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PALLET LOADING

The present invention relates to a pallet loading apparatus for loading articles on a predetermined pattern and in a piled manner upon a pallet.

A pallet loading apparatus according to the prior art
5 loads a pallet with articles by carrying in a predetermined number of articles for one layer and arranging them on an arranging table, by loading the articles for one layer from the arranging table onto a carriage, by bringing the carriage to above a pallet and then retaining the articles for
10 one layer on the carriage with the use of a stopper, and then by retracting the carriage thereby to allow the articles for one layer to drop onto the pallet.

In the case of the conventional pallet loading apparatus thus far described, however, since a large load
15 is exerted upon the carriage and its moving and supporting unit and since the articles are piled in multiple layers, there are required not only both a mechanism for moving up and down the carriage and its moving and supporting unit, which are highly loaded and a mechanism for moving up and
20 down the pallet loaded with the articles but also a space for allowing the carriage to retract. As a result, the pallet loading apparatus has its size enlarged as a whole.

The present invention has been conceived in view of the problems thus far described and contemplates to provide
25 a simplified type pallet loading apparatus for loading a pallet with box-shaped articles. The term "box-shaped article" is used herein to mean any article which is similar in shape to a conventional rectangular box having a

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flat bottom and four upright sides.

It is a first object of the present invention to simplify the construction and reduce the size of a pallet loading apparatus by loading a row of box-shaped articles for one layer plural times. In order to achieve this object, the pallet loading apparatus according to the present invention is constructed such that a carrying-in area, to which respective articles are conveyed preparatory to loading a pallet, and a carrying-out area having a pallet placed thereon for loading the articles are disposed adjacent to each other, such that a post is erected upright in the vicinity of those carrying-in and carrying-out areas, such that there is disposed on that post a lift which is elongated in a horizontal direction above those carrying-in and carrying-out areas and which is enabled to move up and down on that post, such that there is carried on the aforementioned lift a transverse trolley which is made movable in a horizontal direction between those carrying-in and carrying-out areas, and such that a holding mechanism for holding the articles is carried by that transverse trolley. Thus, the pallet loading apparatus transfers and loads the articles onto the pallet by holding that number of articles which is to constitute a row on the loaded pallet, in the holding mechanism, by transferring the articles which are held in the holding mechanism to the carrying-out area both by the vertical movement of the lift and the horizontal movement of the transverse trolley, and by releasing the articles from the holding mechanism.

In the aforementioned pallet loading apparatus,

moreover, in addition to the advantage that box-shaped articles can be loaded by the use of the holding mechanism equipped with a pair of clamping members, the positioning operations of the box-shaped articles and the holding mechanism both at the carrying-in unit is enabled to have their degrees of freedom relatively increased by driving both the paired clamping members of the holding mechanism to move toward and away from each other so that the positioning operations can be facilitated to ensure the clamping and holding operations of the box-shaped articles.

In the case of the aforementioned holding mechanism having both its paired clamping members driven, still moreover, the holding mechanism itself is enabled to have its construction simplified and its size reduced by driving both the clamping members by means of a single cylinder.

In the aforementioned pallet loading apparatus, furthermore, in addition to the advantage that the box-shaped articles can be loaded by the use of the holding mechanism having the paired clamping members, the gap between the box-shaped articles loaded on the pallet can be remarkably reduced by driving only one of the paired clamping members of the holding mechanism to move it toward and away from the other.

By equipping the aforementioned respective holding mechanisms having the paired clamping members with a supporting member which is adapted to move to and from below the box-shaped articles, furthermore, the box-shaped articles are clamped with a suitable force between the paired clamping

members, and the box-shaped articles thus clamped between the clamping members are prevented exclusively by that support member from dropping down so that they can be prevented from being broken by the clamping forces of the 5 clamping members.

In the aforementioned respective pallet loading apparatus, still moreover, the box-shaped articles can be loaded on various patterns disposing the holding mechanism, which is made operative to hold the box-shaped articles, on 10 the transverse trolley such that it can rotate in a horizontal plane.

Other objects and advantages of the present invention will become apparent from the following description to be made with reference to the accompanying drawings.

