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(54) Apparatus for preparing used paving bricks for reuse

(57) Apparatus for preparing used paving bricks for reuse, comprising a feed station (1, 101). The feed station comprises a conveyor belt (2, 102) and a shaking trough (3, 103) in alignment therewith, which defines a number of openings (6, 106) for passing the paving bricks. Aligned with each opening is a guide element (9, 9') for guiding the paving bricks falling down through the openings. The guide elements give way to a vibrating table (10, 110), which is positioned below the conveyor belt (2, 102), and includes a number of horizontal tracks for guiding and transporting the paving bricks in a direction opposite to that of the conveyor belt. Downstream of the feed station the apparatus includes one or more processing and checking stations. Processing stations include a cleaning section (120), a brick rotating unit (199) and any one of at least a first robot arm (118), a second robot arm (124), a pick-up table (231) and a draw out platform (145). Checking stations include a weight checking and monitoring station (122).

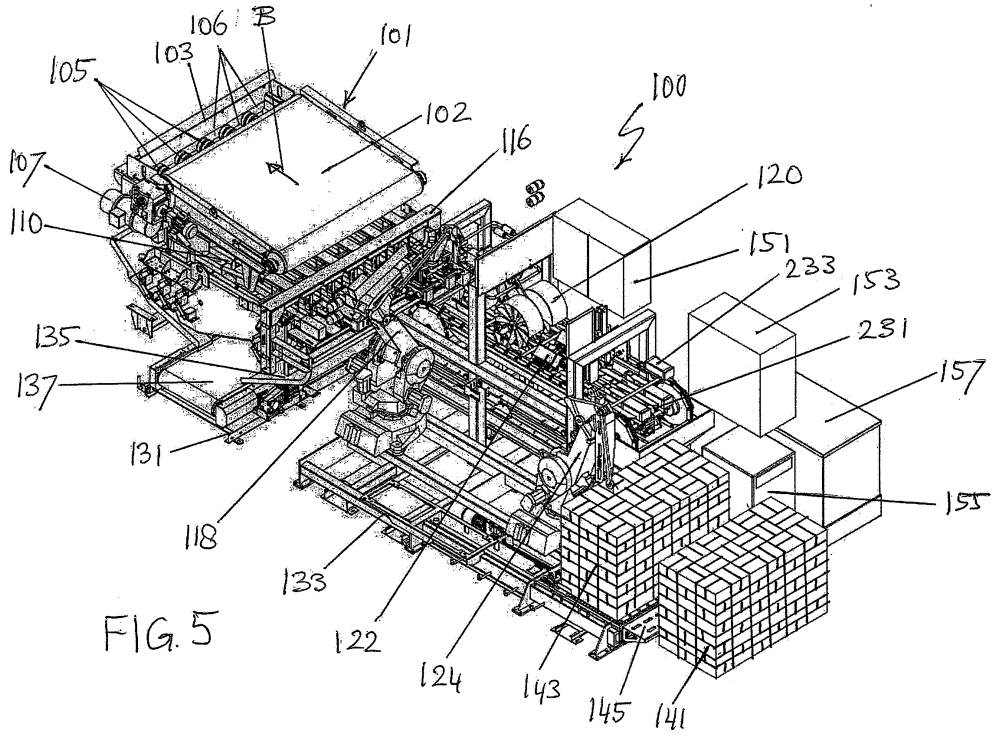

FIG. 5

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Description

[0001] The present invention relates to an apparatus for preparing used paving bricks for reuse. In particular, the present invention relates to an apparatus for cleaning, checking, sorting and stacking used paving bricks. Such apparatuses are known per se in the art, which known apparatuses, however, are very complicated and voluminous.

[0002] The object of the present invention is to provide an apparatus for preparing used paving bricks for reuse that is very compact, more specifically such that this apparatus can be wholly included in a standard container. This provides the important advantage that with conventional means the apparatus can be placed there where the used bricks are taken from the street. Thus, the used bricks can be fed directly into the apparatus and thereupon, after undergoing the necessary processing operations, be re-placed in the street again, for instance with a paving machine known per se.

[0003] Such apparatuses for preparing paving bricks for reuse generally comprise a number of stations, which are consecutively traversed by the paving bricks. Thus, such an apparatus generally comprises a feed station, where the used paving bricks are fed batchwise to the apparatus by a shovel or the like, and the bricks are thereupon sorted and arranged for processing in following stations, such as, for instance, a cleaning station, a checking station, and a stacking station.

[0004] An important cause of the voluminous structure of the known apparatuses is the construction of the feed station of the apparatus, which takes up much space.

[0005] It is therefore an object of the present invention to provide an apparatus for preparing used paving bricks for reuse, having at least a feed station, which feed station has a compact and efficient structure.

[0006] A next object of the present invention is to provide a feed station in which the used paving bricks are stripped of any coarse dirt, the bricks not suited for reuse are substantially removed, and the bricks are consecutively presented to consecutive processing stations.

[0007] Generally it is thus an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art. It is also an object of the present invention to provide alternative structures which are less cumbersome in assembly and operation and which moreover can be made relatively inexpensively. Alternatively it is an object of the invention to at least provide the public with a useful choice.

[0008] These objects are achieved, according to the invention, with an apparatus that includes the features set forth in claim 1. As the conveyor belt and the vibrating table are situated substantially vertically above each other, in a horizontal direction a particularly compact feed station is obtained, so that the total apparatus for preparing used paving bricks for reuse can be included in a standard container, and hence is easily movable, so that it can always be set up at the site of use. Moreover, the combination of shaking trough and vibrating tracks provides the possibility of removing the coarse dirt and faulty bricks.

[0009] Other efficient features and variants are set forth in claims 2-19.

[0010] The invention is further elucidated with reference to the accompanying drawings schematically representing the feed station of an apparatus for preparing paving bricks for reuse, wherein:

Figure 1 shows a schematic side view of the feed station according to the invention;
Figure 2 is a schematic front view of the feed station of Figure 1, without vibrating table;
Figure 3 is a schematic top plan view of the feed station of Figure 1;
Figure 4 is a top plan view of the vibrating table of the feed station of Figure 1;
Figure 5 is a perspective view of the entire apparatus for preparing used paving bricks for reuse, but without the standardized container in which it can be accommodated;
Figure 6 shows an alignment and sorting station for rejecting damaged or incompatible brick sizes;
Figure 7 shows a detail of a first robot for transferring aligned and sorted bricks to cleaning and weighing stations;
Figure 8 in side elevation shows the cleaning and weighing stations;
Figure 9 in cross section shows one of the weighing stations and a brick monitoring provision contained therein;
Figure 10 shows a brick rotating station; and
Figure 11 shows a second robot for forming stacks of reusable bricks.

[0011] Figure 1 schematically shows a feed station 1 for an apparatus for preparing used paving bricks for reuse, which apparatus generally comprises a number of consecutive processing stations, such as a cleaning station, a checking station, a stacking station. The feed station described here is in fact the first station of the apparatus, where the used paving bricks are supplied, are sieved, sorted, and are presented to the next processing station of the apparatus.

[0012] As can be seen in Figures 1-3, the feed station comprises a feed hopper 1, whose bottom is formed by a conveyor belt 2 passed over first and second rollers 2a and 2b and intermittently driven in the direction of the arrow A. With the aid of a shovel for instance, used paving bricks are dumped into the feed hopper 1 and end up on the upper belt part of the conveyor belt 2. Through the intermittent drive, the paving bricks are carried along by the conveyor belt in a dosed manner and at the end of the belt fall down into a shaking trough 3, arranged at an end of the conveyor belt, slightly under an end thereof. To obtain a gradual supply of paving bricks into the shaking trough 3, the conveyor belt in the direction of transport

runs upwardly to some extent, preferably inclined at an angle of approximately 5°. This means that the second roller 2b is situated slightly higher than the first roller 2a, which is not visible in the drawing.

