15 shows a partially sectioned front view of a possible embodiment of the detail according to Figure 6, in different operating conditions;

[0026] Figure 16 shows a side view of a possible embodiment of a detail according to Figure 6;

[0027] Figure 17 shows a front view of a possible embodiment of a detail according to Figure 16;

[0028] Figure 18 shows a top plan view of the detail according to Figure 17;

[0029] Figure 19 shows a side view of an enlarged detail of Figure 16.

[0030] With reference to the above mentioned figures, 10 denotes in its entirety a plant for the production of metal sections according to the present invention. The present plant is particularly suitable for the production of sections made of light alloy, for example aluminium alloy.

[0031] Figure 1 shows a possible layout of a plant according to the present invention. The example shown relates to a plant comprising four presses or extruders 12 suitable for the continuous production of the metal section. The number of presses may vary depending on the production output and the plant will be modular and expandable in the manner which will be described below.

[0032] According to a possible embodiment, downstream of each press, there is a cooling and straightening station and a station 14 for cutting the section produced continuously and for transversely arranging alongside each other several section portions.

[0033] The term "layer" or "pack" is understood as referring to a plurality of sections having a given length and arranged alongside each other on a horizontal surface. An initial layer S1 having a given initial length is obtained downstream of the station 14.

[0034] 16 denotes overall an area for formation of a final layer or pack S2 having a given length less than the length of the initial layer and width variable according to the requirements of the plant downstream. The area 16 corresponds essentially to the detail II in Figure 1, further illustrated in Figures 2 and 3.

[0035] According to a possible embodiment, the area 16 comprises a first conveying line 18, for example of the roller type, on which the initial layer S1 is made to travel in a first feeding direction A1. 20 denotes a cutting machine which receives the initial layer S1 from the first

roller conveying line 18 and cuts it to the length of the final layer S2, along a cutting line indicated by the reference T-T in Figure 2. The layer obtained immediately downstream of the cutting machine 20 is indicated as the intermediate layer S3 which has a length equal to the length of the final layer S2. The number of section portions forming part of the intermediate layer S3, and therefore its width, may be different from that of the final layer S2.

[0036] 22 denotes a second conveying line, for example of the roller type, arranged for example immediately downstream of the cutting machine 20. According to a possible embodiment, the second conveying line 22 is provided with a stop 23 for cutting to size, preferably movable in both senses in a direction parallel to the first feeding direction A1. A vane 23a extends from the stop 23, transversely with respect to the first feeding direction A1.

[0037] An evacuation line 24 is able to receive the intermediate layer S3 from the second conveying line 22 and move it in an evacuation direction E. According to a possible embodiment, the evacuation line 24 and the corresponding evacuation direction E are arranged transversely with respect to the second conveying line 22 and the first feeding direction A1.

[0038] According to a possible embodiment, vertical displacement means, not shown, are operationally connected to the evacuation line 24 in order to raise and lower it, for example with respect to the second conveying line 22, in a direction of movement indicated by V1.

[0039] According to a possible embodiment, the evacuation line 24 comprises a first series of evacuation belts 24a and a second series of evacuation belts 24b which are slightly staggered with respect to each other in the feeding direction A1 and slightly superimposed in the evacuation direction E.

[0040] According to a possible embodiment, the first series of evacuation belts 24a and the second series of evacuation belts 24b are operationally connected to movement means, not shown, able to move them at speeds different from each other.

[0041] A third conveying line 26, for example of the roller type, receives the final layer S2 from the evacuation line 24 and conveys it to the next area in a further feeding direction A2. According to a possible embodiment, the direction of feeding A2 of the third conveying line 26 is transverse to the direction of evacuation E of the evacuation line 24 and parallel to the first direction of feeding A1 of the first and second conveying lines 18 and 22.

[0042] According to a possible embodiment, vertical displacement means, not shown, are operationally connected to the third conveying line 26 in order to raise and lower it, for example with respect to the evacuation line 24, in a direction of movement indicated by V2.

[0043] The evacuation line 24 and in particular the first series of evacuation belts 24a and the second series of evacuation belts 24b define means for transfer between

the second conveying line 22 and the third conveying line 26.

[0044] Operation within the area 16, for example illustrated in Figure 2, is now described. The initial layer S1 advances on the first conveying line 18 and passes through the cutting machine 20, being deposited on the second conveying line 22. When the initial layer S1 projects by the desired amount from the cutting line T-T, feeding is interrupted and cutting is performed, resulting in an intermediate layer S3 which lies on the second conveying line 22. The first series of evacuation belts 24a moves upwards and separates the intermediate layer S3 from the second conveying line 22, moving it out of the volume of said second conveying line. Then the first series of evacuation belts 24a moves downwards, returning into the initial position so that the second conveying line 22 is able to receive a new layer.

[0045] It is possible to maintain a different feeding speed of the two series of evacuation belts 24a and 24b in order to vary the number of section portions which make up the final layer S2, and therefore its width. It is possible to obtain equally well a final layer S2 with a width equal to, greater than or less than the intermediate layer S3.

[0046] When the final layer S2 is formed on the second series of evacuation belts 24b, the third conveying line 26 moves upwards, lifts the final layer S2 from the evacuation line 24 and causes it to advance in the direction A2 as far as the downstream area.

[0047] According to a possible embodiment, the plant 10 comprises a transfer area 28, substantially corresponding to the detail IV in Figure 1 and further illustrated in Figures 4 and 5.

[0048] Said transfer area 28 comprises an additional conveying line 30, for example of the roller type, able to receive the final layers S2 and feed them in a feeding direction A4. This additional conveying line is also able to move in a transfer direction D1. According to a possible embodiment in which both the transfer area and the layer formation area are envisaged, the direction of transfer D1 is transverse to the direction of feeding A2 of the final layer S2 on the third conveying line 26 and the direction of feeding A4 on said conveying line 30.

[0049] According to a possible embodiment, illustrated for example in Figures 4 and 5, the additional conveying line 30 comprises a trolley 32 able to move along rails 34. The number of trolleys 32 may vary for example depending on the number of presses and the production output to be handled.

[0050] Operation within the transfer area 28, as for example illustrated in Figure 4, is now described. The final layer S2 supplied from the cutting station, if present, is fed by the third conveying line 26 in the direction A2 as far as the end of said conveying line and from here positioned on the additional conveying line 30. The transfer between the two conveying lines is performed when the trolley 32 is aligned with the third conveying line and therefore when the feeding directions A4 and A2 are

aligned with each other.

[0051] When the layer is fully positioned on the trolley 32, the latter may be displaced along the rails 34 until it reaches the position of the station immediately downstream, as will be described for example below.

[0052] According to a possible embodiment, the plant 10 comprises a layer treatment area 36, substantially corresponding to the detail VI in Figure 1 and further illustrated in Figures 6 and 7. A possible embodiment illustrated in the figures envisages that the layer treatment area 36 is arranged downstream of the layer formation area 16, with the arrangement of the transfer area 28 in between, if present.

[0053] In the example according to Figure 1, the four presses 12 serve a single layer treatment area 36, even though a different arrangement may be envisaged.

[0054] According to a possible embodiment, the layer treatment area 36 comprises at least one oven 38 for ageing of the sections forming part of the final layers S2. In the particular example according to Figure 1, four ovens are provided, facing each other in pairs. The number and arrangement of the ovens may obviously vary for example depending on the number of presses and the production of layers to be treated.

[0055] An oven 38 advantageously comprises racks 40 which are able to be incorporated in the structure of the oven itself. Preferably the racks 40 are fixed to the walls of the oven so that they can be replaced after a certain number of cycles of use. These racks define a plurality of support surfaces 42 arranged at different heights inside the oven for receiving the layers.

[0056] According to a possible embodiment, the support surfaces 42 are formed by means of comb-like supports.

[0057] According to a possible further embodiment, a rack 40 comprises at least two uprights 40a which are arranged alongside each other and from which projecting cross members 40b (Figures 7A-7D) extend. At least one of the two uprights is movable in a vertical direction with respect to the other one so that, if the projecting cross members 40b are aligned in the same horizontal plane, the rack defines as many support surfaces 42 as there are projecting cross members 40b for each upright 40a, whereas if the two series of projecting cross members 40b are staggered, the rack defines a number of support surfaces 42 twice the number of projecting cross members for each upright 40a. An example of staggered racks is also illustrated in Figure 15, in which the right-hand oven has the two uprights staggered in the vertical direction with respect to the left-hand oven. This allows double the number of support surfaces to be obtained, arranged at a smaller distance from each other.

[0058] Moreover, a door 43 which opens and closes off access into the oven is envisaged. The racks remain inside the respective oven and are loaded and unloaded from the outside. Moreover, the racks may be fixed with respect to the oven structure or fixed in a removable

manner so that they can be replaced after long operation of the plant.

[0059] 44 denotes a trolley which, by means of movements along three axes indicated by the reference letters X, Y and Z, is able to receive the layer, transport it to the oven, raise it to the desired height and insert it inside the oven on the respective shelf 42.

[0060] According to a possible embodiment, the trolley 44 travels along bottom and top rails 45 and comprises movable arms 46, which displace the layer laterally so as to insert onto the shelf of the rack incorporated in the oven, and a platform 47 for bringing the layers to the desired height. Moreover, the trolley 44 comprises a top surface 44a formed by a series of rollers on which the layer can be made to travel in a feeding direction A5.

[0061] The number of trolleys 44 may vary depending on the number of presses and the production output of layers to be treated.

[0062] With reference to the example illustrated in the figures, operation within the treatment area 36 and in particular of the trolley 44 is now described.

[0063] The additional conveying line 30, if present, is positioned aligned with the trolley 44 onto which the layer S2 is pushed in the feeding direction A5. When the layer is in position, namely when it is fully resting on the top surface 44a, the trolley 44 moves in the direction of the axis X, positioning itself opposite the oven access opening. In the example illustrated, a trolley 44 serves two rows of ovens, even though another arrangement may be envisaged depending on the layer production output.

[0064] According to a possible embodiment, during displacement of the trolley 44, the layer is raised by the platform, producing a movement along the axis Z, and brought to the height of the shelf 42 onto which it must be transferred.

[0065] The movable arms 46 raise the layer from its support surface on the trolley 44 and displace it laterally with respect to the trolley itself in the direction defined by the axis Y. When the movable arms 46 have moved out completely from the volume of the trolley 44, the layer is situated inside the oven. Following lowering of the platform of the trolley 44, or of the movable arms alone, the layer is deposited on the respective shelf 42.

[0066] The movable arms 46 retract inside the trolley 44 so as to allow the latter to return into the position for loading a new layer.

[0067] For the purposes of the ageing treatment, the trolley 44 is positioned in front of the oven which has completed the heat cycle and the movable arms 46 pick up the layer from the respective shelf 42, transport it onto the trolley 44 and lower it causing it to rest on the top surface 44a of said trolley. The trolley 44 on which the treated layer rests is displaced, while the platform lowers the layer and brings it into the unloading position for despatch to the following station.

[0068] During both loading and unloading of the racks 40, the movable arms 46 may extend from both sides of

the trolley 44 in order to load and unload selectively the two facing ovens situated opposite the travel path of the trolley 44.

[0069] According to a possible embodiment, the plant 10 comprises an oven unloading area 48 substantially corresponding to the detail VIII in Figure 1 and illustrated more fully in Figure 8. In the example illustrated, this oven unloading area is positioned immediately downstream of the treatment area 36.

[0070] A trolley 50 moves on rails 52 in a transfer direction D2. According to a possible embodiment, this transfer direction D2 is transverse to a direction of feeding A6 of the layer on a top surface 50a of said trolley 50, for example comprising a rollerway.

[0071] The number of trolleys 50 may vary for example depending on the number of ovens and the layer production output.

[0072] According to the example illustrated in the figures, operation within the oven unloading area 48 and in particular operation of the trolley 50 is now described. The trolley 50 receives the layer leaving the oven and supplied by the trolley 44, preferably when the trolleys are both arranged at a lower height. The layer advances on the top surface 50a of the trolley 50 in the feeding direction A6 until it is situated fully on top of it. At this point the trolley 50 is able to move in the transfer direction D2 until it reaches the desired position inside the plant 10.

[0073] According to a possible embodiment, the plant 10 comprises a store 54 for receiving the treated layers. According to a possible advantageous embodiment, the oven unloading area 48 also acts as a transfer area for the store, positioning the layer resting on the trolley 50 opposite a store loading area 56 substantially corresponding to the detail IX in Figure 1 and further illustrated in Figure 9.