15 Fig. 1 is a front elevation showing a first embodiment of the pallet loading apparatus according to the present invention;

Fig. 2 is a top plan view of the same;

Fig. 3 is a side elevation of the same;

20 Fig. 4 is a top plan view showing a portion of the same;

Fig. 5 is a side elevation showing a portion of the same;

Figs 6 to 8 are longitudinal sections showing the 25 respective portions of the same;

Fig. 9 is a front elevation showing a second embodiment of the pallet loading apparatus of the present

invention, and particularly the holding mechanism of the same;

Fig. 10 is a top plan view of the same;

Fig. 11 is a side elevation of the same; and

5 Fig. 12 is a front elevation showing a third embodiment of the pallet loading apparatus of the present invention, and particularly the holding mechanism of the same.

The present invention will now be specifically
10 described in connection with the embodiments thereof with reference to the accompanying drawings.

Reference numeral 1 appearing in Figs. 1 and 3 generally indicates a horizontal platform, at the two sides of which there are disposed in an adjacent manner a carrying-
15 in area 2 to which box-shaped articles B are carried in and a carrying-out area 3 from which the articles B are carried out for their subsequent loading purpose. In the carrying-in area 2 located at the lefthand side of Fig. 1, there is disposed the leading end portion of a carrying-
20 in conveyor 4 for carrying-in the articles B. A pallet P is to be placed on the carrying-out area 3 located at the righthand side of the platform 1. The carrying-in conveyor 4 is equipped, as shown in Figs. 1 and 2, with a number of rollers 6 which are juxtaposed to one another and
25 borne between side frames 5 located at both the sides thereof and which are to be driven by a not-shown motor. Moreover, the carrying-in conveyor 4 is equipped with an arranging mechanism 7 at its leading end portion and with a turning

mechanism 8 at its base end portion.

The aforementioned arranging mechanism 7 is constructed to include a front stopper 9, which is mounted between the two side frames 5 of the aforementioned carrying-in conveyor 4, a side stopper 10, which is mounted on the right-hand side frame 5, and a pusher 11 which is mounted on the lefthand side frame 5 such that it is juxtaposed to that side stopper 10. That pusher 11 is adapted to be brought toward and away from the side stopper 10 by the action of a not-shown air cylinder which is mounted in a cylinder cover 12.

On the other hand, the aforementioned turning mechanism 8 is constructed to include a turn stopper 13 and a turn pusher 14 both of which are mounted on the aforementioned righthand side frame 5. The turn stopper 13 is rocked by a not-shown driving mechanism to bring its leading end portion to and from above the carrying-in conveyor 4, whereas the turn pusher 14 is brought to and from above the carrying-in conveyor 4 by the action of an air cylinder 15.

20 In the carrying-in conveyor 4 thus far described, therefore, the box-shaped articles B are arranged row by row upon a predetermined piling pattern.

In case the one row of the piling pattern is composed of two articles in the longitudinal direction, the turning mechanism 8 is left inoperative so that the two articles B, which are fed in the longitudinal direction and at an interval,

are allowed to pass as they are until they are stopped by the front stopper 9 of the arranging mechanism 7. Then, the pusher 11 advances to bring the two articles B into abutting contact with the side stopper 10. In case the one
5 row of the piling pattern is composed of three articles in the widthwise or transverse direction, the turn stopper 13 of the turning mechanism 8 is rocked clockwise, as viewed in Fig. 2, to bring its leading end portion to the righthand portion of the carrying conveyor 4. As a result, the three
10 articles B, which are fed in the longitudinal direction and at an interval have their rear portions pushed, when they respectively abut against the leading end portion of the turn stopper 13, by the instant advance or retraction of the turn pusher 14 so that they are turned about a right
15 angle. Then, the articles B are conveyed at that state until they are stopped by the front stopper 9 of the arranging mechanism 7. Then, the pusher 11 moves forward to bring the three articles B into abutment contact with the side stopper 10.

20 Incidentally, if one row of two or three articles B are fed to the carrying-in conveyor 4, the feed of the succeeding articles B is automatically interrupted. When the one row of articles B are carried away, the succeeding articles B are fed again.

25 Moreover, a pallet conveyor for conveying the pallet P may be disposed at the carrying-out area 3 similarly to the aforementioned carrying-in conveyor 4.