[0013] The shaking trough 3 comprises a rectangular frame 4, which is open at the top and at the bottom, which frame extends in longitudinal direction throughout the width of the conveyor belt. Arranged in the frame at uniformly spaced intervals are a number of freely rotating rollers 5, which are perpendicular to the longitudinal direction of the frame and, with the two end walls of the frame, form a number of elongate openings 6 (Fig. 3). In the embodiment shown, five freely rotating rollers 5 are present, thus jointly defining six openings 6. Each roller actually comprises five discs, which are arranged next to each other on a common shaft so as to rotate freely, each disc made from a rubber-like plastic material, such as an elastomeric material. The purpose of the shaking trough 3 is to orient the paving bricks in the longitudinal direction and further it performs a coarse sieve function. This is to say that paving bricks falling into the shaking trough are oriented by the elongate openings 6 and the sand and gravel carried along by the paving bricks will fall through the trough to be discharged. Any large pieces, such as curbstone and tiles, will not get beyond the freely rotating rollers and be suitably removed here. The shaking trough 3 is connected with two vibrating motors 7 and 8, which cause the shaking trough to vibrate with a vertically directed amplitude.

[0014] The paving bricks falling into the shaking trough are thus oriented by the rollers 5, in that the paving bricks can move down, in the longitudinal direction, parallel to the rollers 5, through the openings 6. At the underside of each opening 6, a guide element in the form of two parallel sliding rods 9, 9' are mounted, which, from the side of the frame 4 remote from the conveyor belt 2, extend downwards through substantially a quarter of a circular arc in the direction opposite to the direction of transport of the conveyor belt. Alternatively these sliding rods 9, 9' may also take the form of straight bars at an inclined angle. The bricks falling through each opening 6 are thus captured between the two sliding rods 9; 9' associated with this opening and, with maintenance of the orientation, are passed to a substantially horizontal vibrating table 10 aligning with the sliding rods.

[0015] The vibrating table 10 in fact comprises a substantially horizontal platform 11, on which platform, next to each other, a number of tracks have been formed, the number of tracks corresponding to the number of openings 6 of the shaking trough 3, such that each track of the vibrating table aligns with two sliding rods 9, 9'. The vibrating table 10 includes two vibrating motors 12, which cause the horizontal platform 11 to vibrate with a substantially horizontal amplitude. Each track of the platform 11 is formed by rods 13, 13' extending generally parallel at a distance from each other and at some distance above the surface of the platform 11 and, with some clearance, aligns with the sliding rods 9, 9' (Fig. 4). The paving bricks supplied by the sliding rods 9, 9' are thus transferred to the rods 13, 13' of the track of the vibrating table.

[0016] As can be seen more clearly in Fig. 4, the distance between the two rods 13, 13' of each track of the vibrating table initially increases gradually from the sliding rods 9, 9'. The paving bricks supplied on the sliding rods lie in longitudinal direction on these two sliding rods and in this position are transferred onto the rods 13, 13' of the track of the vibrating table. Due to the increasing distance between the rods 13, 13' of the track of the vibrating table, the paving brick gradually comes down between these rods, until it comes to rest by the narrow longitudinal side thereof on the platform 11. The distance between the rods of the track of the vibrating table thereupon does not diverge further and the rods 13, 13' continue parallel to one another, so that the paving bricks resting on the platform are centered and aligned by the two rods 13, 13'. The platform is of open design up to the point where the bricks come down between the sliding rods and come to rest on the platform, so that dirt having come off the bricks as a result of vibration can fall down through the platform and be discharged via a subjacent discharge belt.

[0017] At the end of each track of the vibrating table, there is a discharge flap 14, which is not connected with the vibrating table and hence does not vibrate. At its end adjacent the vibrating table, the discharge flap is provided with a horizontal pivot 15, about which this discharge flap can tilt down under the action of an actuator, so that the paving brick resting on it falls down (Fig. 1). An actuator for the discharge flap 14 is not shown in Figure 1, but is generally conventional. At the end of the track on the platform 11, the centered and aligned paving brick comes to rest on this discharge flap. From this discharge flap, the paving brick is then picked up by a robot arm, such as will be described herein below, and transferred to a next processing station. If this robot arm is unable to pick up the paving brick, for instance when the robot arm cannot draw sufficient vacuum because the brick is damaged too much or still soiled too much, a signal is delivered to actuate the discharge flap 14. The discharge flap then tilts about the pivot 15, such that the paving brick falls down and via a discharge conveyor, or the like (not shown, but conventional), is discharged as being unsuited for reuse. Preferably however the detection of damaged bricks is effected by sensors on the structure that carries the discharge flaps 14. The structure carrying the discharge flaps 14 may take the form of a sorting station as will be described in more detail herein below. Rather than using a suction gripper on the robot arm, this can also conveniently be equipped with a mechanical gripper, as will be further described herein below.

[0018] The apparatus and the consecutive steps it processes will now be further described in reference to Figures 5 to 11. In Figure 1 there is illustrated an overview of an entire apparatus 100 according to the invention, including feed station 101 with conveyor belt 102, sorting station 116, a first robot arm 118, cleaning section 120,

weight checking and monitoring station 122 and second robot arm 124 representing the stacking station. In as far as the feed station 101 is concerned similar reference numerals will be used, only differing a full "100" from those used in reference to Figures 1 to 4. Figure 5 further shows that the apparatus 100 has a first frame 131 and a second frame 133. The first frame 131 generally supports a transverse discharge conveyor belt, such as 137, and can also be adapted to support the feed station 101 and the sorting station 116. With the apparatus accommodated in a standard shipping container, as is preferred, the feed station 101 and the sorting station 116 may also conveniently be supported directly, or indirectly, from the container walls. The container walls may be reinforced for this purpose. The second frame 133 supports the first and second robot arms 118, 124 and the cleaning and checking stations 120, 122. In use, the first and second frames 131, 133 will be mounted on the floor of a standard size shipping container. Bricks, such as previously used paving bricks, are supplied batchwise to the conveyor belt 102, which moves generally in the direction of arrow B, towards shaking trough 103. The shaking trough 103 has already been described in detail in reference to Figures 1 to 4 and has a plurality of freely rotating rollers 105 defining openings 106 therebetween, for the passing of paving bricks. Large paving elements such as kerb stones will not pas through the openings 106 and can be removed. The paving bricks passing through the openings 106 are guided onto a vibrating table 110, which is positioned subjacent the conveyer belt 102. The shaking trough 103 is set into a vibrating movement by oppositely disposed vibrating motors 107, of which the one on its nearside is visible in Figure 5. The vibrating table 110 includes a plurality of aligning tracks which correspond in number to the number of openings 106 in the shaking trough 103. In the present example there are six such tracks. Each of the aligning tracks ends at the sorting station 116, which is mounted on the first frame 131 separate from the vibrating table 110, but has individual sections corresponding with each of the tracks of the vibrating table 110 to receive each of the paving stones transported thereby. The sorting station 116 includes tilting discharge means, such as the pivoted flaps 14 of Figures 1 to 4, to intercept and discharge damaged or otherwise unusable bricks. For its discharge the sorting station is provided with a shute 135, which leads onto a transverse discharge conveyor belt 137. It is further seen in Figure 5 that the second robot arm 124 stacks the bricks that have been released by the cleaning and checking stations 120, 122 into organized stacks 141, 143. As illustrated the stack 143 is being finished while the stack 141 represents a previously finished stack ready to be collected. The stack 143 is formed on a draw out platform 145, which can move the stack 143 into the position of the stack 141 at a position outwardly of the container in which the apparatus 100 is positioned. There it will be in easy reach of a forklift truck or like transport equipment. This external pick-up position will also ensure that such transport equipment may not cause damage to any parts of the apparatus 100. It will further ensure that forming of the next stack is not delayed by the finished stack not being transported away. Formation of a next stack of bricks will be programmed to commence only after the draw out platform 145 has returned to its initial position. The internal space of an accommodating container (not shown, but conventional) which is not necessary for the mechanical components of the apparatus 100 can be occupied by cabinets 151, 153 for housing the electrical and pneumatic control means of the apparatus 100. A cabinet 155 is reserved to accommodate an air compressor. It is optionally also possible to include an electric power generator 157 for powering the apparatus independently of an electric mains supply.

[0019] In Figure 6 the sorting station 116 is shown in greater detail, and is seen to include a mounting frame 161. The mounting frame 161 has a plurality of cover plates 163, corresponding with the tracks on the vibrating table 110 and extending over these tracks. Mounted on these plates are sensors (not shown, but conventional) to detect the presence of bricks in the relevant tracks. Bricks such as the bricks 165, 167 thus enter the sorting station 116 in the direction of arrow C and are received on tiltable supports 114 against a forward aligning plate 169. Further sensors 171 are positioned adjacent each tiltable support 114 to detect faulty or defective bricks 165, 167. In accordance with the detected sensor signals the tiltable supports 114 can be operated to support a brick 167 for transfer into the cleaning station or for discharge of an incompatible brick by tilting downwardly and allowing the brick to be discharged via the shute 135 onto the discharge conveyor belt 137.