[0074] According to a possible embodiment, a trolley 58, which is for example structurally similar to the trolley 44 described above, is able to move inside the store 54 between two rows of racks 60, as for example illustrated in Figure 9. The racks 60 comprise comb-like structures which define support shelves 62 on which the treated layers rest, avoiding the need for packaging or containers. According to an advantageous embodiment, each corridor between two adjacent racks is served by an associated trolley 58.

[0075] The trolley 58 is in particular able to move the layer along three axes X, Y and Z so as to load it onto the racks. In greater detail, the trolley 58 receives the layer from the trolley 50, if present, conveys it opposite the rack 60 on which it must be stored, raises it to the height of the shelf 62 on which it must be rested and places it on said shelf.

[0076] According to a possible embodiment, the trolley 58 travels on bottom and top rails 64 and comprises movable arms 66 which displace the layer laterally so as to insert it on the corresponding shelf of the rack. Moreover, the trolley 58 comprises a top surface 58a

formed by a series of rollers on which the layer can travel in a feeding direction A7.

[0077] With reference to the example illustrated in the figures, operation within the store loading area 56 and in particular operation of the trolley 58 is now described.

[0078] The trolley 50, if present, is positioned aligned with the trolley 58 onto which it pushes the treated layer in the feeding direction A7. When the layer is in a position completely inside the top surface 58a, the trolley 58 moves parallel to the racks in the direction defined by the axis X, positioning itself opposite the rack in which the layer must be stored.

[0079] According to a possible embodiment, during displacement of the trolley 58, the layer is raised by a platform 59, in the direction defined by the axis Z and brought to the height of the shelf 62 onto which it must be transferred.

[0080] The movable arms 66 raise the layer from the surface on which it is resting on the trolley 58 and displace it laterally with respect to the trolley itself in the direction defined by the axis Y. When the movable arms 66 have moved out completely from the volume of the trolley 58, the layer is situated inside the rack 60. Following lowering of the platform of the trolley 58, or of the movable arms 66, the layer is deposited on the respective shelf 62.

[0081] The movable arms 66 retract inside the trolley and the platform moves downwards so as to allow the latter to return into the position for loading a new layer.

[0082] The trolley 58, operating in a manner opposite to that described above, removes the layers from the racks 60 and conveys them to a downstream station. The trolley 58 is positioned in front of the layer to be removed with the movable arms and the associated support surface 58a arranged at the height of the surface 62.

[0083] The movable arms, which are arranged at a greater height than the associated surface of the trolley 58, emerge from underneath the layer to be removed, and are inserted into the metal rack. Then the platform of the trolley 58 is raised, raising the movable arms which in turn raise the layer from the shelf 62 of the respective rack. The arms retract inside the trolley 58 supporting the layer. When the latter is situated within the volume of the trolley 58, the movable arms 66 move downwards, depositing the layer onto said trolley and in particular onto the top surface 58a of the trolley comprising a series of rollers.

[0084] Then the trolley 58 moves between the two racks and at the same time the platform moves downwards, positioning the layer at the bottom level.

[0085] During both loading and unloading of the racks 60, the movable arms 66 may extend from both sides of the trolley 58 in order to load or unload selectively the two racks which face the travel path of the trolley 58.

[0086] The number of trolleys 58 and racks 60 varies depending on the dimensions of the store 54 and therefore the quantity of products to be stored.

[0087] According to a possible embodiment, 68 denotes a section pick-up area, for example positioned immediately downstream of the store 54. This pick-up area 68 corresponds substantially to the detail X in Figure 1 and is further illustrated in Figure 10.

[0088] The section pick-up area 68 is able to receive the layers, for example removed from the store 54 by means of the trolley 58. In the example illustrated in the figure, the layers may be transferred from the trolley 58 to the area 68 when the platform 59 is completely lowered, namely when the top surface 58a of the trolley 58 is situated at the lowest level or in different positions of the platform 59.

[0089] The pick-up area 68 comprises a fixed structure 70 which extends in a transfer direction D3 which, according to a possible embodiment, is transverse to the direction of movement of the trolleys 58 along the axis X.

[0090] The above mentioned fixed structure 70 comprises support surfaces 72a-72d in turn comprising means 74 for picking up the layers from the trolley 58 and means 76 for transferring the layers to a downstream station. Owing to the presence of a plurality of surfaces, it is possible to transfer simultaneously several layers on several levels so as to direct them to the area immediately downstream. In the example illustrated in Figure 10, four support surfaces are envisaged, 72a denoting the bottom one, while 72b-72d denote the surfaces which are higher than the bottom surface. In the example illustrated in Figure 12 five support surfaces are envisaged, 72a denoting the bottom one, while 72b-72e denote the surfaces which are higher than the bottom surface.

[0091] According to a possible embodiment, the means 76 for transferring the layers comprise conveyor belts 78 able to transfer the layers in said transfer direction D3 as far as a downstream station.

[0092] According to a possible embodiment, the means 74 for picking up the layers comprise a series of rollers 80, for example situated in between two conveyor belts 78 which are adjacent and parallel thereto, structured so as to be able to move upwards and downwards with respect to the level of the conveyor belts 78. In said transfer direction D3, the fixed structure 70 comprises a plurality of series of rollers 80, preferably arranged so that each of them faces a corridor between two racks 60 and a respective trolley 58, if present.

[0093] The rollers 80 of each series extend preferably only over a section of the length of the fixed structure 70 in said transfer direction D3, for example extend over a section equal to the width of the corridor between two adjacent racks 60.

[0094] According to a possible embodiment, each roller 80 is pivotably mounted on one end of levers 82. According to a possible embodiment, each roller is operationally connected to actuating means, not shown, able to cause rotation thereof about its axis or is mounted idle so as to allow the layer pushed by the rotation of the rollers of the trolley 58 to travel freely.

[0095] The opposite ends of the levers 82 are pivotably mounted on the fixed structure 70 and in particular on the support surfaces 72. Actuating means, not shown, are operationally connected to the levers 82 so as to cause rotation thereof about the end pivotably mounted on the fixed structure 70 and therefore modify the position of the rollers 80 from a lowered configuration to a raised configuration and vice versa.

[0096] With reference to the example illustrated in the figures, operation within the section pick-up area 68 is now described.

[0097] The layer, for example picked up from the store 54 by means of the trolley 58, reaches the unloading position illustrated in Figure 1, facing the fixed structure 70 opposite a series of rollers 80 which are located in the raised configuration. The rollers of the trolley 58, if the latter is present, are made to rotate and push the layer onto the rollers 80.

[0098] When the layer is positioned on the rollers 80, the levers 82 move downwards so as to deposit it onto the conveyor belts 78. By actuating the conveyor belts 78, the layer is displaced laterally in the direction of transfer D3, outside of the volume of the rollers 80 which may move back up into the raised configuration in order to receive a new layer from the store.

[0099] The displacement of the layer on the conveyor belts 78 proceeds along the length of the fixed structure 70 as far as the area immediately downstream.

[0100] The number of conveyor belts 78 and the series of rollers 80 varies in accordance with the number of racks 60 of the store and the number of trolleys 58.

[0101] According to a possible embodiment, the plant 10 comprises a by-pass area 84, for example positioned immediately downstream of the fixed structure 70. The by-pass area corresponds substantially to the detail XII in Figure 1 and is further illustrated in Figures 12-14.

[0102] According to a possible embodiment, the by-pass area 84 comprises two conveying lines 86 and 88, for example formed by means of conveyor belts, able to receive the layers for example supplied by the plurality of surfaces of the fixed structure 70.

[0103] The bottom surface 72a of the fixed structure 70 comprises an additional series of rollers 90 arranged in the vicinity of the terminal end of said surface and the associated conveyor belts 78. The rollers 90 which unload the layer from the fixed structure 70 are situated in between the conveyor belts, as in the case of the rollers denoted by the reference number 80 which load the layer onto the fixed structure 70.

[0104] The conveying line 86, which extends transversely with respect to the transfer direction D3 along which the fixed structure 70 extends, is arranged at the terminal end of the bottom surface 72a of the fixed structure 70 and in particular opposite the additional series of rollers 90.

[0105] The other conveying line 88 extends parallel to the conveying line 86, slightly further outwards with respect to the fixed structure 70.

[0106] The reference number 92 denotes a transfer device able to pick up the layers transported by the belts 78 of the raised surfaces of the fixed structure 70 and position them on the conveying line 88.

[0107] The transfer device 92 comprises a trolley 94 movable in a direction X towards and away from the fixed structure 70 and a framework 96 mounted on the trolley 94 and movable with respect thereto in a direction Z perpendicular to the direction X.

[0108] Some roller structures 98 are associated with the framework 96 and extend therefrom in shelf fashion in the direction of the fixed structure 70. According to a possible embodiment, the framework 96 comprises a number of roller-type structures 98 equal to the number of raised surfaces of the fixed structure 70, namely equal to the number of surfaces of the structure 70 excluding the bottom surface.

[0109] In the zone affected by the movement of the trolley 94 in the direction X a cavity 99 is advantageously provided in the surface for supporting the plant 10, inside which the framework 96 moves vertically.

[0110] With reference to the example illustrated in the figures, operation within the by-pass area 84 is now described.

[0111] When the layer resting on the bottom surface 72a reaches the terminal unloading end, the series of rollers 90 moves upwards and transfers the layer to the conveying line 86.

[0112] When the layers resting on the raised surfaces 72b-72e reach the terminal unloading end, the transfer device 92 and in particular the trolley 94 moves in the direction X so as to be positioned underneath the layers. When the roller structures 98 are located underneath the associated layers, the transfer device 92 and in particular the framework 96 moves upwards, being displaced in the direction Z, therefore raising the layers. A further displacement of the trolley 94 along the axis X brings the layers opposite the conveying line 88; the framework 96 moves downwards so that the layer on the surface 72b is positioned on said conveying line. When the deposited layer moves away, the framework 96 moves down further until the layer of the surface 72c is positioned. Lowering of the framework continues until all the layers of the raised surfaces are resting on the conveying line 88.

[0113] According to a possible embodiment, the plant 10 comprises a packaging area 100 able to receive the layers for example supplied by the conveying lines 86, 88. The packaging area 100 corresponds substantially to the detail XIII in Figure 1 and is further illustrated in Figures 13 and 14.

[0114] According to a possible embodiment, the packaging area 100 comprises at least one packaging station. The example illustrated envisages two packaging stations 102, 104 in which the operation is performed manually. The conveying lines 86, 88 on which the strips are supplied have the possibility of stopping at one of the above mentioned packaging stations.

[0115] 106 and 107 denote transverse conveyor belts which are operationally connected to raising means, not shown, which raise or lower the transverse conveyor belts with respect to the conveying lines 86, 88. These transverse conveyor belts are able to transfer selectively the layers from the conveying lines 86, 88 to the packaging stations 102, 104. In particular the conveyor belts 106 transfer the layers from the conveying line 88 to the packaging stations, while the conveyor belts 107 transfer the layers from the conveying line 86 to the conveying line 88, defining means for transfer of a layer of sections between two conveying lines arranged alongside each other. In particular, the conveyor belts 107 define an evacuation line able to receive the layer and move it in an evacuation direction arranged transversely with respect to the two conveying lines.

[0116] With reference to the example illustrated in the Figures, operation within the packaging area 100 is now described.

[0117] The layers advance from the preceding area, for example the by-pass area, to the packaging area, travelling on the conveying lines 86, 88. Both the layers which travel along the conveying line 88 and those which travel along the conveying line 86 are able to stop selectively in front of one of the packaging stations 102, 104.

[0118] If the layer arrives in position facing the respective packaging station on the conveying line 88, the transverse belts 106 move upwards and raise the layer, transferring it directly to the packaging station where the operator may package the required sections.

[0119] Then the conveyor belts 106 move downwards, allowing the possibility for another layer to advance along the respective conveying line and stop at one of the packaging stations.

[0120] If the layer arrives in position facing the respective packaging station on the conveying line 86, the transverse belts 107 move upwards and raise the layer, transferring it to the conveying line 88 where they are picked up by the conveyor belts 106 so as to be finally transferred to the packaging station where the operator is able to package the required sections.

[0121] Then both the transverse belts 106 and the transverse belts 107 move downwards, allowing the possibility for another layer to advance along the respective conveying line and stop at one of the packaging stations.

