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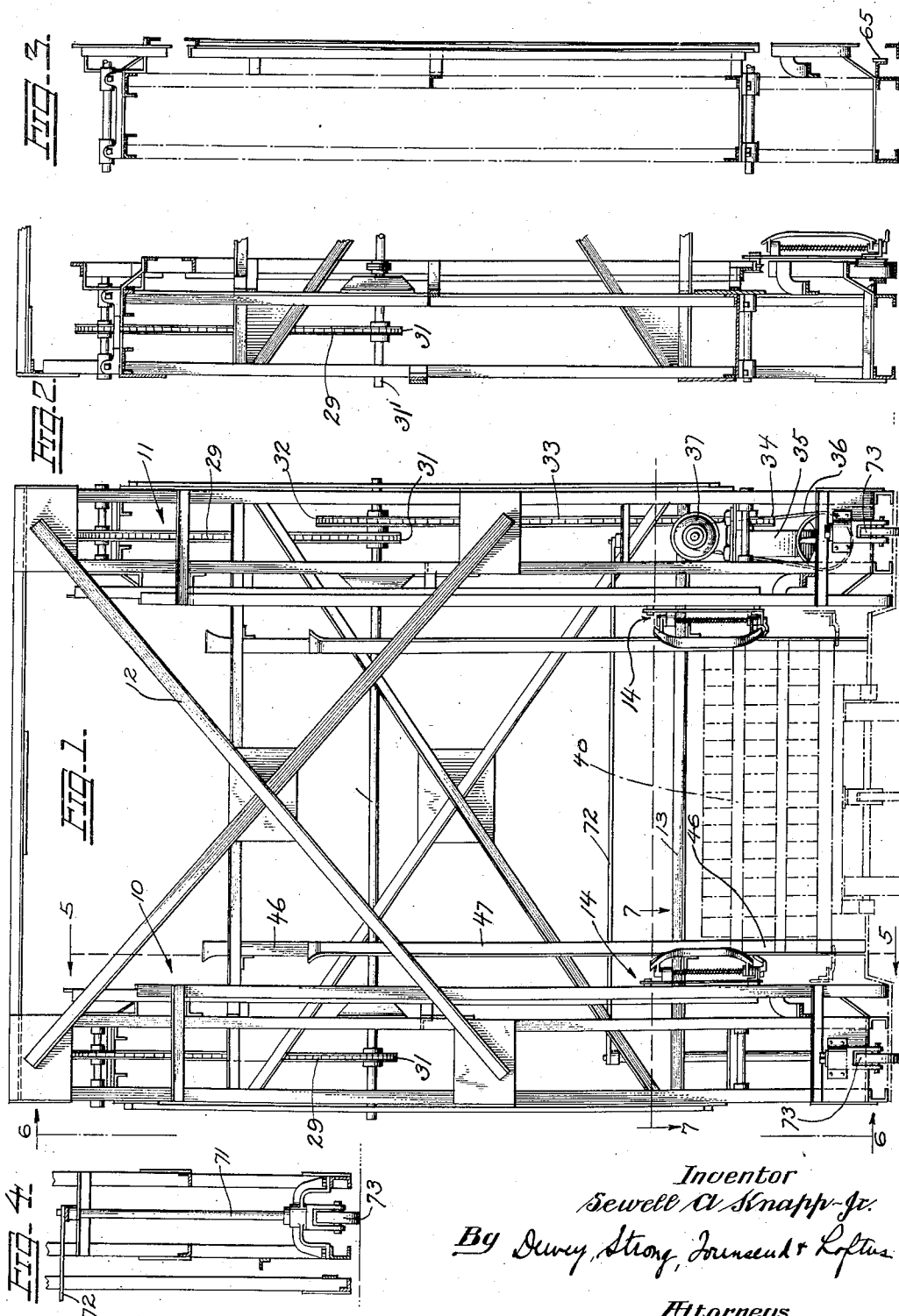
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S. A. KNAPP, JR