[0020] Figure 7 shows a transfer gripper 175 of the first robot arm 118. It is seen to hold two bricks 165A, 165B. Two more bricks 165C, 165D may still be on a relevant support 114 of the sorting station 116, to await being picked up in a next movement of the first robot arm 118. The transfer gripper 175 has a gripper frame 177 onto which pneumatic clamping actuators 179 are mounted. Further pneumatic actuators 180 are positioned on the transfer gripper to individually lower the respective gripper frame for either one of the bricks 165A or 165B. This allows the transfer gripper 175 to pick-up the bricks individually from the sorting station. As a result there is no delay in the operation of the first robot arm 118 whenever there are not two bricks side-by-side on the sorting station 116. This can happen when bricks have just been rejected. In this case the gripper 175 is controlled to ignore the tiltable support 114 on which there is no brick to be picked up. It will then pick up a second brick from another location of the sorting station 116.

[0021] Figure 8 shows a side elevation of the cleaning station section which has two side-by-side conveying tracks onto which the first robot arm 118 transfers the bricks 165A, B. The bricks are conveyed through the cleaning section 120 by means of a transport chain 181 to both lateral sides of the cleaning section 120 (only the

near side one is visible). Extending between the opposite chain links are a plurality of transverse rods which are spaced according to the length of the bricks to push successive bricks. The cleaning section 120 has a frame 183 which supports a first rotating brush set 185. Further downstream of the cleaning section 120 the frame 183 has a first portal 187 which supports a second rotating brush set 189. The second rotating brush set 189 is provided with a counter weight 191, which as seen in Figure 8 partly overlaps with a similar counter weight of the first rotating brush set 185. The first and second brush sets 185, 189 are pivotally suspended and adapted to clean the leading and trailing faces of each brick and can move independently from one another. Also supported by the first portal 187 and positioned downstream of the second brush set is an upper brush set 193 and a lower brush set 195 for cleaning all longitudinal faces of the bricks passing between the upper and lower brush sets 193, 195. The upper and lower brush sets 193, 195 are similarly counterweighted as the first and second rotating brush sets 185, 189. The bricks between the transverse rods of the transport chain 181 are supported in an inclined position on parallel guide rails. One guide rail supports a longitudinal side face of a brick and the other of the pair of parallel guide rails supports either a bottom or top face of the same brick. As a result of this inclined position the upper brush set 193 contacts both a longitudinal slide face and a top or bottom face of each brick. The same is true for the lower brush set 195 so that the two facing brushes together clean all of the longitudinal faces of a brick passing therebetween. Treating the bricks in this orientation substantially simplifies the arrangement of the rotating brushes and keeps their rotating shafts parallel to the machine frame. Directly downstream of the upper brush set 193 is positioned the weight checking and monitoring station 122. The weight checking station 122 will be discussed in more detail in reference to Figure 9. Again downstream of the weight checking station 122, the cleaning section 120 has a second portal 197, which carries a brick rotating unit 199 that will be described in reference to Figure 10.

[0022] Reverting now to Figure 9, there is shown in cross-section, the weight checking station 122. The weight checking station 122 has a base support 201 by which it attaches to the frame 183 of the cleaning section 120. A cradle 203 is pivotally supported on the base support 201 by a pivotable arm 205. The cradle 203 has a plurality of upwardly and inwardly facing support rollers 207 which support a brick 165E in an inclined position from a longitudinal side-face and a longitudinal bottom-face 166. It is also important to notice in the cross-sectional view of Figure 9 that the brick 165E ha a longitudinal top face 164, which is separated from the longitudinal side- faces by facetted edges 168 at both longitudinal sides. A first thing that the weight checking station 122 monitors is the weight of the brick which for a reusable and cleaned brick can be predefined between relatively narrow limits. A concrete paving brick of 214x105x80 mm will typically have a weight in the region of 4 kg. The weight is detected by the resilient deflection of the pivotable arm 205 by means of a sensor suitable for that purpose. The brick to be weighed will be transferred by the transport chain 181 from the parallel guide rails onto the support rollers 207 of the cradle 203. After this the transport chain 181 will be halted and the weight sensor value will be communicated to the electrical control means. Another thing that the weight checking station 122 monitors is the position of the paving brick. The inclined position of the bricks in the cleaning section 120 is irrespective of whether the top face 164 of the bricks is facing upwardly or downwardly. To detect the position of the top face 164 of each brick the cradle 203 is additionally provided with an edge sensor 209. This edge sensor 209 can distinguish the edge between a bottom-face 166 and a longitudinal side-face by being depressed downwardly. When a facetted edge 168 would be facing the edge sensor 209, it would not be depressed downwardly and this would then determine that a top face 164 of a brick would be facing downwardly. Again the relevant signal is communicated to the electrical control means and stored for later use. After the weight sensor and the position sensor 209 have finished their jobs the brick 165E will be transported further by the transport chain 181 towards the second portal 197 (see Figure 8). Between the weight checking station 122 and the second portal 197 the brick will be allowed to return to a non-inclined horizontal position. This horizontal position can be either with the top face 164 or the bottom-face 166 facing downwardly. The only fixed parameter is that the bricks are all rotated in the same direction from the position they had in the weight checking station 122. The thus repositioned bricks will be advanced into the brick rotating unit 199, which is illustrated in Figure 10.

[0023] It is seen in Figure 10 that that the brick rotating unit 199 includes a bracket 211 by which it is supported from the second portal 197. For clarity, the portal is deleted in Figure 10. The bracket 211 supports a pneumatic actuating cylinder 213 which can lower and raise a clamping frame 215. The clamping frame 215 has a centrally arranged rotary drive unit 217, which defines first and second brick accommodation spaces 219, 221 on either lateral side thereof. On opposite outer legs of the clamping frame 215 are positioned first and second clamp actuators 223,225 that are facing the central rotary drive unit 217. When lowered by the actuating cylinder 213 the bracket frame 215 coincides with the two side-by-side transporting tracks of the bricks in the cleaning section. The first and second clamping actuators 223, 225 can be operated individually or simultaneously in accordance with the brick position data saved by the electrical control means. If any of the bricks within reach of the brick rotating unit has been detected to be upside-down, the relevant clamp actuator 223, 225 will be activated and clamp the upside-down brick 165F against the central rotary drive 217, which has a rotatable pad for frictionally engaging a longitudinal side-face of a brick. As illustrated

in Figure 10, the brick rotating unit has clamped brick 165F between its first clamp actuator 223 and has returned to its raised position. In this position the relevant output of the rotary drive 217 is activated and the brick 165F is rotated through 180° into its upright position with its top-face up. Thereafter the actuating cylinder 213 is activated to lower the brick 165F back in position on its track of the conveyor chain 181. To increase the speed of the apparatus, it is only necessary that the electrical control means rotate bricks that have been recorded with a proper weight by the brick monitoring unit 122. After the brick rotating unit 122 has had an opportunity for action, the transport chain 181 will advance two bricks side-by-side to a pick-up table 231 (see Figures 5 and 8). The pick-up table 231 is within reach of the second robot arm 124, but the robot arm 124 will be programmed to collect only those bricks that have been approved by the checking station 122. The rejected stones, which are thus not collected from the pick-up table 231 will eventually fall off the end of the conveying surface with a next conveying step of the transport chain 181. Whenever a brick has been recorded by the brick monitoring unit 199 that is outside the predefined weight range the second robot arm 124 will ignore this rejected brick. The rejected brick will thus subsequently be discharged on a subjacent conveyor belt running in an opposite direction (not shown, but conventional) to be further discharged via transverse conveyor belt 137. Alternatively the pick-up table 231 may also be provided with individual swivable support flaps similar to the flaps 14 and 114 at the end of the vibrating table 10, 110. From the pick-up table 231 the second robot arm 124 will in principle be adapted to pick-up two bricks side-by-side and stack these in a predefined pattern, except when one or both bricks in the pick-up position have been disqualified.

[0024] As seen in Figure 11 the second robot arm 124 is provided with a suction gripper 241. The suction gripper 241 includes first and second suction pads 243,245 which are each supported from first and second vertical actuating cylinders 247,249 and corresponding suction pads 243, 245 can be operated individually by the electrical control means.