[0122] From the above it can be appreciated how by providing a plant in accordance with Claim 1 it is possible to limit the dimensions, the parts to be moved inside the plant and therefore also the labour involved. For this purpose it is particularly advantageous to provide racks which are incorporated in the oven structure and are loaded and unloaded by means of suitable means, avoiding therefore the movement and storage of the racks.

[0123] A further advantage of the plant according to the invention consists in its unusual structural simplicity

which allows it to be produced at a very low cost with maximum automation of the individual steps.

[0124] For example, owing to the advantageous design of a trolley for loading and unloading the ovens, which allows the layers to be moved in at least three directions, it is possible to obtain a layer treatment zone which is very versatile and compact and which may be modified modularly in order to satisfy different production requirements.

[0125] It is moreover particularly advantageous to envisage an additional trolley which provides an area for unloading the ovens, receiving the layers in one direction and causing them to move in a transverse direction. In this case also, by varying the number of trolleys, it is possible to modify in a modular manner the plant according to the different production outputs.

[0126] It is particularly advantageous to provide a store formed by racks with several surfaces inside which the layers can be stored without wrapping and without containers. The use of an additional trolley for loading and unloading the store allows the plant to be adapted to the requirements relating to production and use of the sections.

[0127] The provision of a multiple-surface area for picking up the layers results in a high degree of versatility as regards the number of layers which may be moved. If, moreover, a by-pass area is associated, it is possible to select the path to which said sections may be directed.

[0128] It is obvious that variations and/or additions may be made to that described and illustrated above.

[0129] The different working areas illustrated in Figure 1 may also be provided individually inside a plant in particular for the production of metal sections.

[0130] Figures 15-19 illustrate a possible embodiment of the trolley 44 or trolley 58.

[0131] 108 denotes a structure formed by uprights 108a and cross members 108b. Wheels 110 mounted on the bottom end of the uprights are able to travel on bottom rails 45 and are operationally connected to actuating means 112.

[0132] 114 denotes cross members movable in a vertical direction with respect to the structure 108 and defining a substantially horizontal plane. Figure 15 illustrates a cross member 114 both in a bottom position and in a high position. According to a possible embodiment, the movable cross members 114 are integrally joined to chains 116 (only partially illustrated in Figures 15 and 16) wound around toothed pulleys 118, one of which is operationally connected to actuating means 120.

[0133] The support surface 44a of the trolley 44 is defined by a series of rollers 122a and 122b. According to a possible embodiment, the first and last rollers of the trolley 44, which are denoted by the reference number 122a, are mounted idle, whereas the central rollers, denoted by the reference number 122b, are made to rotate preferably by means of a single drive system which transmits the movement to the rollers 122b by means of

a chain drive 124.

[0134] 126 denotes elements for supporting the rollers 122a and 122b in turn supported by additional cross members 128. 130 denotes means for raising and lowering the additional cross members 128 operationally situated in between the cross members 128 and the cross members 114. According to a possible embodiment, the means 130 comprise levers 132 having ends hinged respectively with the movable cross member 114 and the additional cross member 128.

[0135] According to a possible embodiment, one or more rollers 122b are alternated with the movable arms 46. Preferably, a movable arm 46 is situated between every two rollers 122b.

[0136] In accordance with a possible embodiment, a movable arm 46 comprises a section 134 sliding with respect to a support 136 mounted on the movable cross member 114. Each end of the movable arm 46 comprises a tooth 138 which projects transversely with respect to the extension of the arm 46.

[0137] According to a possible embodiment, the movable arm 46 comprises roller wheels 140 mounted idle on said arm and interacting with the support 136 so that the movable arm 46 is slidable. Preferably the movable arm 46 comprises at least one pair of roller wheels 140 arranged on opposite sides of a portion of the support 136.

[0138] 142 denotes means for displacing the movable arm 46 with respect to the support 136, in both directions with respect to the structure 108. According to a possible embodiment, the means 142 comprise a chain drive mounted on the support 136 and operationally connected to the movable arm 46.

[0139] A person skilled in the art, in order to meet contingent and specific requirements, may make numerous modifications and adaptations to the preferred embodiment of the plant described above and replace parts with other functionally equivalent parts, without however departing from the scope of the following claims.

Claims

1. Plant for the production of metal sections, comprising an area for treatment of layers (36) provided with at least one oven (38) for ageing of the sections, **characterized in that** said at least one oven (38) comprises racks (40) incorporated in the structure of said oven and defining a plurality of support surfaces (42) arranged at different heights inside the oven in order to receive the layers of sections and **in that** said plant comprises means for loading and unloading the racks incorporated in the oven structure.
2. Plant according to Claim 1, in which the support surfaces (42) are formed by means of comb-like supports.

3. Plant according to Claim 1 or 2, in which a rack comprises two uprights (40a) which are arranged alongside each other and from which projecting cross members (40b) extend, at least one of said uprights being movable in a vertical direction with respect to the other one so as to stagger the respective projecting cross members (40b). 5
4. Plant according to one of the preceding claims, in which said layer treatment area (36) comprises at least one trolley (44) able to receive the layer, transport it to the oven, raise it to the desired height and insert it inside the oven on the respective shelf (42). 10
5. Plant according to Claim 4, in which said at least one trolley (44) travels on rails (45). 15
6. Plant according to Claim 4, in which said at least one trolley (44) comprises movable arms (46) able to displace the layer so as to insert it onto a shelf (42) of the rack (40) incorporated in the oven. 20
7. Plant according to Claim 6, in which said movable arms (46) may extend from both sides of the trolley (44). 25
8. Plant according to Claim 4, in which said at least one trolley (44) comprises a platform (47) for bringing the layers to the desired height corresponding to the height of the shelf (42) of the rack (40). 30
9. Plant according to Claim 4, in which said at least one trolley (44) comprises a top surface (44a) provided with a series of rollers on which the layer may travel in a feeding direction (A5). 35
10. Plant according to one of the preceding claims, in which it is envisaged positioning an oven unloading area (48) downstream of the treatment area (36). 40
11. Plant according to Claim 10, in which said oven unloading area (48) comprises a trolley (50) able to move in a transfer direction (D2). 45
12. Plant according to Claim 11, in which said trolley (50) moves on rails (52) in said transfer direction (D2). 50
13. Plant according to Claim 11, in which said transfer direction (D2) is transverse to a direction of feeding (A6) of the layer on a top surface (50a) of said trolley (50). 55
14. Plant according to one of Claims 10 to 13, in which a store (54) for receiving the treated layers is envisaged.
15. Plant according to Claim 14 when dependent on Claim 10, in which said oven unloading area (48) also acts as a transfer area for the store (54).
16. Plant according to Claim 14 or 15, in which it is envisaged arranging a store loading area (56) downstream of said oven unloading area (48).
17. Plant according to Claim 16, in which said store loading area (56) comprises a trolley (58) able to move inside the store (54) between two rows of racks (60).
18. Plant according to Claim 17, in which said racks (60) comprise comb-like structures which define support shelves (62) on which the treated layers rest.
19. Plant according to Claim 17, in which said trolley (58) is able to move the layer along three axes (X, Y and Z) so as to load it onto the racks (60).
20. Plant according to Claim 17, in which said trolley (58) is able to travel on rails (64).
21. Plant according to Claim 17, in which said trolley (58) comprises movable arms (66) able to displace laterally the layer so as to insert it in the store (54).
22. Plant according to Claim 17, in which said movable arms (66) may extend from both sides of the trolley (58) in order to load or unload selectively two racks which face the travel path of the trolley (58).
23. Plant according to Claim 17, in which said trolley (58) comprises a top surface (58a) provided with a series of rollers on which the layer can travel in a feeding direction (A7).
24. Plant according to Claim 17, in which said trolley (58) comprises a platform (59) able to bring the layer to the height of a shelf (62) of the store (59) onto which it must be transferred.
25. Plant according to one of the preceding claims, in which it is envisaged positioning a section pick-up area (68) downstream of a store (54).
26. Plant according to Claim 25, in which said pick-up area (68) comprises a fixed structure (70) which extends in the transfer direction (D3).
27. Plant according to Claim 26, in which said fixed structure (70) comprises at least one support surface (72a-72d) provided with means (74) for picking up the layers.
28. Plant according to Claim 26 or 27, in which said fixed structure (70) comprises at least one support surface (72a-72d) provided with means (76) for

transferring the layers to a downstream station.

29. Plant according to Claim 27 or 28, in which said fixed structure (70) comprises a plurality of support surfaces (72a-72d).
30. Plant according to Claim 27, in which the means (74) for picking up the layers comprise at least one series of rollers (80) structured so as to be able to move upwards and downwards.
31. Plant according to Claim 30, in which said rollers (80) extend preferably only over a section of the length of the fixed structure (70) in said transfer direction D3.
32. Plant according to Claim 30, in which said rollers (80) are respectively pivotably mounted on one end of levers (82), the opposite end of which is pivotably mounted on the fixed structure (70).
33. Plant according to Claim 28, in which said means (76) for transferring the layers comprise conveyor belts (78) able to transfer the layers in said transfer direction (D3) as far as a downstream station.
34. Plant according to Claims 30 and 33, in which said rollers (80) are situated in between said conveyor belts (78).
35. Plant according to one of the preceding claims, in which it is envisaged providing a by-pass area (84) able to direct the sections selectively at least towards two conveying lines (86, 88).
36. Plant according to Claims 27 and 35, in which said by-pass area (84) comprises at least two conveying lines (86, 88) able to receive the layers supplied by the plurality of support surfaces of the fixed structure (70).
37. Plant according to Claim 36, in which a bottom surface (72a) of the fixed structure (70) comprises an additional series of rollers (90) arranged in the vicinity of the terminal end of said surface and in the vicinity of one of said conveying lines (86).
38. Plant according to Claim 35, in which said by-pass area comprises a transfer device (92) able to pick up the layers supplied on several surfaces from an upstream area and position them on one of said conveying lines (88).
39. Plant according to Claim 38, in which said transfer device (92) comprises a trolley (94) movable in a direction (X) towards and away from a fixed structure (70) from which the sections are supplied and a framework (96) mounted on the trolley (94) and

movable with respect thereto in a direction (Z) perpendicular to said direction (X) of towards and away movement.

- 5 40. Plant according to Claim 39, in which said framework (96) comprises roller structures (98) which extend in shelf fashion therefrom in the direction of the fixed structure (70).
- 10 41. Plant according to Claim 39, in which a cavity (99) is provided in a surface for supporting the plant, able to receive said framework (96) during its displacement in said direction (Z) perpendicular to the direction (X) of towards and away movement.
- 15 42. Plant according to one of the preceding claims, in which means for transferring a layer (S1; S2; S3) of sections between two conveying lines (22, 26; 86, 88) are envisaged.
- 20 43. Plant according to Claim 42, in which said transfer means comprise an evacuation line (24; 107) able to receive a layer and move it in an evacuation direction (E) arranged transversely with respect to the two conveying lines (22, 26; 86, 88).
- 25 44. Plant according to Claim 43, in which vertical displacement means are operationally connected to the evacuation line (24) in order to raise and lower it with respect to the conveying lines (22, 26; 86, 88).
- 30 45. Plant according to Claim 44, in which said evacuation line (24) comprises a first series of evacuation belts (24a) and a second series of evacuation belts (24b).
- 35 46. Plant according to Claim 45, in which the first series of evacuation belts (24a) and the second series of evacuation belts (24b) are operationally connected to movement means able to move them at speeds different from each other.
- 40 47. Plant according to Claim 43, in which one of said conveying lines (26) able to receive the layer from said evacuation line (24) is operationally associated with means for vertical displacement with respect to the evacuation line (24).
- 45 48. Plant according to one of the preceding claims, in which a packaging area (100) is envisaged, said area being able to receive the layers supplied by at least one conveying line (86, 88) and comprising at least one packaging station (102, 104).
- 50 49. Plant according to Claim 48, in which said packaging area (100) comprises conveyor belts (106) situated in between said at least one conveying line (86, 88) and said at least one packaging station
- 55

(102, 104), said conveyor belts being operationally connected to raising means which raise or lower them with respect to the at least one conveying line (86, 88).

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- 50.** Plant according to Claim 48 and one of Claims 42 to 44, in which said packaging area comprises at least two conveying lines (86, 88) between which said transfer means (107) are situated.

