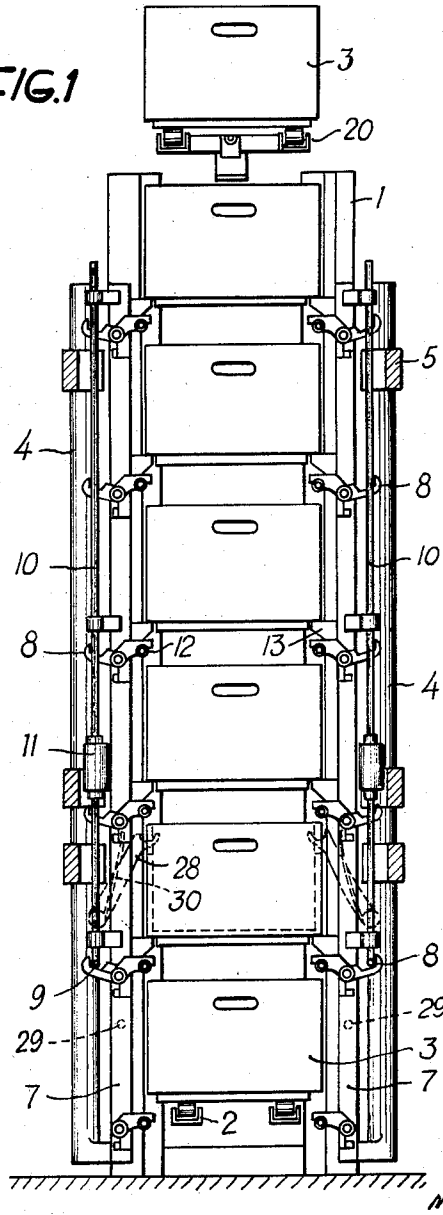
April 5, 1960 N. R. HALLENIUS 2,931,524

STACKING MACHINES AND VERTICAL CONVEYORS

Filed March 14, 1957 3 Sheets-Sheet 1

FIG. 1



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STACKING MACHINES AND VERTICAL CONVEYORS

Filed March 14, 1957 3 Sheets-Sheet 2

FIG.3

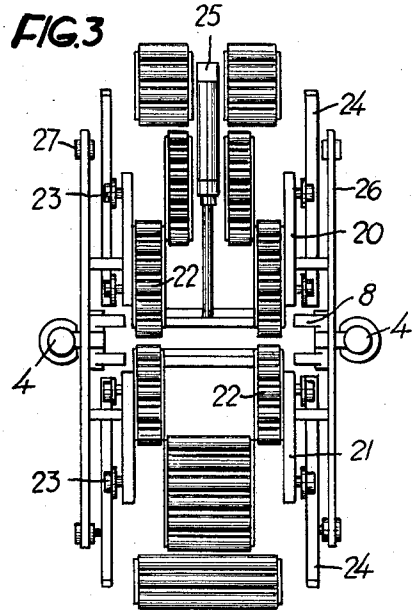
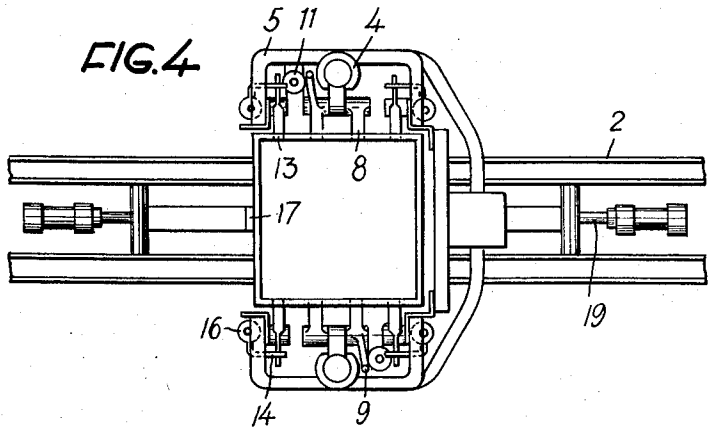