[0025] However the movement of the second robot arm 124 from the pick-up to the stack 143 will only be enabled by the electrical control means if two bricks are held by the suction gripper 241. To achieve this measure of efficiency the pick-up table 231 is provided with an auxiliary tray 233 which under all circumstances will be required to have one extra brick in store. The electrical control means will be programmed, or otherwise arranged, to detect that one of the two side-by-side bricks on the pick-up table 231 has been rejected and direct the second robot arm 124 to pick-up a second brick from the auxiliary tray 233. Conversely if only one brick is available on the pick-up table 231 and the auxiliary tray 233 is detected to be empty, then the robot arm 124 will be directed to place the one brick from the pick-up table 231 onto the auxiliary tray 233. The second robot arm 124 will then skip a stacking movement and await for the next two bricks to arrive at the pick-up table. It will be apparent to the skilled person that the movement of the second robot arm 124 and the actuating of its suction gripper 241 can be programmed by the electrical control means to stack in any desired relative arrangement or pattern, including specific brick laying patterns for pavement.

[0026] It is thus believed that the operation and construction of the present invention will be apparent from the foregoing description. To the skilled person in this field of the art it will be clear that the invention is not limited to the embodiment represented and described here, but that within the framework of the appended claims a large number of variants are possible. Also kinematic inversions are considered inherently disclosed and to be within the scope of the present invention. The terms comprising and includeing when used in this description or the appended claims should not be construed in an exclusive or exhaustive sense but rather in an inclusive sense. Expressions such as: "means for ..." should be read as: "component configured for ..." or "member constructed to ..." and should be construed to include equivalents for the structures disclosed. The use of expressions like: "critical", "preferred", "especially preferred" etc. is not intended to limit the invention. Features which are not specifically or explicitly described or claimed may be additionally included in the structure according to the present invention without deviating from its scope.

Claims

1. Apparatus for preparing used paving bricks for reuse, comprising a feed station (1, 101) for receiving the used paving bricks with downstream thereof one or more processing and checking stations, and a stacking station, where the bricks, ready for reuse, are stacked according to a desired relative arrangement,
   wherein the feed station comprises:

   - a driven conveyor belt (2, 102) on which the used paving bricks are dumped,
   - a shaking trough (3, 103) which, viewed in the direction of movement of the conveyor belt, is arranged under one end thereof and extends throughout the width of the conveyor belt, which shaking trough defining a number of openings (6, 106) for passing the paving bricks,
   - a guide element (9, 9') mounted at each opening (6, 106) of the number of openings defined by the shaking trough, for guiding the paving bricks falling down through the relevant opening,
   - a substantially horizontal vibrating table (10), which is situated at a vertical distance under the conveyor belt, and which includes a number of tracks (13, 13') corresponding to the number of

openings of the shaking trough, each track being aligned with a respective guide element of the shaking trough, which vibrating table has a direction of transport opposite to the direction of movement of the conveyor belt.

2. An apparatus according to claim 1, wherein the conveyor belt (2, 102) is intermittently driven.

3. An apparatus according to claim 1 or 2, wherein the number of openings (6, 106) in the shaking trough are defined between a number of freely rotating rollers (5, 105), whose axis of rotation extends parallel to said direction of movement of the conveyor belt.

4. An apparatus according to claim 3, wherein the rollers (5, 105) have at least a circumferential portion of elastic material.

5. An apparatus according to any preceding claim, wherein the conveyor belt (2, 102) in the direction of transport runs up obliquely through an angle of approximately 5°.

6. An apparatus according to claim 3 or 4, wherein the rollers (5, 105) of the shaking trough (3, 103) each include of a number of juxtaposed discs which are arranged on a common shaft so as to rotate freely.

7. An apparatus according to any preceding claim, wherein each guide element comprises two guide bars (9, 9') running parallel at a distance from each other.

8. An apparatus according to any one of the preceding claims 1-7, wherein the vibrating table (10, 110) includes a horizontal platform (11) and each track is formed by two bars (13, 13'), which are situated at some distance above said platform, which bars have one end aligned with the guide bars of the guide elements, thereupon diverge to some extent so that the paving bricks situated on the rods come to rest on the platform, and thereafter run parallel to one another, thereby centering the paving bricks moving between them.

9. An apparatus according to one or more of the preceding claims 1-8,
wherein the shaking trough (3, 103) with the guide elements (9, 9') attached thereto is vibrated by means of one or more vibrating motors (7, 107, 8), with a substantially vertical amplitude.

10. An apparatus according to one or more of the preceding claims 1-9,
wherein the vibrating table (10, 110) is connected with one or more vibrating motors (12), which vibrate the table with a substantially horizontal amplitude.

11. An apparatus according to one or more of the preceding claims 1-10,
wherein, viewed in the direction of movement of the paving bricks, at the end of each track of the vibrating table (10, 110), a discharge flap (14, 114) is arranged, which stands clear of the vibrating table, which discharge flap is tiltable about a horizontal axis (15).

12. An apparatus according to claim 11, wherein the discharge flap is controlled by sensor feedback, such that the flap swings down when the brick, resting on this discharge flap, has been detected as faulty.

13. An apparatus according to one or more of the preceding claims,
wherein the one or more processing stations include a cleaning section (120).

14. An apparatus according to claim 13, wherein the cleaning section (120) includes at least one pair of opposing rotating brush sets (185, 189, 193, 195).

15. An apparatus according to one or more of the preceding claims,
wherein the one or more checking stations include a weight checking and monitoring station (122).

16. An apparatus according to claim 15, wherein the weight checking and monitoring station (122) includes an edge sensor (209).

17. An apparatus according to one or more of the preceding claims,
wherein the one or more processing stations include, or further include, a brick rotating unit (199).

18. An apparatus according to one or more of the preceding claims,
wherein the one or more processing stations include, or further include, any one of a first robot arm (118), a second robot arm (124), a pick-up table (231), an auxiliary tray (233) and a draw out platform (145).

19. An apparatus according to one or more of the preceding claims,
wherein the apparatus is accommodated in a standardized shipping container.