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- 51.** Plant according to one of the preceding claims, in which a transfer area (28) is envisaged, said area comprising an additional conveying line (30) able to receive the layers and feed them in a feeding direction (A4) and move in a transfer direction (D1).

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- 52.** Plant according to Claim 51, in which said transfer direction (D1) is transverse to said direction of feeding (A4) of the layer on the additional conveying line (30).

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- 53.** Plant according to Claim 51 or 52, in which said additional conveying line (30) comprises a trolley (32) able to move along rails (34) in said transfer direction (D1).

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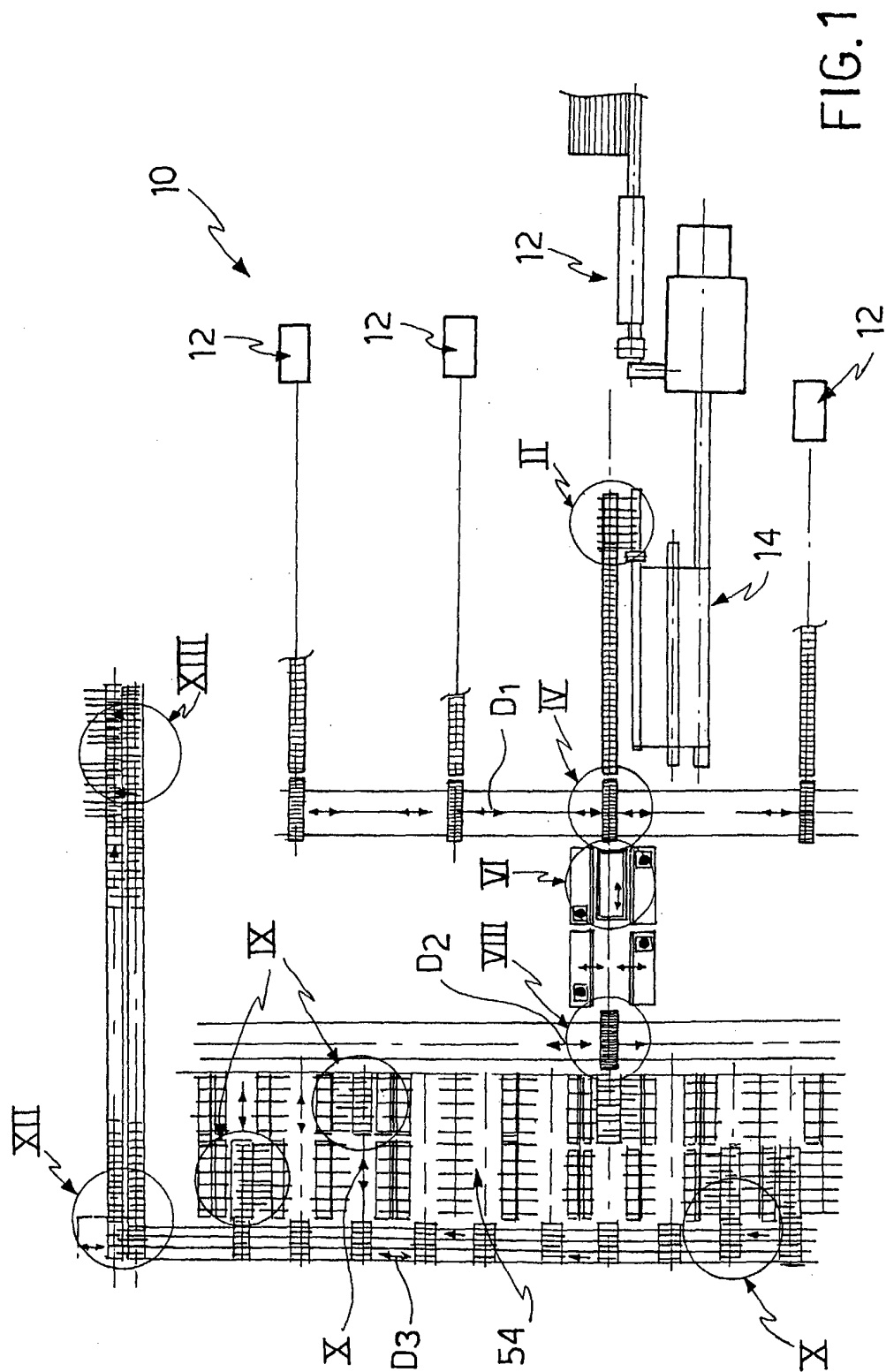
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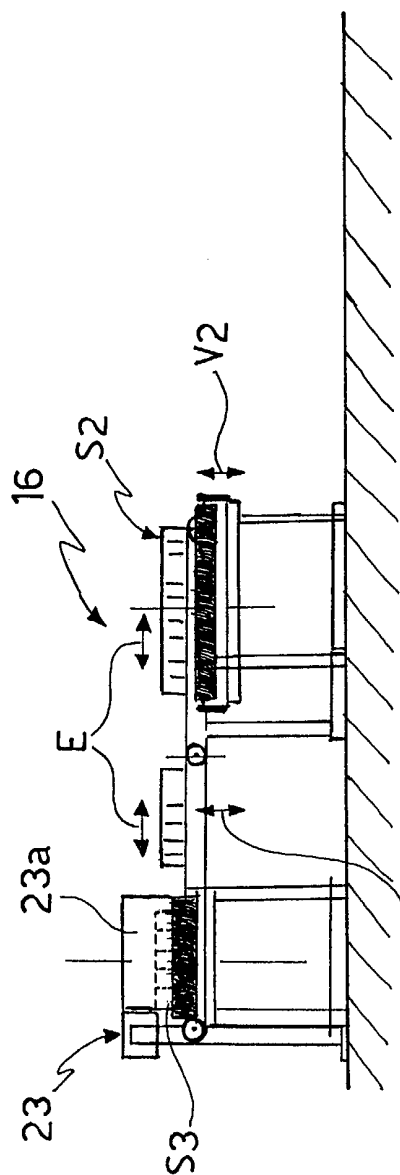


FIG. 2

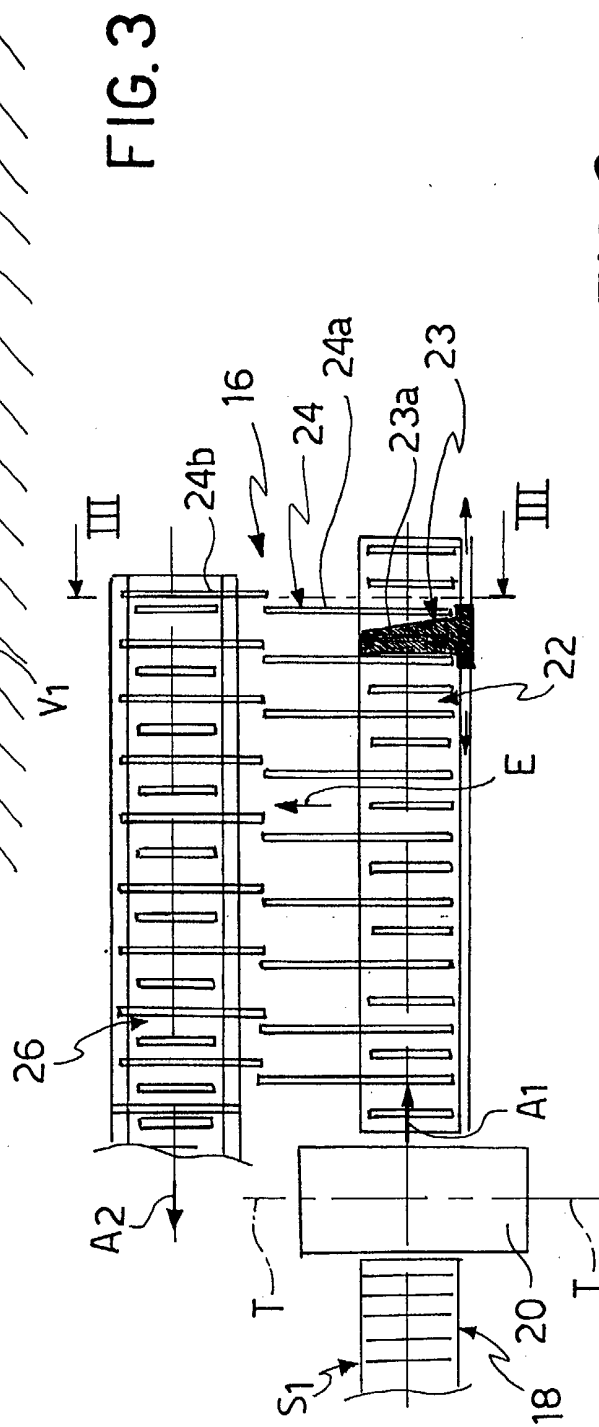
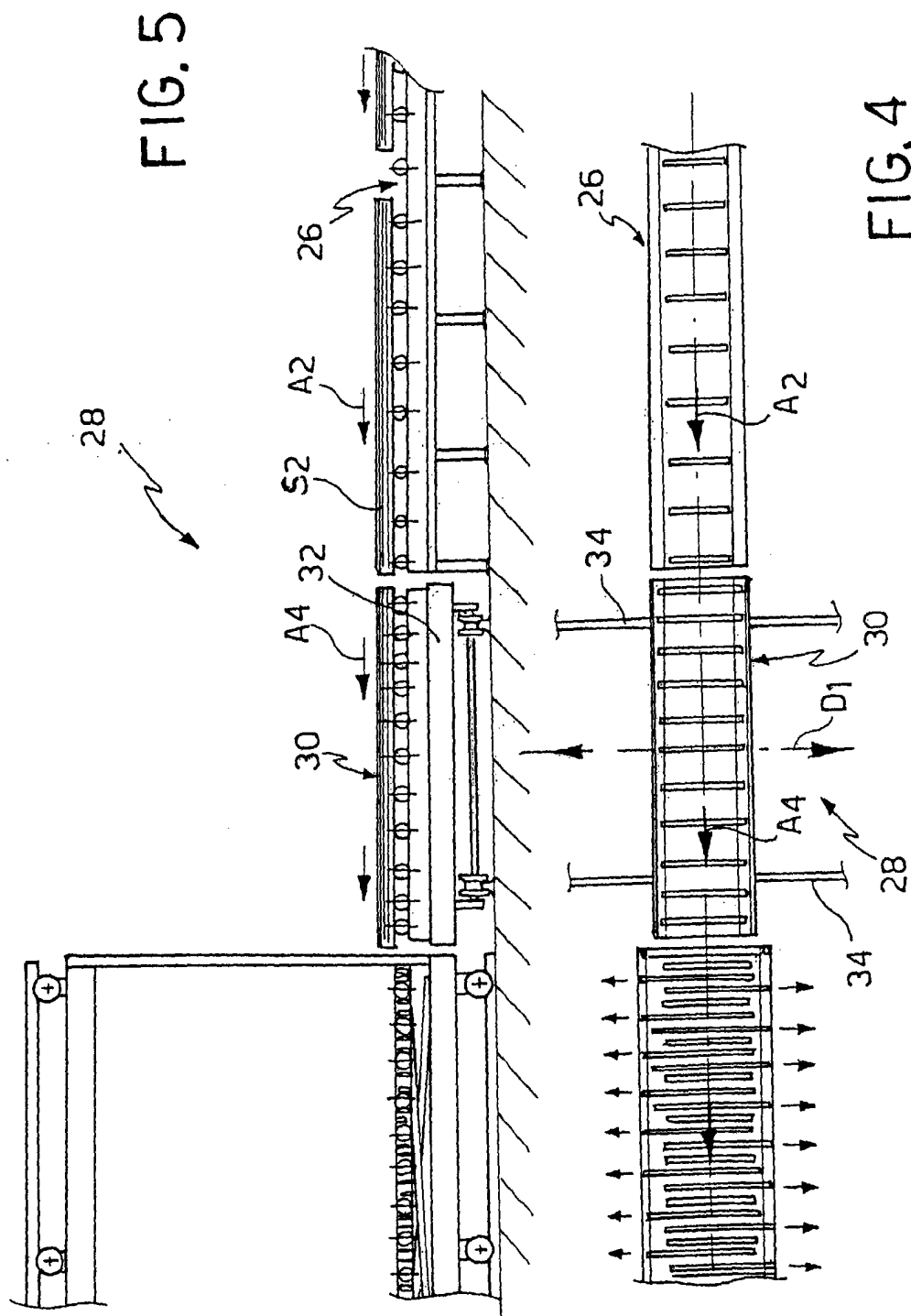