In the vicinity of the carrying-in and carrying-out areas 2 and 3 thus far described, moreover, there is erected upright a stationary post 21 which is disposed at the back of the aforementioned platform 1. On that 5 stationary post 21 at the side of the carrying-in and carrying-out areas 2 and 3, i.e., at the front side thereof, there are vertically movably disposed a lift 22 which is elongated in a horizontal direction along the carrying-in and carrying-out areas 2 and 3, i.e., in a transverse 10 direction.

As better seen from Figs. 4 and 5, more specifically, the aforementioned stationary post 21 is equipped at both its respective sides with vertical guide rails 23. On the rear portion of the aforementioned lift 22, on the other 15 hand, there are rotatably borne through a pair of facing brackets 25 a plurality of rollers 24 which are in engagement with the aforementioned guide rails 23.

On the upper end portion of the aforementioned stationary post 21, moreover, there is borne a sprocket 28 20 which is connected through a reduction mechanism 26 to a lift motor 27. A chain 29, which is made to run on that sprocket 28, has its one end portion attached to the aforementioned lift 22 and its other end portion attached to a balance weight 30 inside of the stationary post 21. As a result, 25 the lift 22 is moved up and down along the stationary post 21 by the drive of the lift motor 27.

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On the aforementioned lift at the side of the carrying-in and carrying-out areas 2 and 3, i.e., at the front side thereof, moreover, there is disposed a transverse trolley 31 which has a generally C-shaped side view and which is made movable along the lift 22.

As better seen from Figs. 4 and 5, more specifically, the aforementioned lift 22 is equipped on its upper and lower portions at both the sides thereof with horizontal guide rails 32. On the upper and lower portions of the aforementioned transverse trolley 31, there are borne a plurality of rollers 33 which are in engagement with the aforementioned guide rails 32.

Moreover, the aforementioned lift 22 is equipped at its front portion with a rack 34 which extends in the longitudinal direction thereof. On the aforementioned transverse trolley 31, there is borne a pinion 35 which is in meshing engagement with that rack 34 and which is connected to a transverse motor 36 mounted on the upper portion of the transverse trolley 31. Thus, this transverse trolley 31 is moved in a horizontal direction along the lift 22 by the drive of the transverse motor 36.

On the front portion of the aforementioned transverse trolley 31, moreover, there is carried a holding mechanism 41 for holding the articles B. This holding mechanism 41 is constructed, as better seen from Figs. 4 and 5, to include a supporting frame 42, which is supported on the transverse trolley 31, and a pair of plate-shaped clamping members 43

and 44 which are made of an elastic material such as a rubber and which are disposed below the front and rear portions of the supporting frame 42, respectively.

In the embodiment being described, the aforementioned supporting frame 42 is supported vertically movably on the aforementioned transverse trolley 31.

At both sides of the front portion of the aforementioned transverse trolley 31, more specifically, there are disposed, as better seen from Fig. 6, a pair of grooved guides 46 which are formed with retaining portions 45 at their lower ends. On both sides of the front portion of the aforementioned supporting frame 42, moreover, there are respectively borne a pair of upper and lower rollers 47 which are in engagement with the aforementioned guides 46.

On the other hand, the aforementioned supporting frame 42 of the embodiment under consideration is elastically supported on the aforementioned transverse trolley 31 such that it is biased upward.

On the front portion of the aforementioned transverse trolley 31, more specifically, as better seen from Fig. 7, there is mounted a horizontal plate member 48 at which a pair of supporting rods 49 are anchored upright. On the rear portion of the aforementioned supporting frame 42, moreover, there is mounted a plate member 50 having holes 51, which are fitted on the aforementioned supporting rods 49. Still moreover, coil springs 52 are mounted on those supporting rods 49 and are sandwiched between the two plate members 48 and 50.

In the embodiment being described, the aforementioned paired clamping members 43 and 44 are both made movable back and forth and adapted to be driven commonly by a single cylinder.

5. Specifically, the front clamping member 43 is mounted on the shorter side portion of a generally L-shaped arm 53, which has its longer side portion so fitted in grooved guides 54 mounted on both sides of the front portion of the aforementioned supporting frame 42 that it can move back and
10 forth. On the other hand, the rear clamping member 44 is mounted on the lower end portion of a slightly shorter arm 55, which has its upper end portion fixed to a pivot pin 56 borne rotatably in a horizontal direction in the rear lower portion of the supporting frame 42.