FIG.4



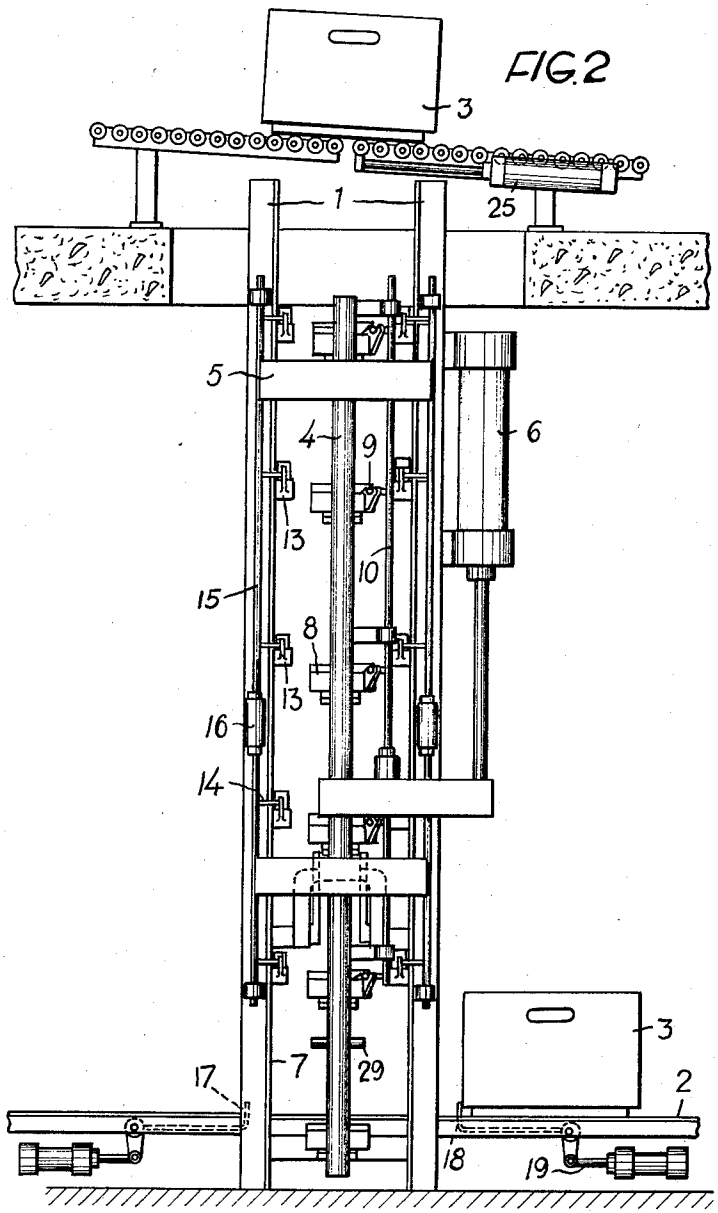
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STACKING MACHINES AND VERTICAL CONVEYORS

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FIG. 2



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2,931,524

STACKING MACHINES AND VERTICAL CONVEYORS

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Claims priority, application Sweden March 21, 1956

4 Claims. (Cl. 214—95)

The present invention refers to a stacking machine and to a vertical conveyor for boxes and the like. The field of use may also be extended to the breaking down of stacks and to the conveyance of stacks and individual boxes upwardly and downwardly between different planes.

In connection with stacking machines, the mode of operation hitherto applied would involve lifting of individual boxes and their transport laterally and putting them down onto the uppermost box in a stack formed laterally of the machine. These machines require a large space and have a limited field of use. The machine according to the present invention calls for less space and has a considerably increased field of use as compared with those previously employed, and is distinguished by substantially vertical shafts moving vertically back and forth in a frame and having a number of superimposed swingable carrying members arranged thereon, and by the arrangement on the frame of foldable supporting members corresponding to the number of carrying members, a box or the like permitting thus of being conveyed intermittently from one supporting member to the next supporting member thereabove or therebeneath through the movement of the carrying members, while during the return movement of the carrying members the transported box rests on the last-mentioned supporting members, which are adapted to be folded in underneath the bottom of the box.

A form of embodiment of the invention is illustrated in the accompanying drawings, wherein Fig. 1 shows a stacking machine in elevation, Fig. 2 shows the machine according to Fig. 1 viewed from the right, Fig. 3 shows a conveying track arranged above the machine, and Fig. 4 shows the machine viewed from above.

According to Figs. 1 and 2, a machine frame consisting of vertically set angle irons 1 is mounted on a foundation. Arranged between the angle irons on the foundation is a through-conveyor 2 for the feeding for instance of a line of boxes or crates 3. The conveyor may be of an ordinary type, for instances a roller or chain conveyor. On either side of the frame, a vertical shaft 4 is mounted in brackets 5 arranged on the angle irons 1, said shafts being connected to a double-acting piston in a compressed air cylinder 6 and being displaceable upwardly and downwardly by said piston. Lifting rods 7 are arranged on the shafts 4 in parallel to the same so as to be entrained in the movement of the shafts. A number of box carriers 8 are swingably arranged on the lifting rods 7, and the distance between the box carriers in a vertical direction is somewhat greater than the height of the boxes 3 to be stacked. The number of the box carriers depends on the height of the stacks in consideration. The box carriers 8 tend to take the swung-down position shown in Fig. 1, but are swingable upwardly during their downward movement by abutting a box 3 therebeneath or by means of studs 9 arranged on vertical shafts 10 mounted on the lifting rods 7, said shafts 10 being movable upwardly and downwardly under the influence of the piston