FIG. 3



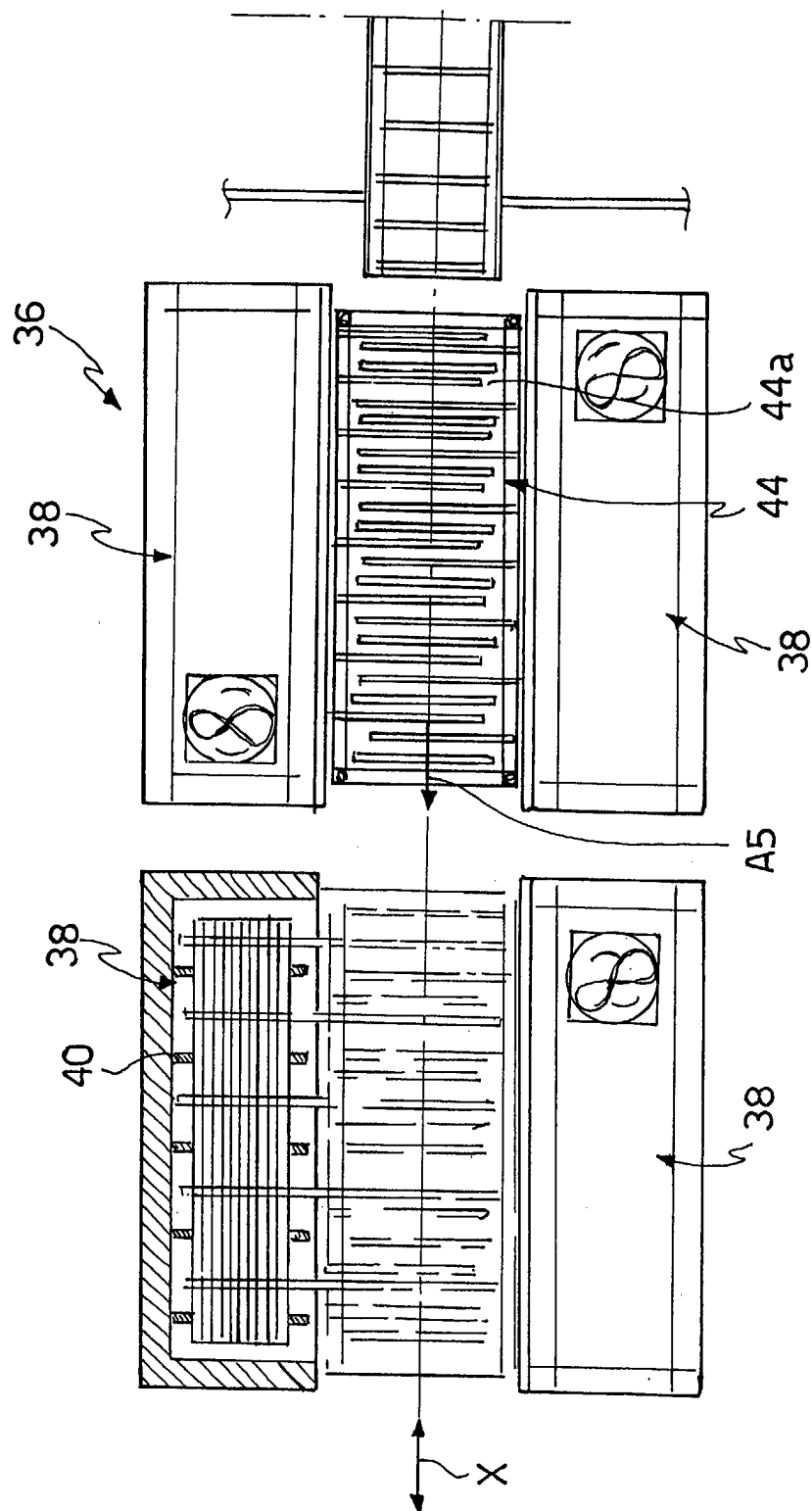


FIG. 6

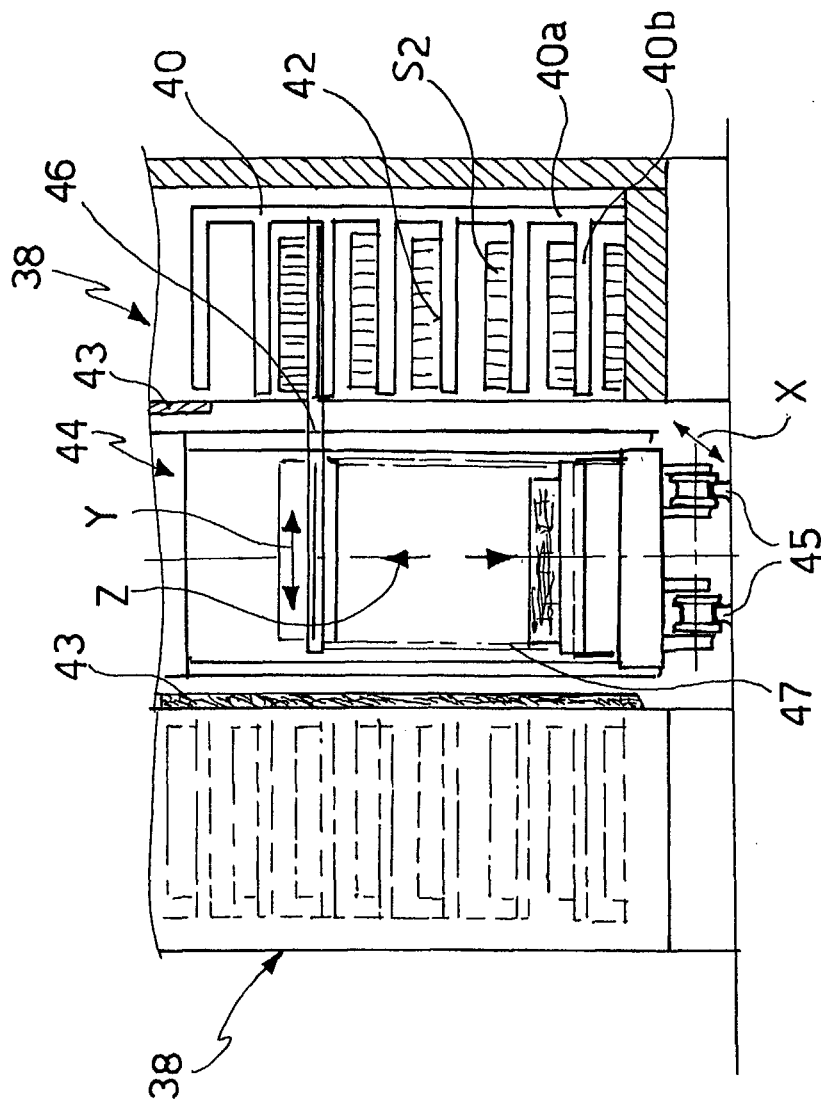


FIG. 7

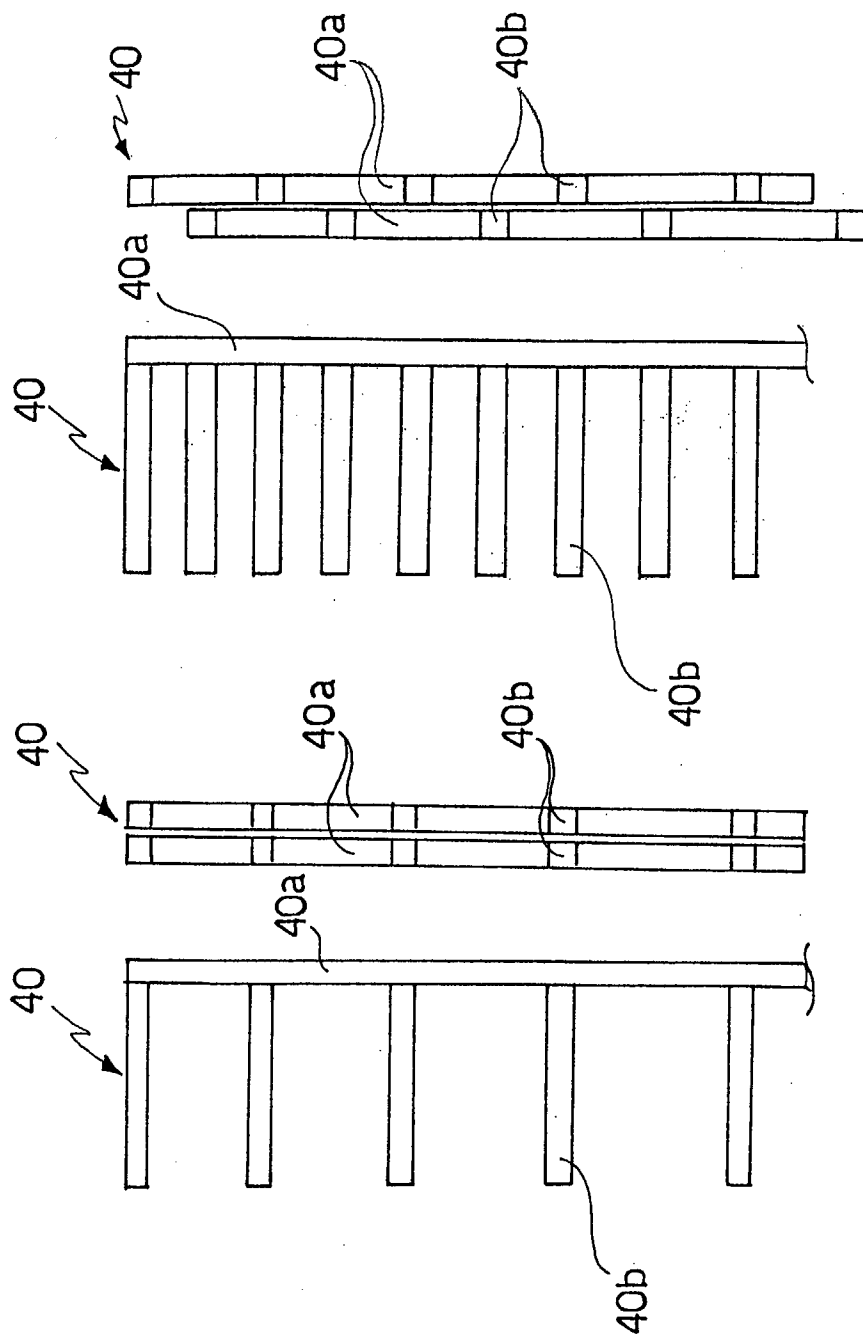


FIG. 7a FIG. 7b FIG. 7c FIG. 7d