15 To the upper portion of the aforementioned supporting frame 42, on the other hand, there is hinged an air cylinder 57 having a piston rod, to the leading end of which a drive arm 58 is hingedly connected. To the intermediate portion of that drive arm 58, as better seen from Fig. 8, there is
20 attached an annular member 59 having a slot, in which a pin 61 fixed to the base end portion of the aforementioned first arm 53 through a supporting member 60 is loosely fitted through a roller 62. Moreover, the drive arm 58 has its leading end portion secured to the pivot pin 56 to which the
25 aforementioned second arm 55 is fixed. As a result, if the aforementioned air cylinder 57 is actuated to protrude the piston rod, the drive arm 58 is rotated clockwise, as

viewed in Fig. 5, about the pivot 56 so that the arm 53 is retracted to the right along the guides 54 whereas the arm 55 is rotated clockwise about the pivot pin 56, thereby to close the respective clamping members 43 and 44. If the
5 aforementioned air cylinder 57 is returned to retract the piston rod, on the contrary, the drive arm 58 is rotated counter-clockwise, as viewed in Fig. 5, about the pivot pin 56 so that the arm 53 is protruded to the left along the guides 54 whereas the arm 55 is rotated counter-clockwise
10 about the pivot pin 56, thereby to open the respective clamping members 43 and 44.

On the other hand, the aforementioned front arm 53 is constructed, as better seen from Figs. 4 and 5, to include a plurality of plate members 63 and 64, which are
15 jointed by means of screws 66 through a plurality of slots 65 formed in the respective plate members 63 and 64 so that the length of that arm 53 can be adjusted to adjust the size of or the gap between the respective clamping members 43 and 44.

20 The operations of the embodiment having the construction thus far described will be described in the following.

The articles B are fed to the carrying-in conveyor 4 so that two or three of them are arranged in a row at the
25 leading end portion of the carrying-in conveyor 4.

Then, the lift motor 27 is energized to move down the

lift 22 along the stationary post 21 to a predetermined position by the coaction of the sprocket 28 and the chain 29 so that the respective clamping members 43 and 44 are brought to the front and back of the two or three articles B. After that, the air cylinder 57 is actuated to protrude its piston rod so that the respective clamping members 43 and 44 are closed to clamp the two or three articles B from the front and back thereof.

Then the lift motor 27 is energized to move up the lift 22, and the transverse motor 36 is energized to move the transverse trolley 31 rightwardly of Figs. 1 and 2 along the lift 22 by the coaction of the pinion 35 and the rack 34 so that the articles B held by the holding mechanism 41 are brought to above a predetermined piling position of the pallet P.

Then, the lift motor 27 is energized to move down the lift 22 so that the articles B are placed on the pallet P, and the air cylinder 57 is actuated to retract its piston rod so that the respective clamping members 43 and 44 are opened to release the articles B.

Here, when the articles B are placed on the pallet P, the supporting frame 42 of the holding mechanism 41 is so supported that it can move upward relative to the transverse trolley 31 and is also biased upward by the action of the springs 52. As a result, the loads of the lift 22 and the transverse trolley 31 are not exerted between the articles B and the pallet P, and the load of the holding mechanism 41 is

reduced by the actions of the springs 52 so that the articles B are prevented from being broken.

Then, the lift motor 27 is energized to move up the lift 22, and the transverse motor 36 is energized to move 5 the transverse trolley 31 leftwardly of Figs. 1 and 2 so that the holding mechanism 41 is brought to a position above the carrying-in conveyor 4, thus being prepared for the operations thus far described.

Moreover, these operations are repeated until the 10 articles B are piled in a predetermined layers on a predetermined piling pattern upon the pallet P.

As has been described hereinbefore, according to the embodiment under consideration, the holding mechanism 41 having the paired clamping members 43 and 44 is made 15 movable in a vertical direction and in a transversely horizontal direction so that the box-shaped articles B can be piled row by row on the piling pattern upon the pallet P. As is different from the construction according to the prior art, there are required neither the arranging table for 20 arranging the articles B for one layer nor the carriage for supporting and moving the articles B for one layer. Nor is required the mechanism for moving up and down the pallet P loaded with the articles B. As a result, the pallet loading apparatus has its size so reduced that it can be 25 easily installed on an existing factory or warehouse. Moreover, the loading apparatus has its most portion

supported by the stationary post 21 so that its installation is facilitated.