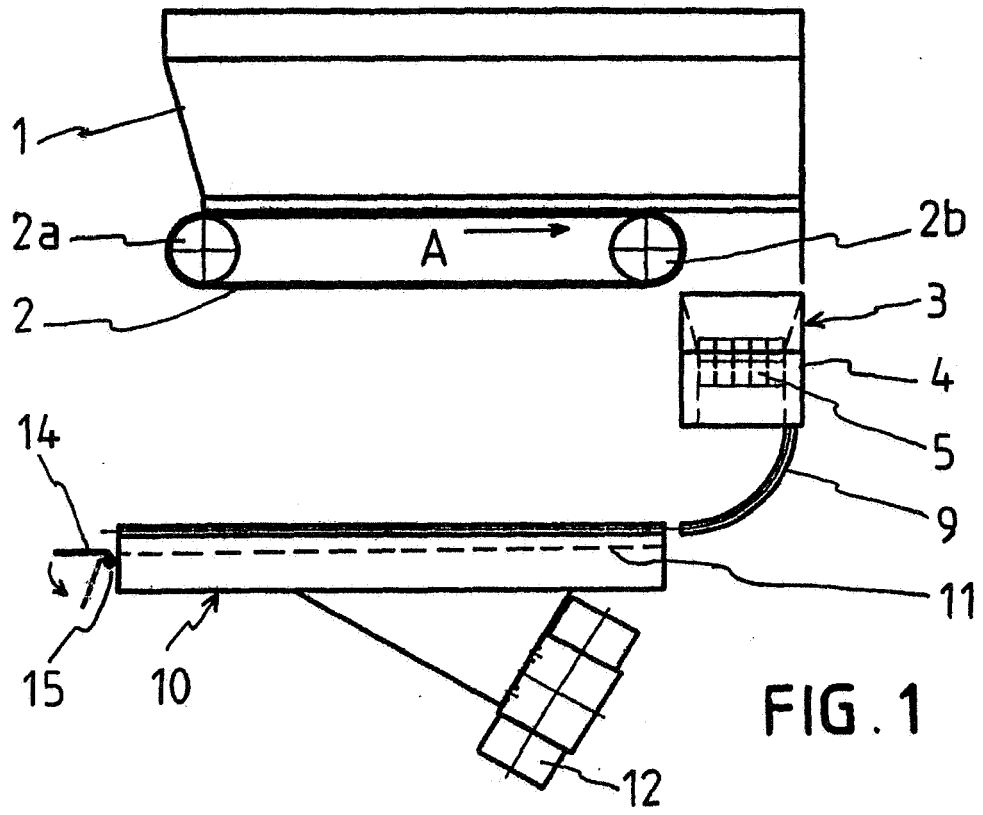


FIG. 1

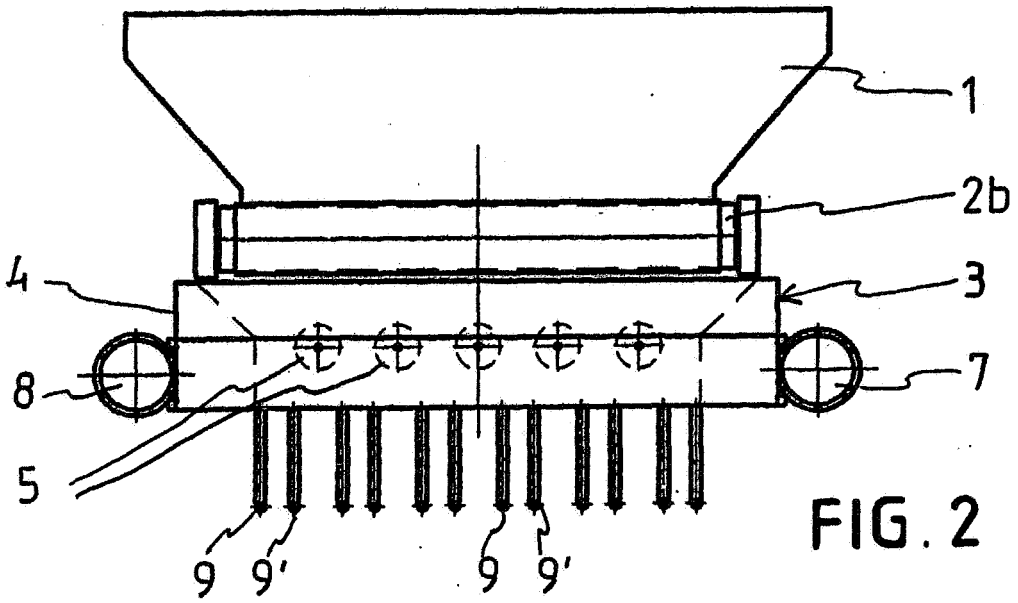


FIG. 2

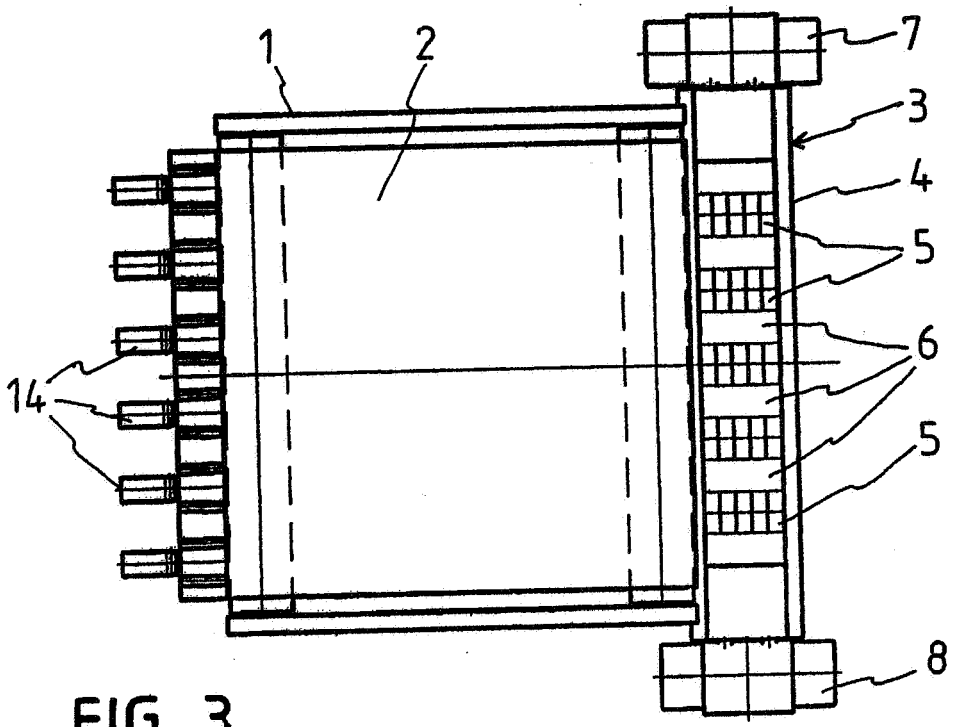


FIG. 3

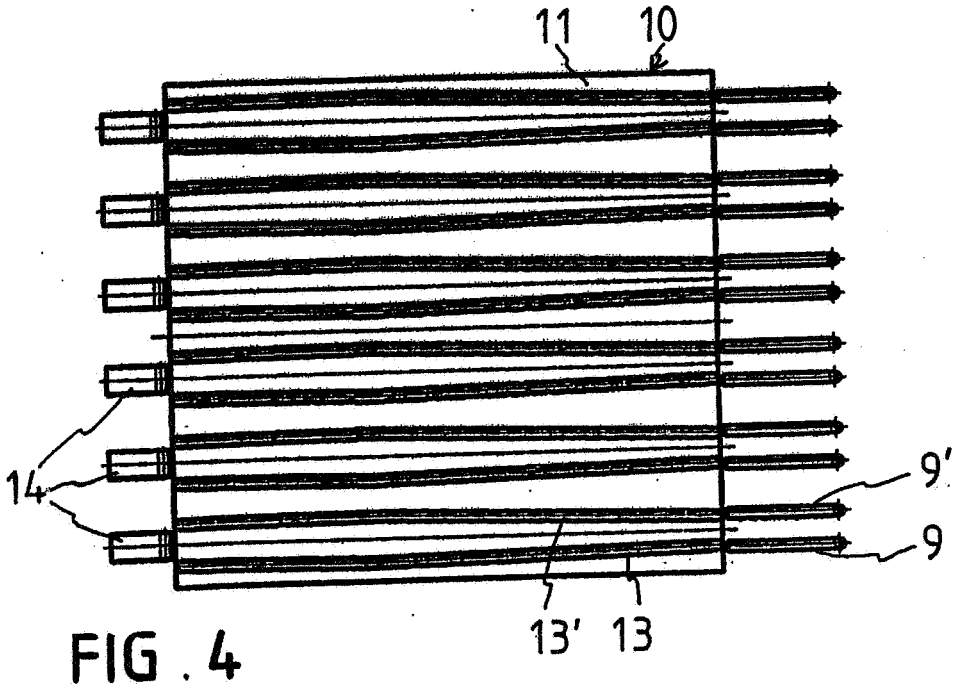
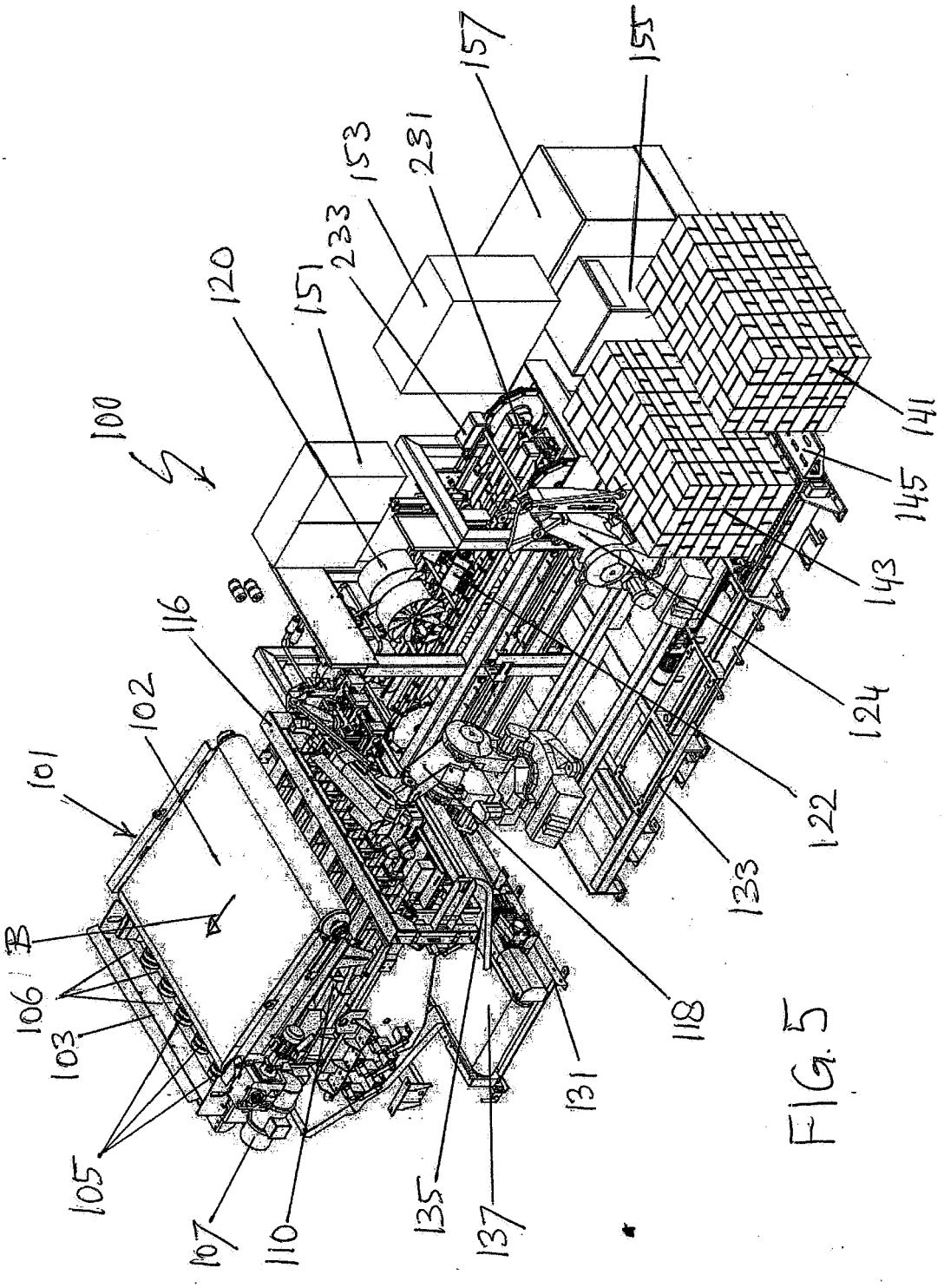