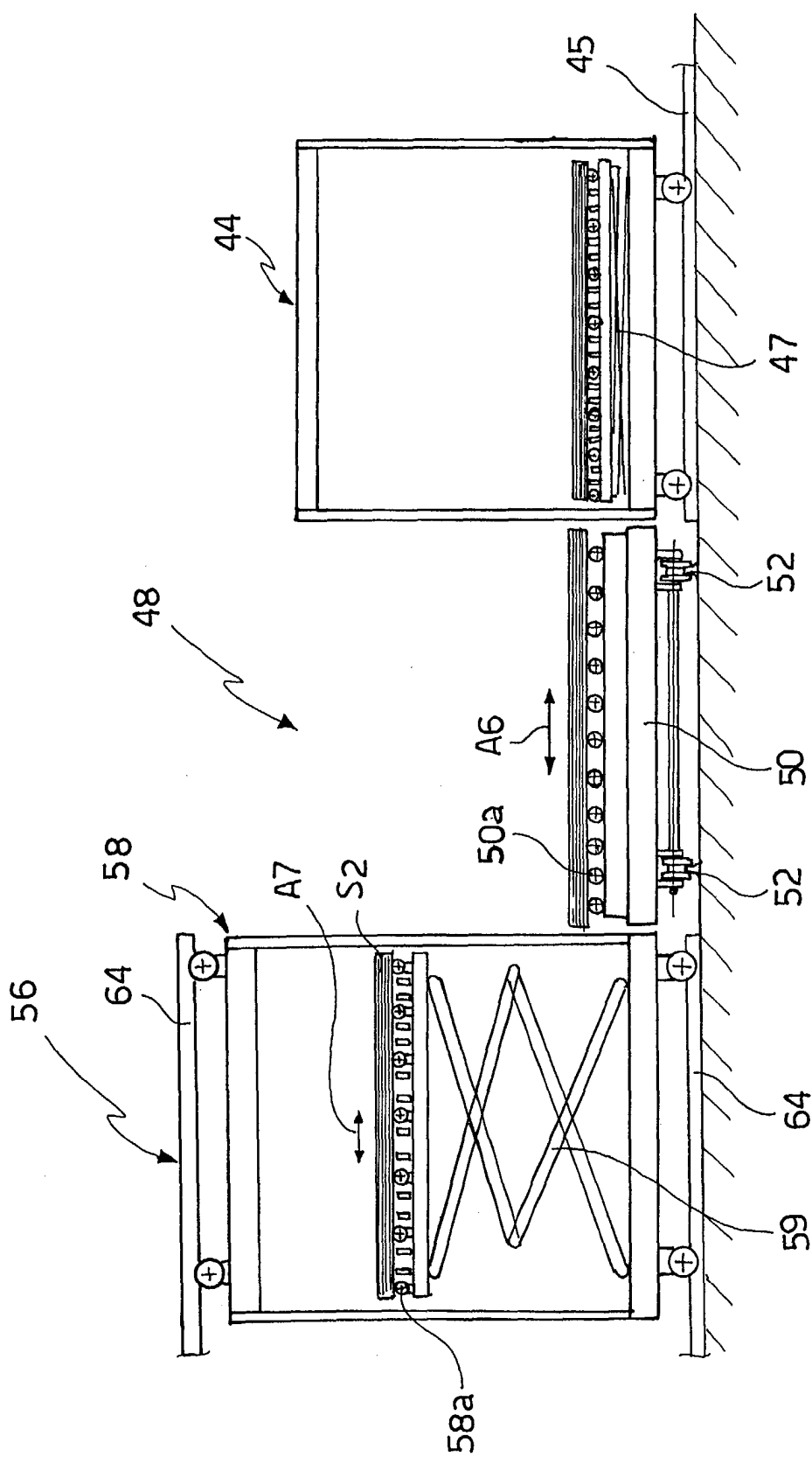


FIG. 8

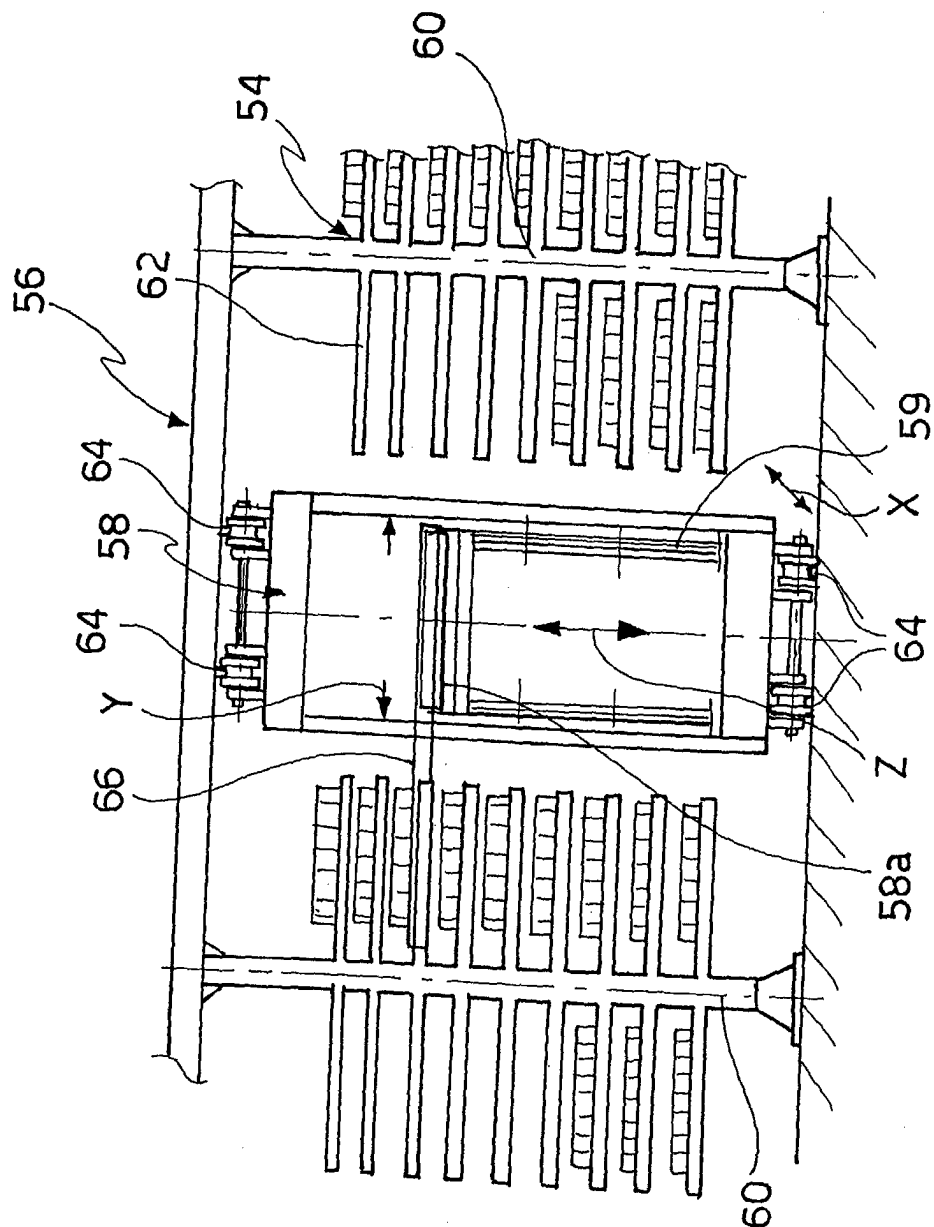


FIG. 9

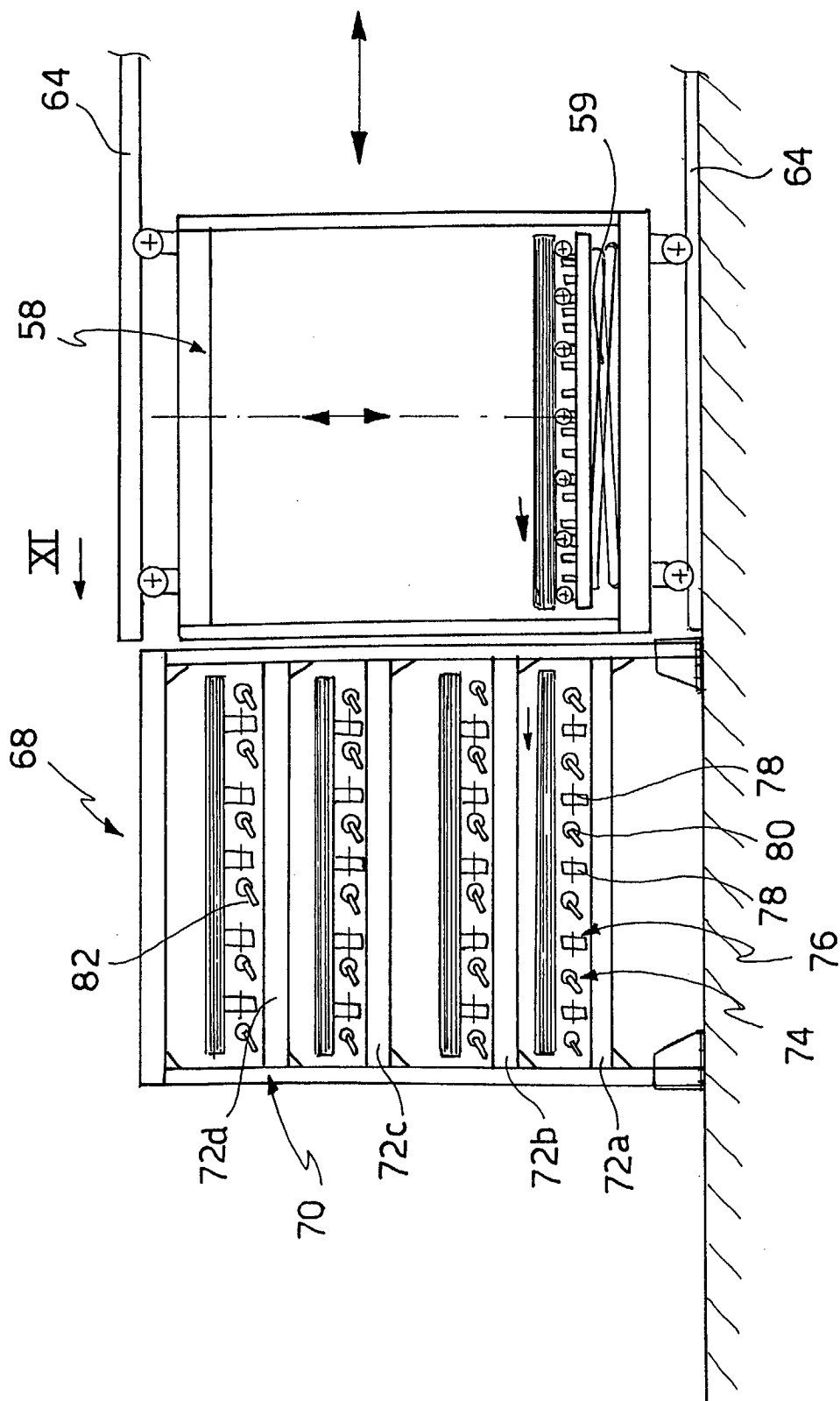


FIG. 10

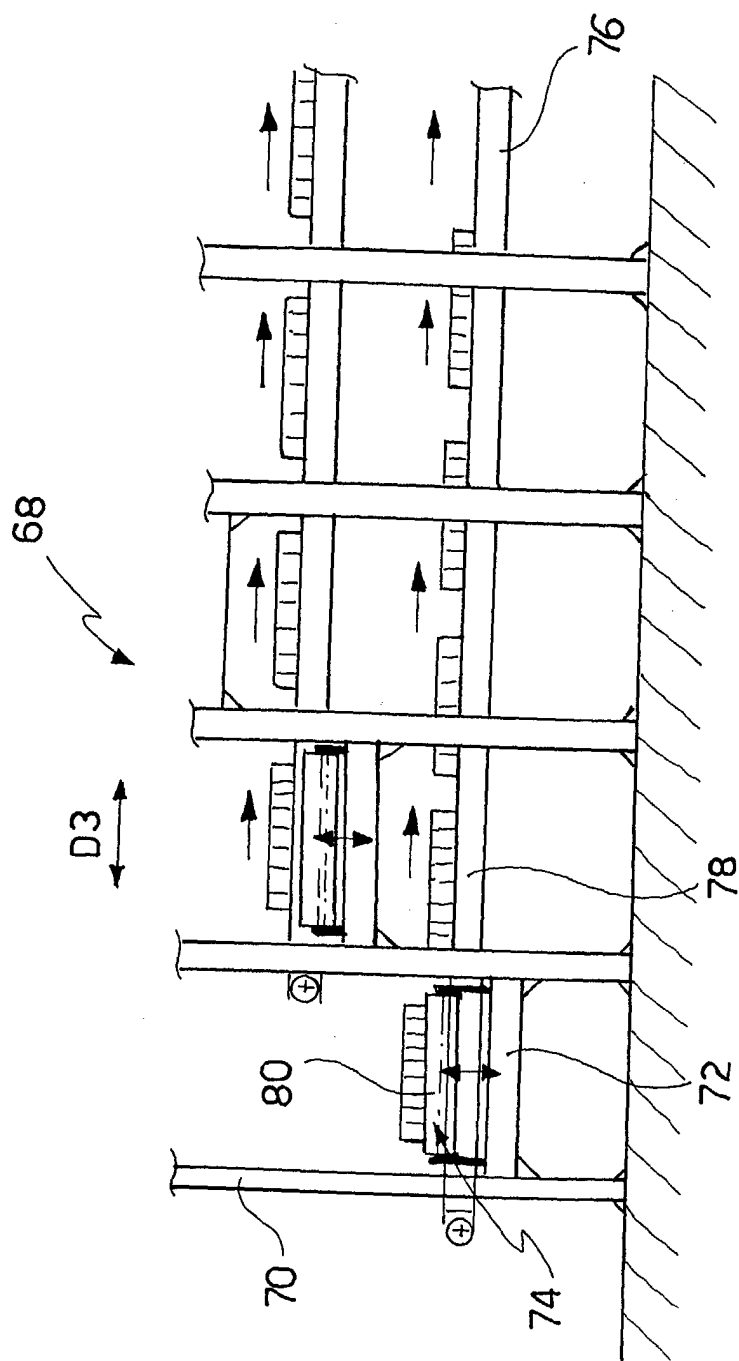