According to this embodiment, moreover, since both paired clamping members 43 and 44 of the holding mechanism 41 are driven, there is little fear that the clamping members 43 and 44 at their close state abut against the articles B, while the holding mechanism 41 is moving down toward the articles B lying on the carrying-in conveyor 4, so that the articles B as well as the holding mechanism 41 can be easily positioned at the carrying-in area 2 while being surely held. Moreover, both the clamping members 43 and 44 are completely synchronized, because they are driven commonly by the single air cylinder 57, and the holding mechanism 41 itself can have its construction simplified and its size reduced.

In the embodiment thus far described, incidentally, the lift 22 is vertically movably supported at its centre portion by the stationary post 21. However, the present invention should not be limited thereto but can be modified such that the lift 22 is supported at its end portion by the stationary post 21.

Figs. 9 to 11 show a second embodiment of the pallet loading apparatus according to the present invention.

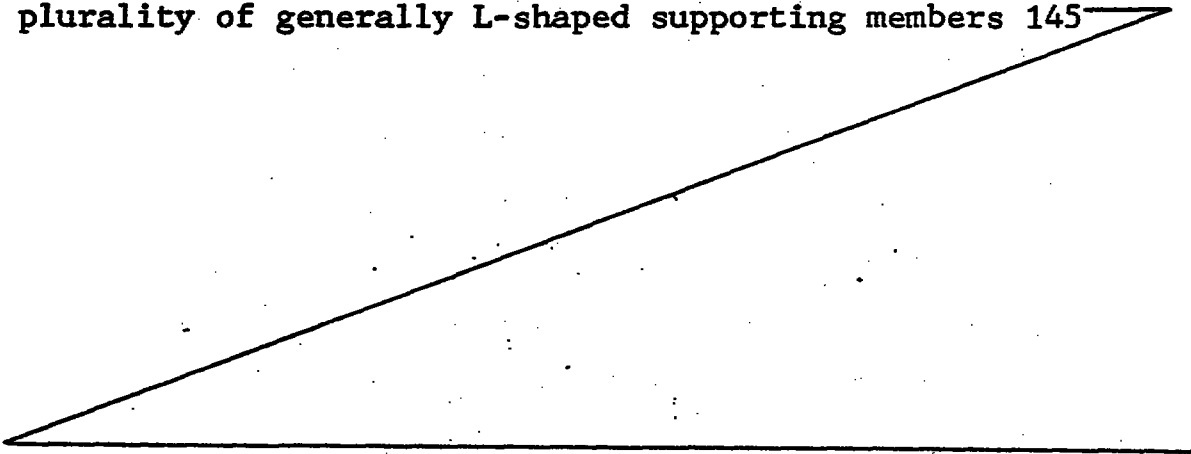
This second embodiment is similar in construction and function basically to said first embodiment, so that only the different portion, namely a holding mechanism will

now be explained.

In Figs. 9 to 11, a reference numeral 141 denotes a holding mechanism which can be mounted on the transverse trolley 31 instead of the holding mechanism shown in the 5 above-mentioned holding mechanism 41.

Further, in this embodiment, the carrying-in area 2 is located at the righthand side, whereas the carrying-out area 3 is located at the lefthand side on the contrary to the first embodiment.

10 The holding mechanism 141 is constructed to include a supporting frame 142, which is supported on the transverse trolley 31, a first plate-shaped clamping member 143, which is mounted on that supporting frame 142 at the lower portion thereof at the lefthand side, i.e.,
15 at the side of the carrying-out area 3, a second plate-shaped clamping member 144 which is mounted on the supporting frame 142 at the lower portion thereof at the righthand side i.e., at the side of the carrying-in area 2 in a position opposite to the first clamping member 143, and a
20 plurality of generally L-shaped supporting members 145



which are mounted on the righthand side lower portion and which are positioned outside of the aforementioned second clamping member 144.

In this embodiment, moreover, the first clamping member 143 is fixedly mounted on the lefthand lower portion of the aforementioned supporting frame 142.