in a compressed air cylinder 11. The carriers 8 of each pair of carriers may also be swingable individually. When the box carriers are moving downwardly, they may traverse freely past the boxes and are thus preferably provided with rollers 12 or slide shoes bearing on the side of the box 3 during the movement. The rollers 12 are preferably resilient in themselves. Optionally, springs may be provided to press the carriers 8 in beneath the boxes 3 in the lower turning position.

A number of box supports 13 are arranged in pairs on the frame 1, said supports being optionally provided with rollers or slide shoes similar to those of the box carriers 8 while being swingable upwardly and permitting of being folded aside mechanically by means of pins 14 on a shaft 15, which is movable vertically in the frame 1 and adapted to be operated by means of a compressed air cylinder 16. The distance in the vertical direction between the box supports 13 is the same as the distance between the movable box carriers 8. The mutual location in the vertical direction between the movable carriers 8 and the box supports 13 is such that when the box 3 and thus the box carriers 8 take their highest position, the supports 13 shall permit of being swung in beneath the box. In the same manner the movable carriers 8 shall be swingable in beneath the box 3, when the carriers are at their lowermost point and the box is resting on the supports.

When the machine is used for transport from a lower plane to an upper plane, the boxes 3 will be fed in successively onto the conveyor 2 so as to strike against a stop member 17 adapted to be moved aside. The next box on the conveyor 2 is impeded by a stop contrivance 18 adapted to be moved aside with the aid of a lever device 19 operated by compressed air. The box 3 introduced into the machine is then raised by means of the compressed air contrivance 6 with the aid of the lowermost carriers 8 so high that the lowermost supports 13 fall in underneath the bottom of the same, whereupon the carriers 8 move downwardly and the box is left resting on the supports 13. When the carriers 8 are in the upper turning position, the next box 3 is fed into the machine by the stop device 19 being moved aside, and in the succeeding upward movement of the carriers 8 this latter box will be entrained, the box which was previously introduced into the machine being at the same time raised one step by the carriers 8 immediately preceding the lowermost ones to the next pairs of supports 13. The operation is repeated, and the box 3 first fed in will ultimately be located at the upper discharge plane, where another conveyor transfers the box to a place in consideration.

To render possible a direct transfer from the stacking machine to the latter conveyor, this is provided above the machine with a contrivance, by means of which the boxes may be put down directly on the conveyor. The contrivance consists of two carriages 20, 21 provided with roller elements 22 connected to the conveyor, said carriages having wheels 23 running on rails 24 toward and from one another in pace with the vertical lifting movement of the machine. The movement of the carriages may be derived from a compressed air cylinder 25 adapted to displace the carriage 20 back and forth, and from this carriage the movement is transmitted by means of endless chains 26 to the opposite carriage 21. The chains run over wheels 27, one of the carriages being connected to the upper part of the chains and the other carriage to the lower part of the same. When the uppermost box 3 in the stack formed is fed upwardly to the upper plane, the carriages 20, 21 are moved toward either side, so that an opening is formed for the box between the same, and when the carriers 8 are lowered down, the carriages 20, 21 are displaced toward one another, the box being thus

put down on the same so as to be permitted to roll further.

The contrivance for the transfer of the boxes to the upper conveyor obviously need not be constructed as set forth above, it being instead possible for the same purpose to make use of a plate or the like, for example, permitting of being moved in beneath the box.

When the machine is to be used for the stacking of boxes fed in from below, only the lowermost box carriers **8** and the lowermost supports **13** need be used, and in this case the remaining carriers and supports are kept folded up by the mechanical means. The box is fed into the machine in the manner set forth above and is raised onto the lowermost supports **13**, and when the next box is raised, the upper box remains standing on the lower one and will follow in the upward movement, the whole box stack being thus caused to rest on the lowermost supports **13**, when the carriers **8** are moved downwardly. When the desired number of boxes have been stacked on each other, the supports **13** are folded up, the whole stack then following with the carriers **8** in their downward movement to be placed on the conveyor **2** in order then to be transported away. If desired, a further box may be introduced into the machine, on which the stack is placed, said box then serving as a lowermost box. By this means the stacking time is reduced still more.