FIG. 11

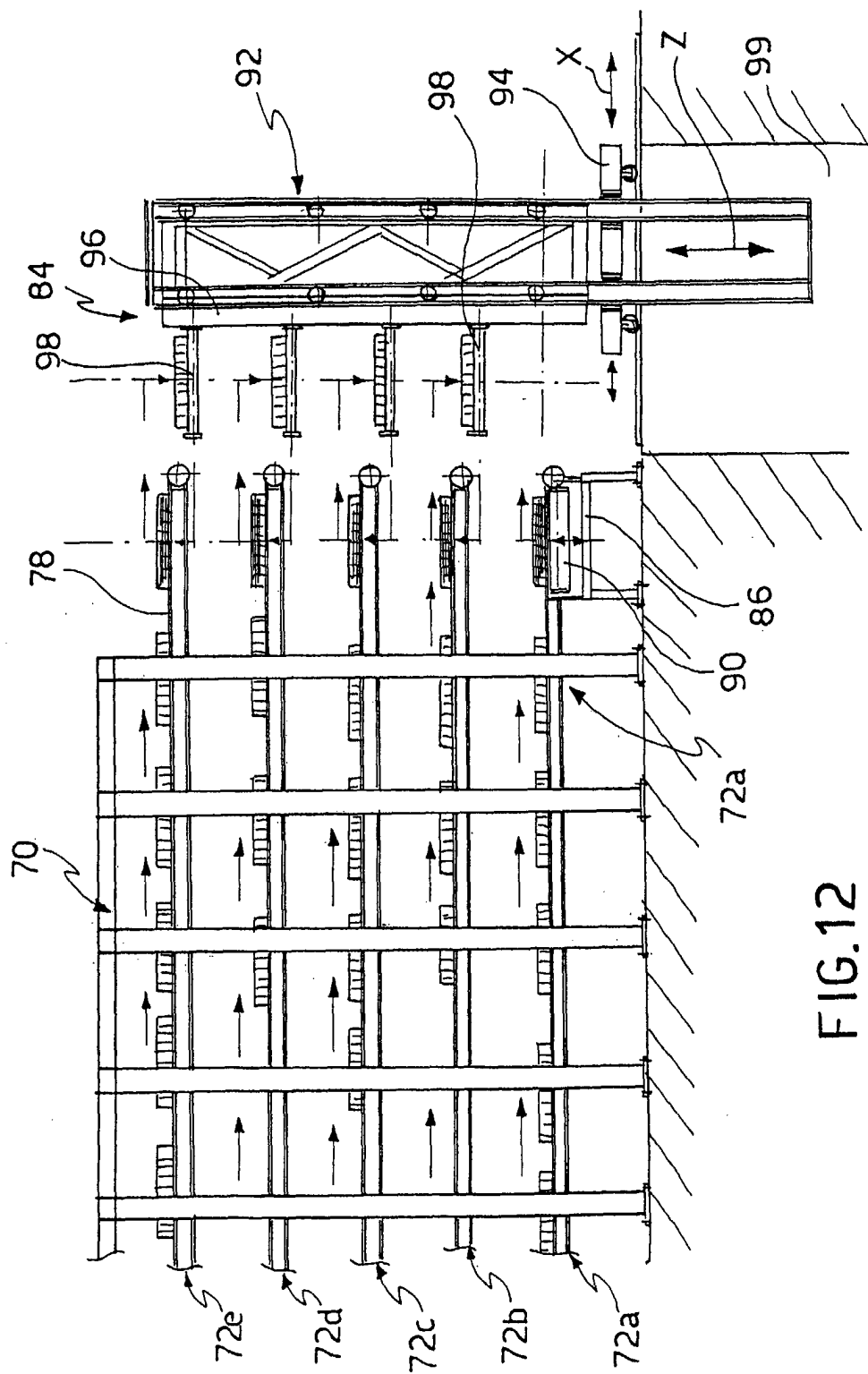
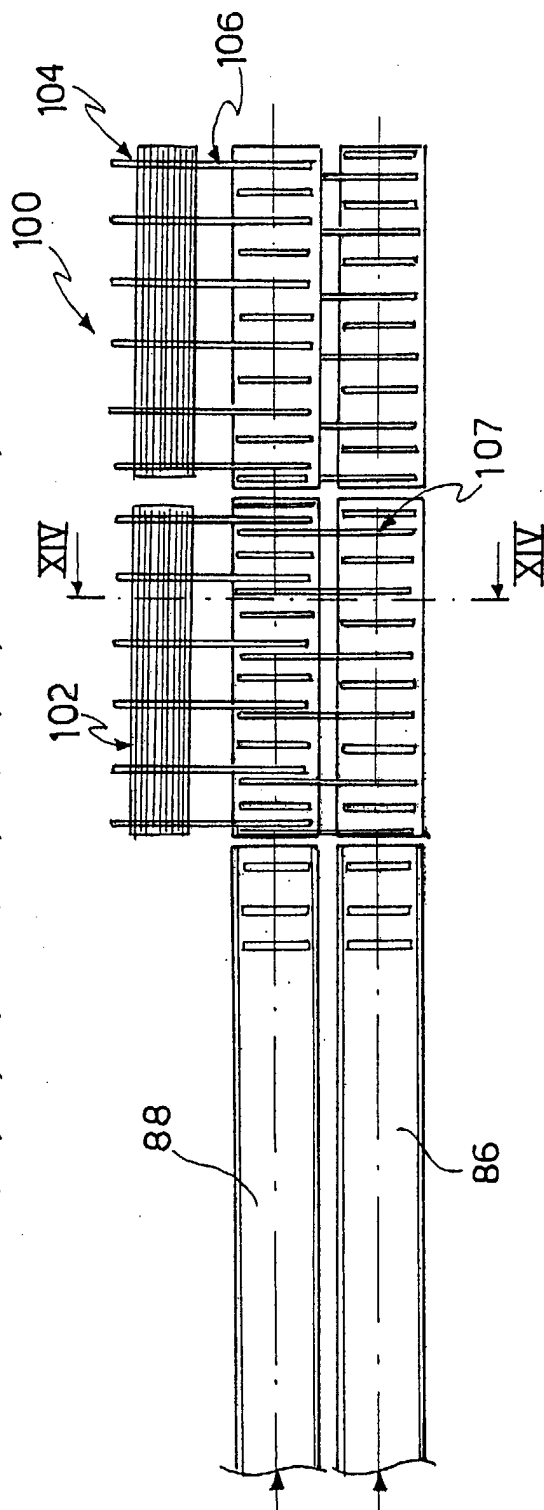
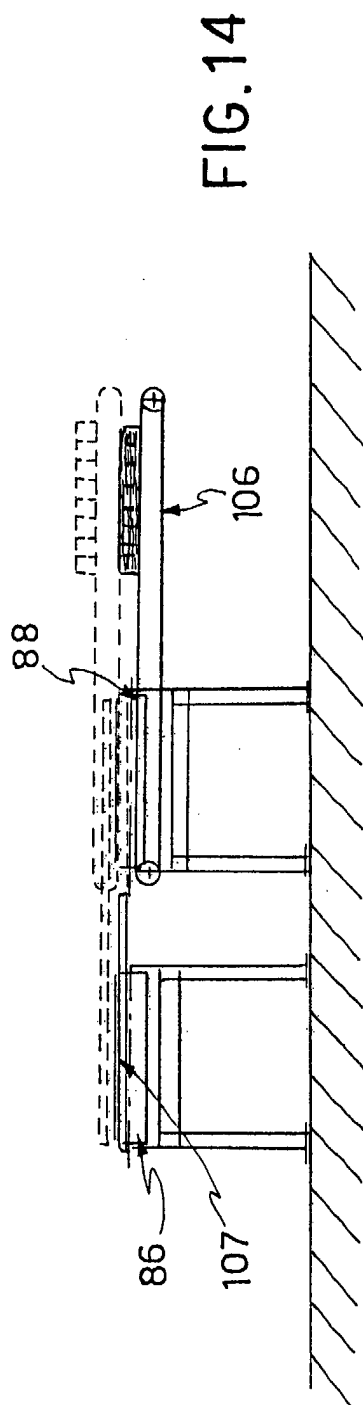
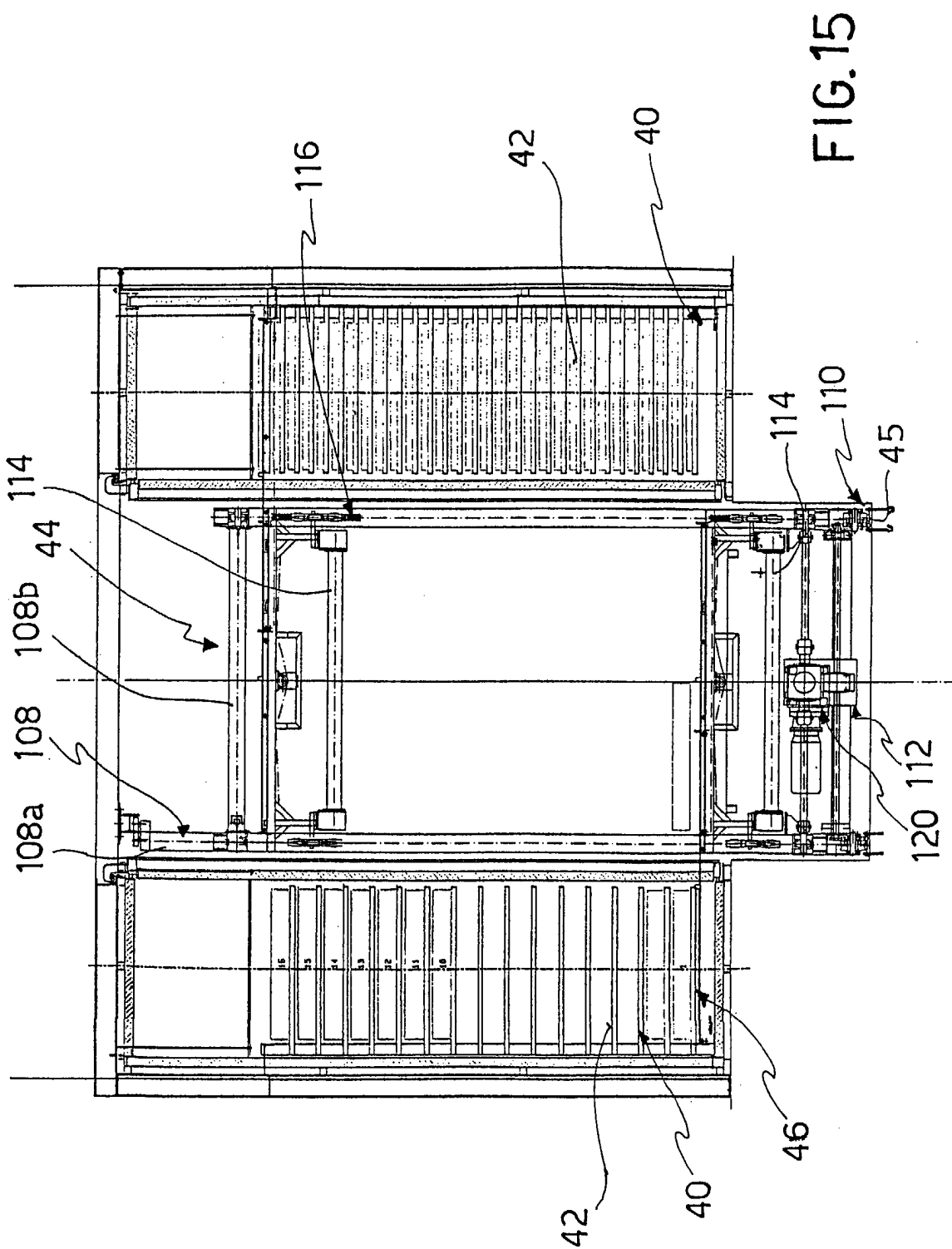