FIG. 4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116
B

FIG. 5

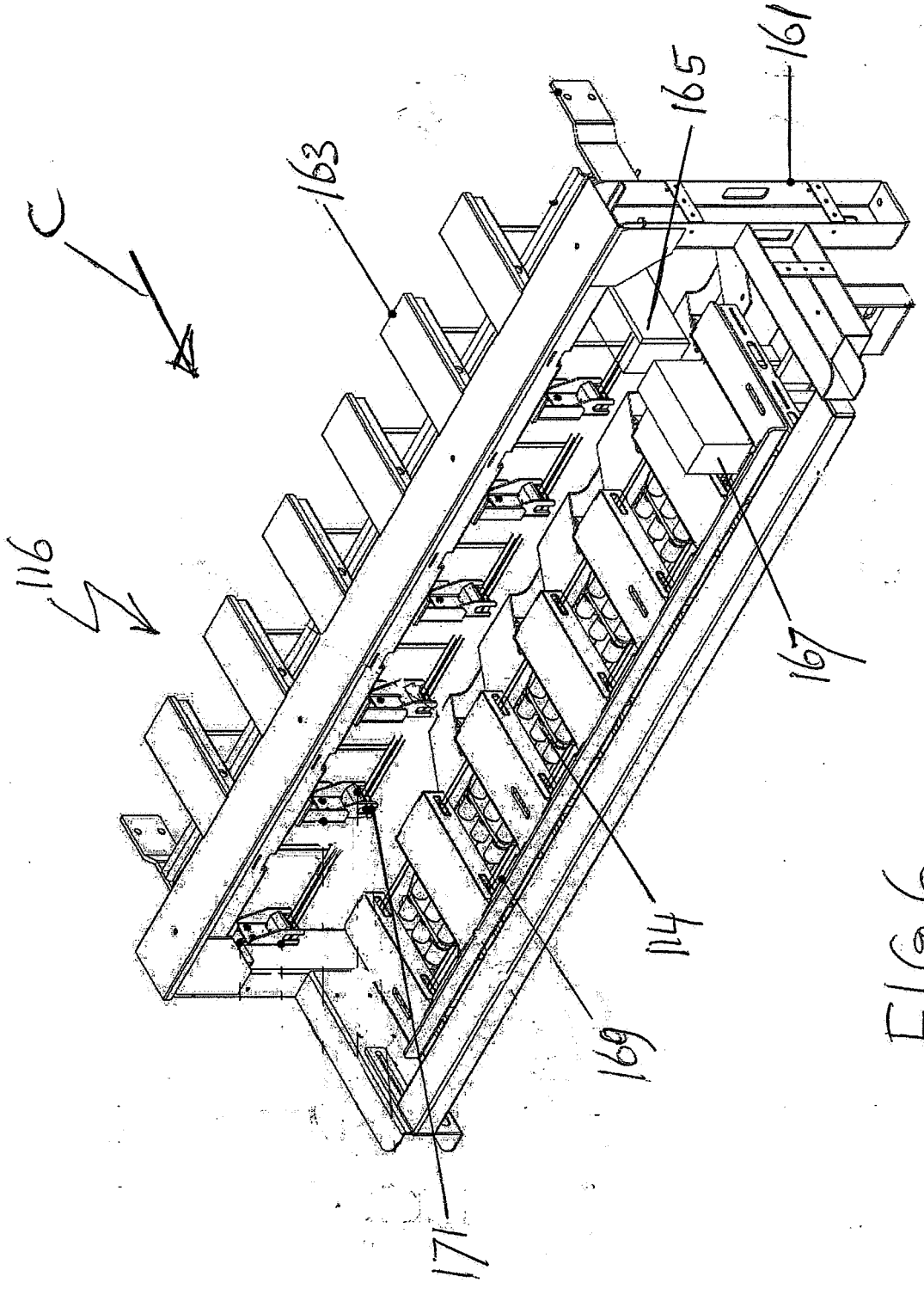

FIG 6