On the other hand, the second clamping member 144 is adapted to move toward and away from the aforementioned first clamping member 143 so that it may clamp a predetermined number of articles B of one row between itself and the first clamping member 143. Specifically, that second clamping member 144 is attached to the leading end portions of the piston rods of a pair of air cylinders 146, which in turn are attached to the lower end portions of mounting plates 147 attached to the righthand lower portion of the aforementioned supporting frame 142, so that it can be brought toward and away from the first clamping member 143 by actuating the air cylinders 146 to protrude and retract their piston rods.

The aforementioned supporting members 145 are so constructed that horizontal supporting portions formed at their lower ends can move from the outside of the second clamping member 144 toward and away from the righthand lower portions of the articles B between the aforementioned first and second clamping members 143 and 144 thereby to prevent the articles B from dropping down from

between the first and second clamping members 143, and 144. Specifically, those supporting members 145 are secured at their base end portions to a single pivot pin 149, which is rotatably supported on the right-hand upper portion of the aforementioned supporting frame 142 through a pair of bearings 150. To that pivot pin 149, there is secured one end of a drive lever 151, which has its other end hingedly connected to the leading end portion of the piston rod of an air cylinder 153 hinged to the upper portion of the aforementioned supporting frame 142 through a bracket 152. By actuating the air cylinder 153 to protrude and retract its piston rod, the supporting members 145 are rocked about the pivot pin 149 so that their supporting portions 148 approach and leave the righthand lower portion of the articles B between the aforementioned first and second clamping member 143 and 144 from the outside of the second clamping member 144. In this embodiment, moreover, the supporting portions 148 are arcuately moved back and forth by rocking the supporting members 145. However, the supporting members 145 can be linearly moved by suitable means so that their supporting portions 148 can be linearly moved back and forth.

25 The operation of the embodiment having the construction thus far described will be described in the following.

In the following explanation, it is assumed that the holding mechanism 141 is mounted on the transverse trolley 31 in said first embodiment and that, as mentioned above, the carrying-in area 2 and the carrying-out area 3 are located reversely the right and left.

A predetermined number of articles B of one row are fed to the carrying-in conveyor 4 and they are stopped at the leading end portion of the conveyor 4, which is disposed at the carrying-in area 2.

10 Then, the lift 22 is moved down along the stationary post 21 to a predetermined position so that the first and second clamping members 143 and 144 of the holding mechanism 141 are brought to both sides of the articles B of one row. After that, the air
15 cylinders 146 are actuated to protrude their piston rods so that the second clamping member 144 is brought toward the first clamping member 143 thereby to clamp the both sides of the articles B of one row. Then, the air cylinder 153 is actuated to protrude its piston
20 rod so that the supporting portions 148 of the supporting members 145 are protruded to below the righthand lower portions of the articles B from the back of the second clamping member 144 thereby to support the articles B.

25 Then, the lift 22 is moved up, and the transverse trolley 31 is moved to the left along the lift 22. Not only the first and second clamping members

143 and 144 but also the articles B held by the supporting members 145 are brought to above the predetermined piling position at the lefthand portion of the pallet P which is placed on the carrying-out unit 3.

5 Next, the lift 22 is moved down to bring down the articles B to the predetermined piling position of the lefthand portion above the pallet P. After that, the air cylinder 153 is actuated to retract its piston rod so that the supporting portions 148 of the
10 supporting members 145 are extracted from the righthand lower portion of the articles B. After that, the air cylinder 146 is actuated to retract its piston rod so that the second clamping member 144 is retracted to release the articles B.

15 Then, the lift 22 is moved up, and the transverse trolley 31 is moved to the right. The holding mechanism 141 is positioned above the leading end portion of the carrying-in conveyor 4.

 Moreover, the operations thus far described
20 are successively carried out to transfer the predetermined number of articles B of one row to the pallet P, thus finishing the loading operation of the articles for one layer. These operations are repeated until the articles B are piled in a predetermined layers on
25 a predetermined piling pattern upon the pallet P.

 In the operations thus far described, incidentally, when the articles B are to be transferred to the predetermined piling positions upon the pallet P,

it may be intended to minimize the gap S between the articles B which have already been transferred to the predetermined piling positions upon the pallet P. For this intention, as the case may be, after the articles B 5 are moved down slightly rightward of the predetermined piling positions upon the pallet P, the transverse trolley 31 is moved slightly leftward to bring the first clamping member 143 into contact with the articles B, which have already been transferred to the lefthand portion, and the 10 supporting members 145 and the second clamping member 144 are retracted to transfer those articles B.