The machine may also be used to break a stack fed into the machine, in which the boxes stand close on each other, so that individual boxes are transported away from the machine. By means of the lowermost carriers **8** the whole stack is first raised so high that a pair of gripping members **28** that are swingably mounted on the frame **1** may seize the handles of the box immediately preceding the lowermost box in the stack, whereby the latter will be hanging in the gripping members **28**, while the lowermost box is again lowered down onto the conveyor **2** by the lowermost carriers **8**. When the carriers **8** are next time adjacent to the upper turning position, the stack will instead rest on the same, while the gripping members **28** are moved out of the handles of the box. In order that the gripping members **28** shall not seize a wrong box, they are actuated by a spring **30** connected to the same and adapted to be strained by a pin **29** on the lifting rod **7** during the movement of the latter, before the carriers **8** raise the stack, said spring thus keeping the gripping members away. When the carriers **8** then move downwardly and entrain the lowermost box, the gripping members **28** are again folded out to engage the handle of the box next above. The working operation is then repeated, until the whole stack has been broken. In this case only the lowermost carriers **8** are made use of, while all supporting members **13** and the remaining carriers are retracted.

When the gripping members **28** are not to be used, they may be folded out and locked in the folded-out position.

A downward transport from an upper plane to a lower one may also be carried out with the machine, and likewise stacks may be formed by the boxes fed down from above. As the machine is preferably operated by a compressed air system, valves for the various operations may be so arranged that all movements become synchronized, so that the machine may operate altogether automatically. Obviously, other driving systems functioning in the same way may also be made use of.

I claim:

1. In a stacking machine and vertical conveyor, a box feeding station, a frame having a number of superimposed supporting members arranged thereon, each of said members being adapted to support one box, vertical shafts mounted to move vertically back and forth in said frame and having arranged thereon a number of superimposed carrying members corresponding to the number of supporting members on the frame, said carrying members being operable to lift a box from one supporting member to be engaged by the next, said supporting members being independently swingable in the vertical plane by action of the boxes lifted by the carrying members and being foldable in underneath a lifted box by gravity and said carrying members being independently swingable in the vertical plane during downward movement by impact on a box resting on said supporting members and in the lowermost position engaging underneath a box standing on the supporting member, and a discharge conveyor at the upper end of the frame.

2. In a stacking machine and vertical conveyor, a box feeding station, a frame having a number of superimposed supporting members arranged thereon, each of said members being adapted to support one box, vertical shafts mounted to move vertically back and forth in said frame and having arranged thereon a number of superimposed carrying members corresponding to the number of supporting members on the frame, said carrying members being operable to lift a box from one supporting member to be engaged by the next, said supporting members being independently swingable in the vertical plane by the action of boxes lifted by the carrying members and being foldable in underneath a lifted box by gravity, means operable simultaneously to swing all the supporting members, said carrying members being independently swingable in the vertical plane during downward movement by impact on a box resting on said supporting members and in the lowermost position engaging underneath a box standing on the supporting member, and a discharge conveyor at the upper end of the frame.

3. In a stacking machine and vertical conveyor, a box feeding station, a frame having a number of superimposed supporting members arranged thereon, each of said members being adapted to support one box, vertical shafts mounted to move vertically back and forth in said frame having arranged thereon a number of superimposed carrying members corresponding to the number of supporting members on the frame, said carrying members being operable to lift a box from one supporting member to be engaged by the next, said supporting members being independently swingable in the vertical plane by the action of boxes lifted by the carrying members and being foldable in underneath a lifted box by gravity, means operable simultaneously to swing all the supporting members, said carrying members being independently swingable in the vertical plane during downward movement by impact on a box resting on said supporting members and in the lowermost engaging underneath a box standing on the supporting member, means operable simultaneously to swing all the carrying members, and a discharge conveyor at the upper end of the frame.

4. In a stacking machine and vertical conveyor, a box feeding station, a frame having a number of superimposed supporting members arranged thereon, each of said members being adapted to support one box, vertical shafts mounted to move vertically back and forth in said frame and having arranged thereon a number of superimposed carrying members corresponding to the number of supporting members on the frame, said carrying members being operable to lift a box from one supporting member to be engaged by the next, said supporting members being independently swingable in the vertical plane by the action of boxes lifted by the carrying members and being foldable in underneath a lifted box by gravity and said carrying members being independently swingable in the vertical plane during downward movement by

impact on a box resting on said supporting members and in the lowermost position engaging underneath a box standing on the supporting member, and a discharge conveyor at the upper end of the frame, said discharge conveyor having the portion right above the frame adapted to move aside to leave a free passage for a box lifted above the frame by the carrying members.

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