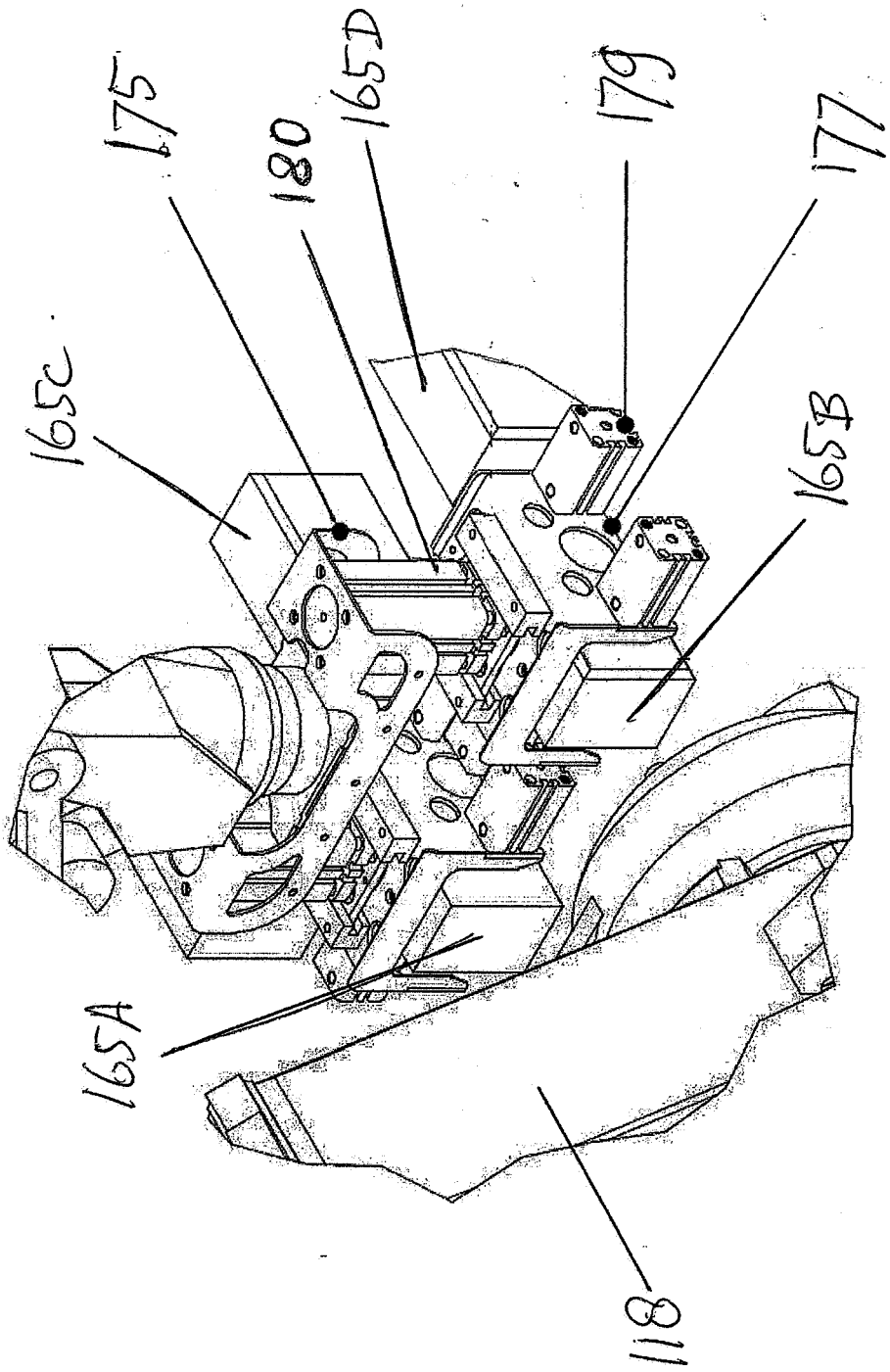

FIG. 7

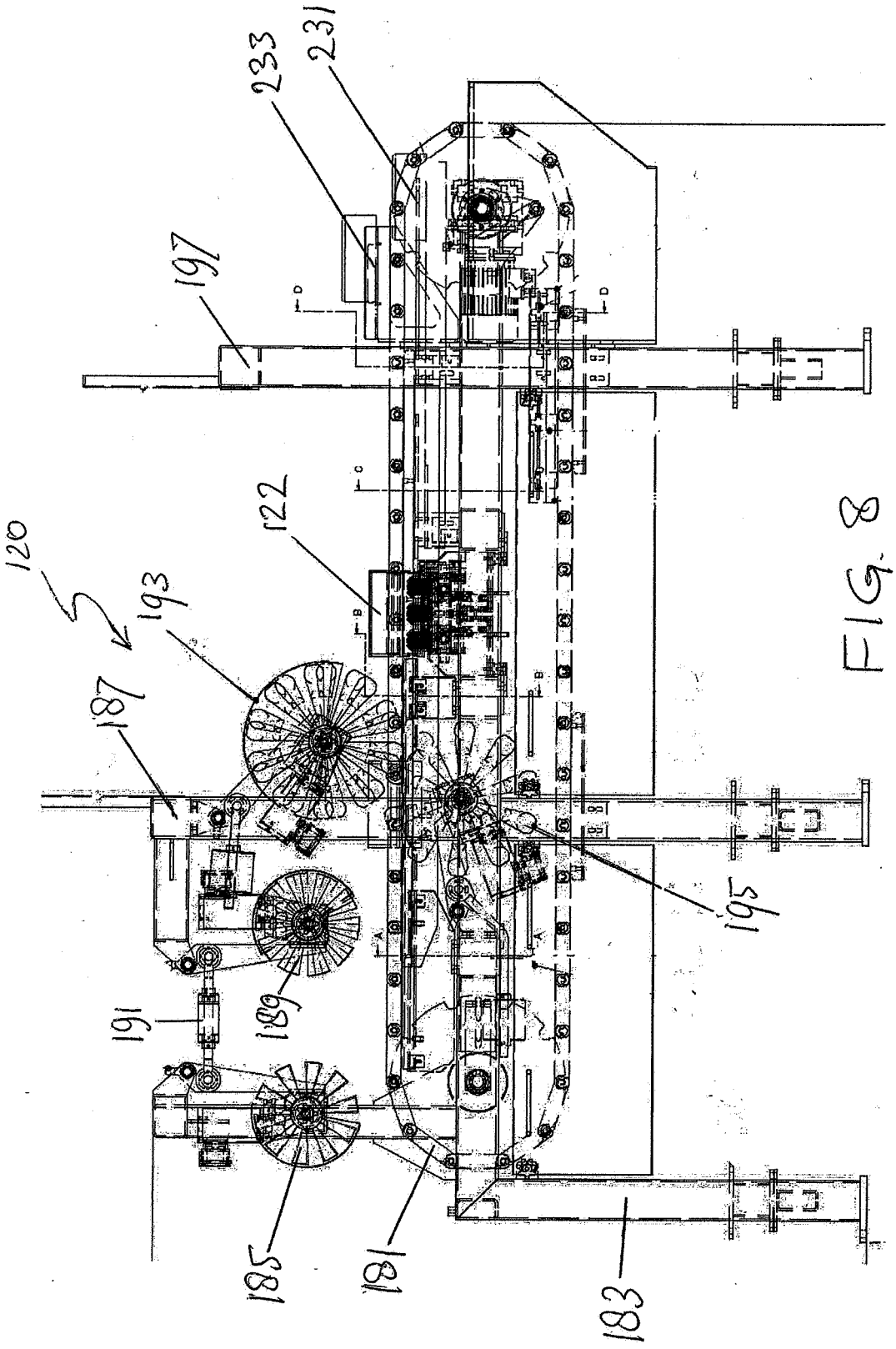

FIG. 8

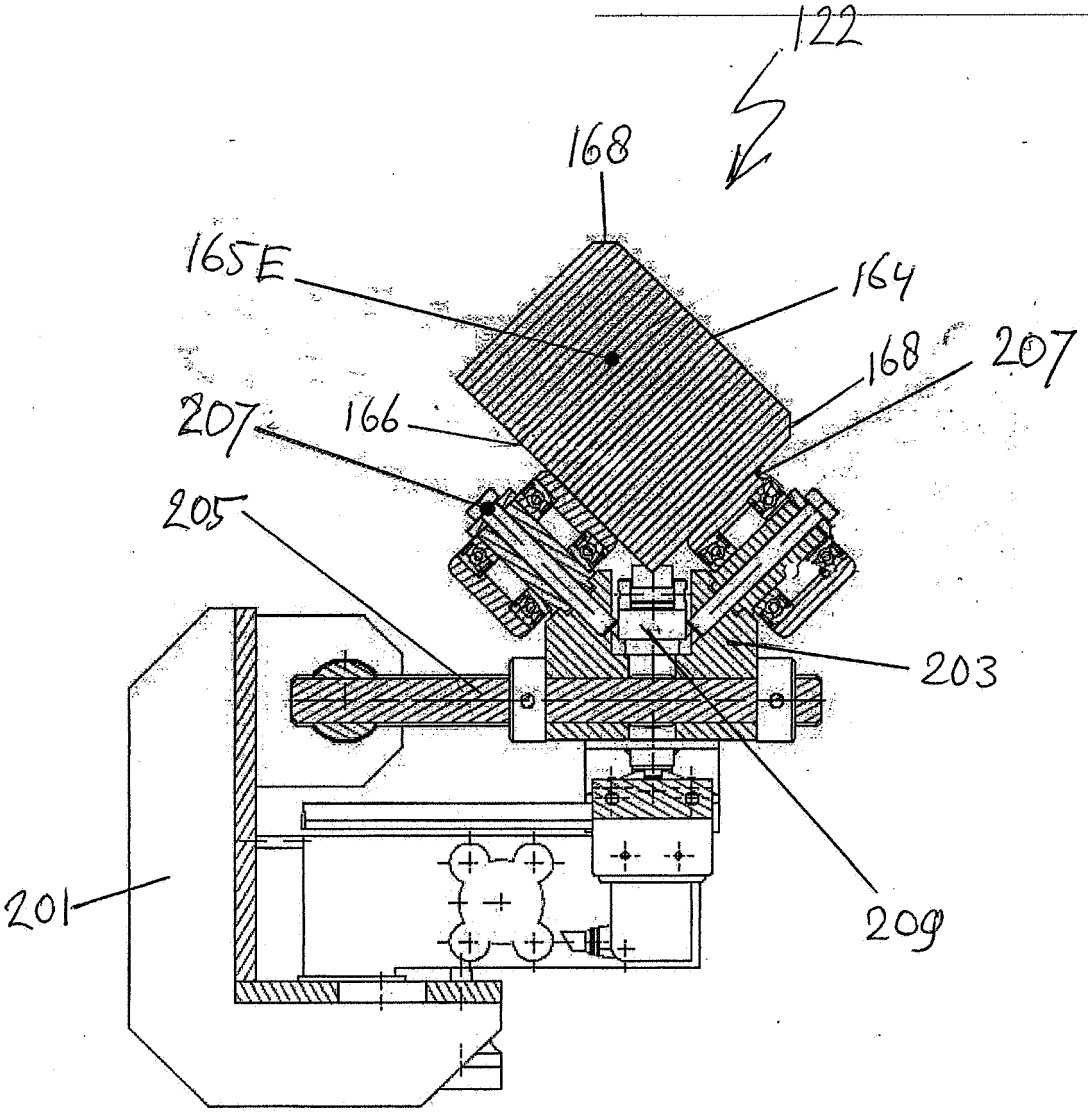