FIG.12





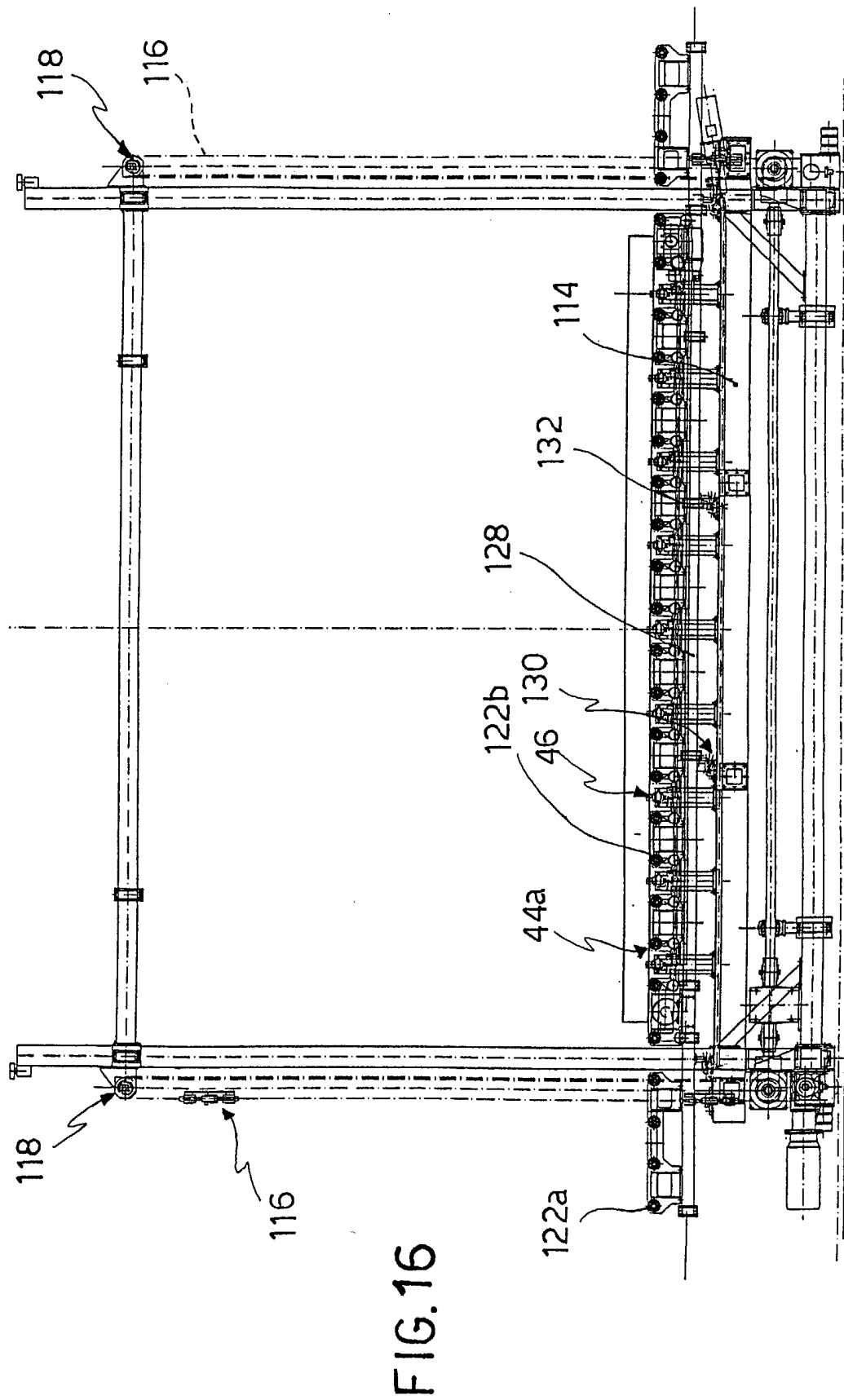


FIG.17

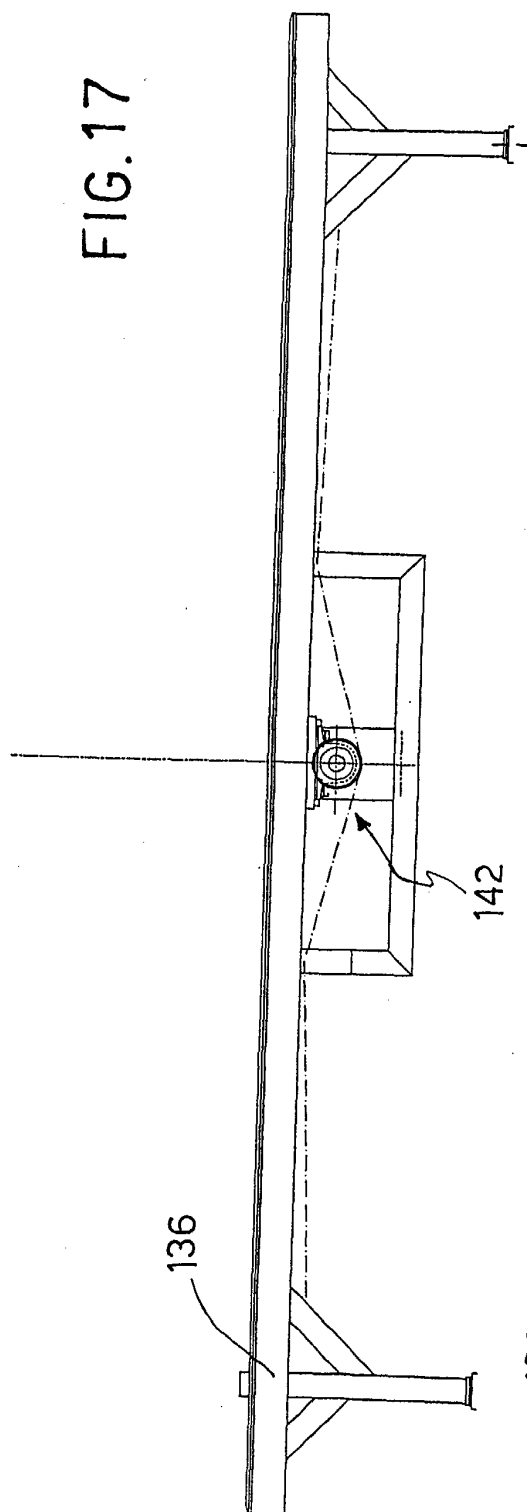
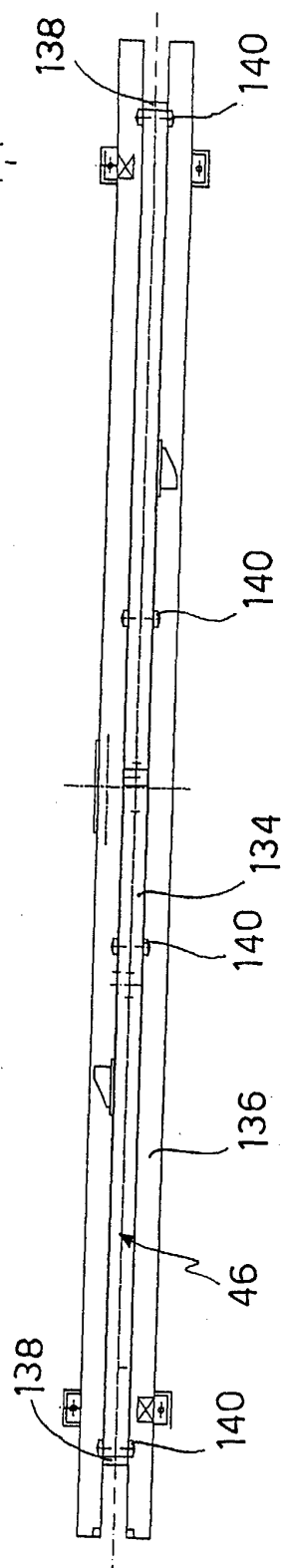
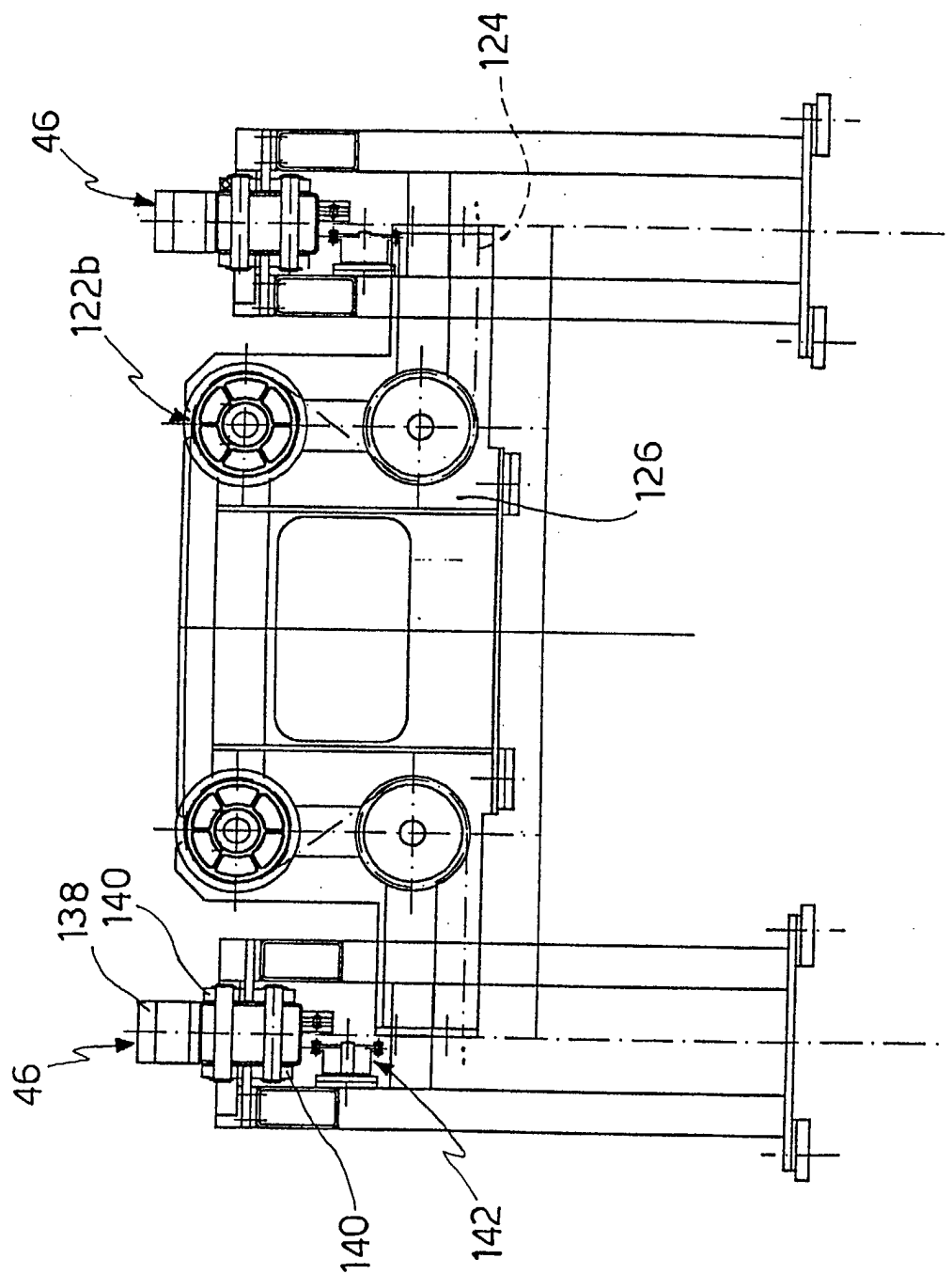


FIG.18







European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5239

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 529 486 A (BRICMONT FRANCIS H) 25 June 1996 (1996-06-25)	1,2,4,6,8	C21D9/00 F27B17/00 F27D3/00
Y	* column 6, line 40 - column 7, line 35; figure 7 *	5,7	
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	* column 1, line 26 - line 55; figure 1 *		

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	* column 2, line 16 - line 23; figures 1-3,8 *		

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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 5 September 2003	Examiner Lilimpakis, E
CATEGORY OF CITED DOCUMENTS		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	
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			

EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 03 42 5239

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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