In this second embodiment, moreover, since only the second one 144 of the paired clamping members 143 and 144 of the holding mechanism 141 is driven to move 15 toward and away from the first clamping member 143, the gap S between the articles B loaded onto the pallet P can be restricted to the thickness of the first clamping member 143.

In the second embodiment, still moreover, the 20 holding mechanism 141 is equipped with the supporting members 145 which have their supporting portions 148 protruding from the outside of the second clamping member 144 to below the articles B between the first and second clamping members 143 and 144 thereby to prevent 25 the articles B from dropping down so that it can hold the articles B without fail. Since the second clamping member 144 can have its clamping force weakened,

furthermore, the articles B are prevented from being broken. When the articles B are to be released, the second clamping member 144 is enabled to function as a stopper by being retracted after the supporting members 145 have been extracted from below the articles B so that the articles B can be prevented from being positionally displaced. In addition, since the first clamping member 143 does not require any elastic pad but can be constructed of a single plate, the gap 10 between the articles B can be remarkably reduced.

In the second embodiment, incidentally, the first clamping member 143 is fixedly mounted on the supporting frame 142. The present invention should not be limited thereto but can be modified such that 15 the first clamping member 143 is so disposed that it can be retracted upward. In this modification, the articles B can be pushed by moving down the articles B onto the pallet P, by retracting the supporting members 145, by retracting the second clamping member 20 144, by retracting upward the first clamping member 143, and by protruding again the second clamping member 144. Thus, the gap S between the articles B can be eliminated.

Fig. 12 shows a third embodiment of the pallet 25 loading apparatus according to the present invention.

Here, in this third embodiment only the holding mechanism will be explained.

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Reference numeral 241 appearing in Fig. 12 generally indicates the holding mechanism which may also be provided on the front of the transverse trolley 31 instead of the holding mechanism 41 which is exemplified in the foregoing first embodiment.

The holding mechanism 241 of this third embodiment is constructed to include a supporting frame 242, which is supported on the transverse trolley 131, a first plate-shaped clamping member 243, which is disposed at the lefthand lower portion of that supporting frame 242, a second plate-shaped clamping member 244, which is disposed at the righthand lower portion of the aforementioned supporting frame 242 in a manner to face the first clamping member 243, and a plurality of generally L-shaped supporting members 245 which are disposed outside of that second clamping member 244.

The aforementioned first clamping member 243 is fixedly attached likewise the second embodiment to the lefthand lower portion of the aforementioned supporting frame 242.

The aforementioned second clamping member 244 is so constructed likewise the second embodiment that it can be protruded toward and retracted away from the aforementioned first clamping member 243 thereby to clamp a predetermined number of articles B of one row together with the first clamping member 243, but is attached in a different manner. Specifically,

the aforementioned supporting frame 242 is equipped at both inner sides with a pair of horizontal guide rails 246, with which there are engaged a plurality of rollers 248 borne on plate members 247. To the 5 plate members 247 at both sides, there is attached the second clamping member 244 which has its upper end portion hinged to the leading end portion of the piston rod of an air cylinder 249 mounted on the aforementioned supporting frame 242. By actuating the air 10 cylinder 249 to protrude and retract its piston rod, the second clamping member 244 is guided by the rails 246 to move toward and away from the first clamping member 243.

In the third embodiment, incidentally, an elastic pad 250 is mounted on the second clamping member 15 244.