FIG. 9

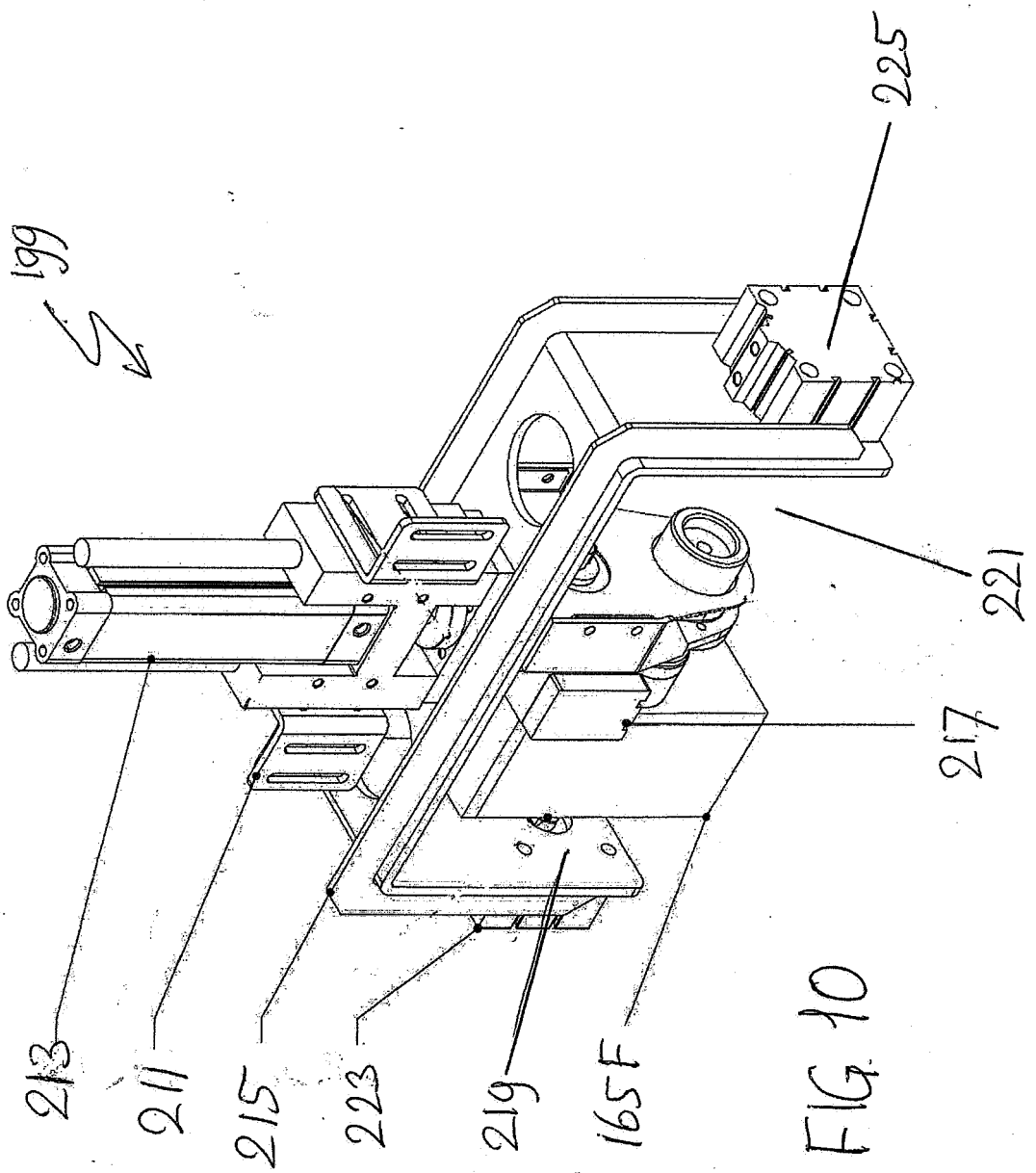

FIG. 10

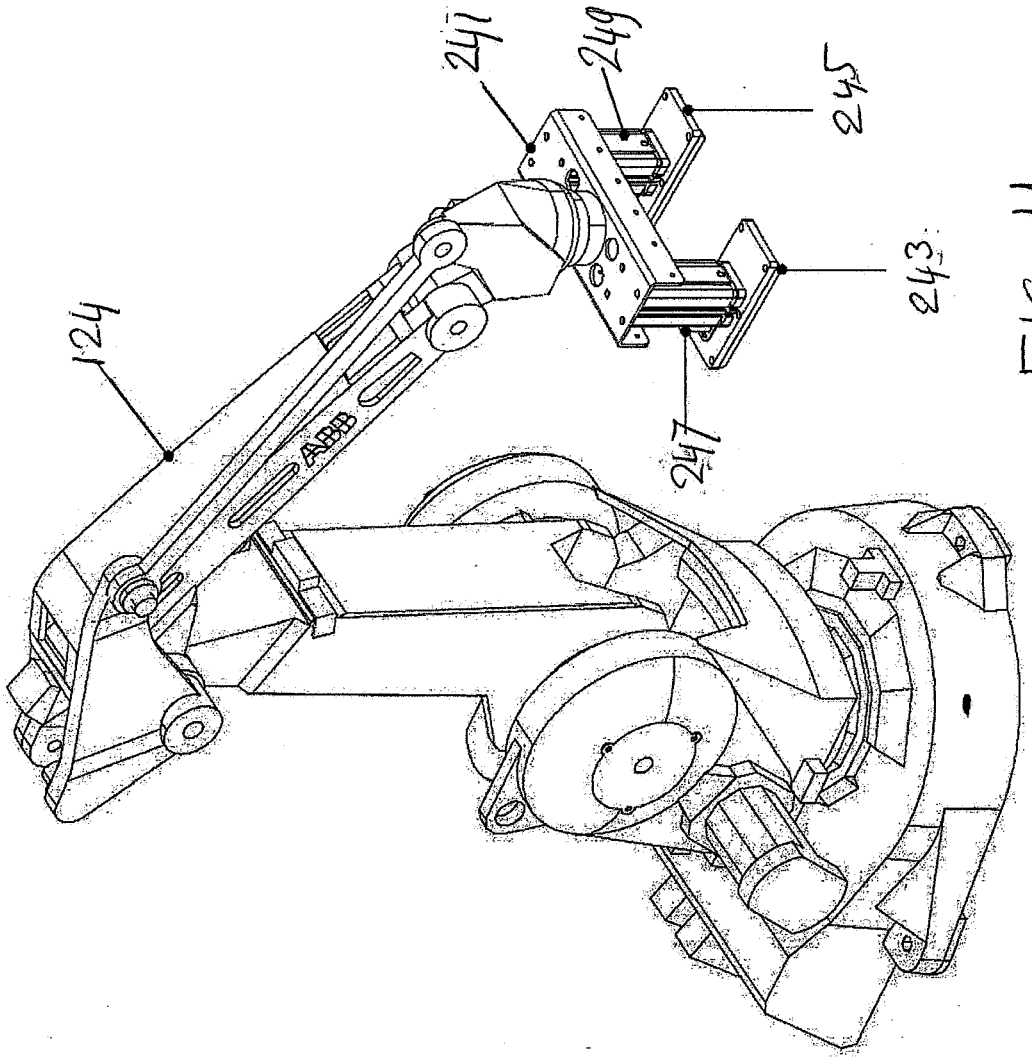

FIG. 11