The aforementioned supporting members 245 are constructed such that supporting portions 251 at their lower ends can be protruded from the outside of the 20 second clamping member 244 toward the righthand lower portions of the articles B between the aforementioned first and second clamping members 243 and 244 and retracted away from those righthand lower portions of the articles B thereby to prevent the articles B between 25 the first and second clamping members 243 and 244 from dropping down, but are attached in different positions with different constructions. Specifically, those supporting members 245 are secured at their base end

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portions to a single pivot pin 252, which in turn is rotatably supported on the outside upper portion of the aforementioned second clamping member 244 by means of a pair of bearings 253. To that pivot pin 252, 5 there is secured one end of a drive lever 254, which has its other end hinged to the leading end portion of the piston rod of an air cylinder 256 hinged to the outside lower portion of the aforementioned second clamping member 244 through brackets 255. Thus, by 10 actuating the air cylinder 256 to protrude and retract its piston rod, the supporting members 245 are rocked about the pivot pin 252 thereby to protrude their supporting portions 251 from the outside of the second clamping member 244 toward the righthand lower portions 15 of the articles B between the aforementioned first and second clamping members 243 and 244 and to retract the same portions 251 away from the righthand lower portions of those articles B. Moreover, the supporting members 245 have their supporting portions 251 so hinged at 20 257 that they can freely rotate a predetermined angle.

Incidentally, the operations and advantages of the third embodiment are similar to those of the foregoing second embodiment, and accordingly the following description is limited to the advantages intrinsic to 25 this third embodiment.

As has been described hereinbefore, according to the third embodiment, since the supporting portions 251 of the supporting members 245 are made rotatable

the predetermined angle by means of the hinge 257,
they slide on the lower sides of the articles B while
being held in their horizontal positions, when they
are extracted from below the articles B, so that the
5 articles B held by the holding mechanism 241 can be
brought close to the pallet P or the articles B of
the underlying layer, whereby their drop distance
can be shortened and whereby the articles B of the
underlying layer can be prevented from being broken
10 by the leading ends of the supporting portions 251.

According to this third embodiment, moreover,
since the supporting members 245, their driving air
cylinder 256 and so on are attached to the second
clamping member 244, the adjustment to cope with the
15 change of the size of the articles B to be held can
be done with remarkably ease in case it is changed.
In the holding mechanism 141 according to the fore-
going second embodiment, specifically, the size adjust-
ment can be performed, in case it is small, exclusively
20 by changing the attached position of the first clamping
member 143, but both the attached positions of the
bearings 150 of the supporting members 145 and the
attached angle of the drive lever 151 have to be adjust-
ed in addition to the attached position of the first
25 clamping member 143 in case the size adjustment is large.
In the holding mechanism 241 according to this third
embodiment, on the contrary, it is sufficient to change

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the attached position of the first clamping member
243 in all cases.



CLAIMS:

1. A method of operating pallet loading apparatus, which comprises a post erected upright in the vicinity of carrying-in and carrying-out areas which are disposed
5 adjacent to each other, a lift elongated in a horizontal direction above said carrying-in and carrying-out areas and so disposed that it can move up and down along said post, a transverse trolley so disposed that it can move in a horizontal direction along said lift between said carrying-
10 in and carrying-out areas, and a holding mechanism comprising a pair of clamping members carried by said transverse trolley, to load a pallet a row at a time by clamping a plurality of box-shaped articles between the clamping members of the holding mechanism at the carrying-in area, transfer-
15 ring the articles held in the holding mechanism to the carrying-out area by vertical movement of the lift and horizontal movement of the transverse trolley, and releasing the articles from the holding mechanism to constitute respective rows of articles on the pallet at the carrying-
20 out area.

2. A method according to Claim 1, wherein said holding mechanism includes a pair of clamping members which are both driven to move toward and away from each other for clamping box-shaped articles therebetween from opposite
25 sides. -



3. A method according to Claim 2, wherein the paired clamping members of said holding mechanism are so driven by a cylinder as to move back and forth in synchronism with each other.
- 5 4. A method according to Claim 1, wherein said holding mechanism includes a pair of clamping members for clamping box-shaped articles therebetween from opposite sides, one of said clamping members being driven to move toward and away from the other.
- 10 5. A method according to any one of Claims 2, 3 or 4 wherein said holding mechanism further includes a supporting member adapted to move to and from below articles which are clamped between said paired clamping members, for supporting the articles between said
- 15 clamping members from the lower side of the same.
6. A method according to any one of Claims 1 to 5, wherein said holding mechanism is so suspended from said transverse trolley that it can rotate in a horizontal plane.
7. A method of operating pallet loading apparatus
- 20 substantially as hereinbefore described with reference to the accompanying drawings.
8. Pallet loading apparatus constructed and arranged to operate substantially as hereinbefore described with reference to the accompanying drawings.
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