TRAY STACKING MACHINE

Filed April 14, 1924

3 Sheets-Sheet 1



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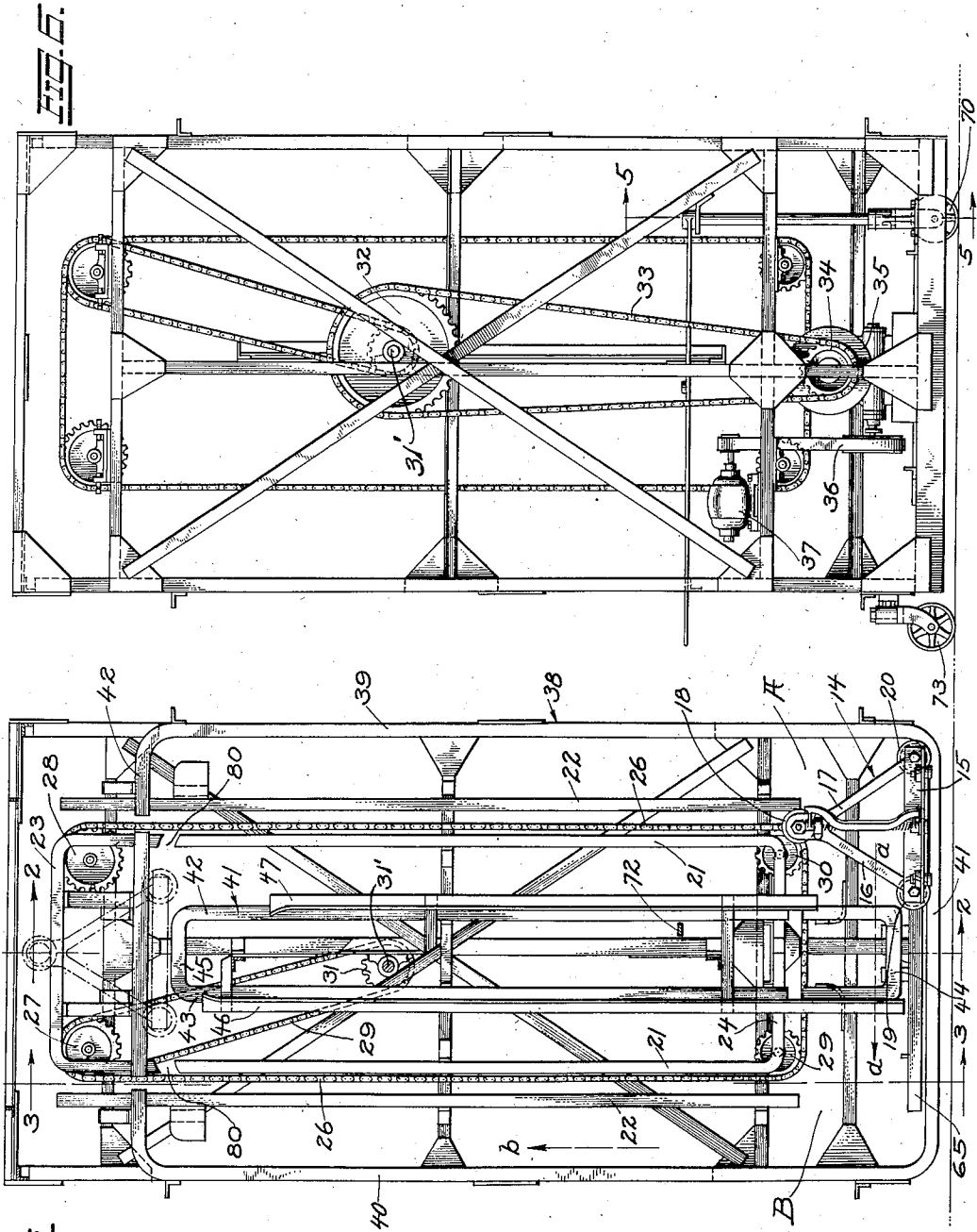
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FIG. 7

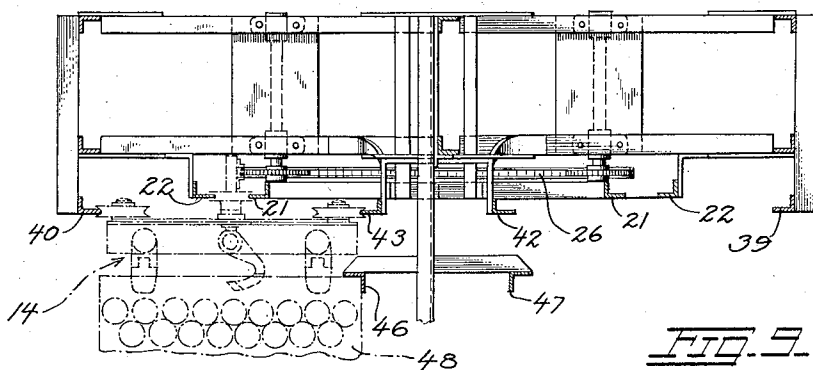


FIG. 8

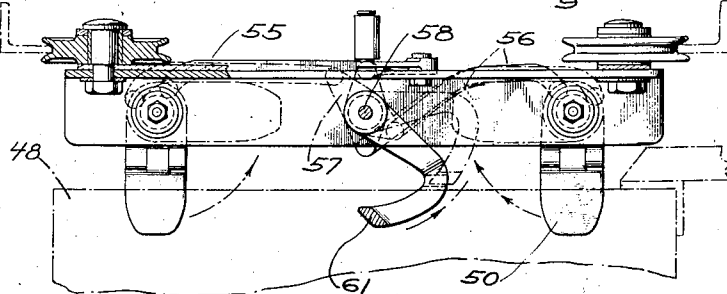
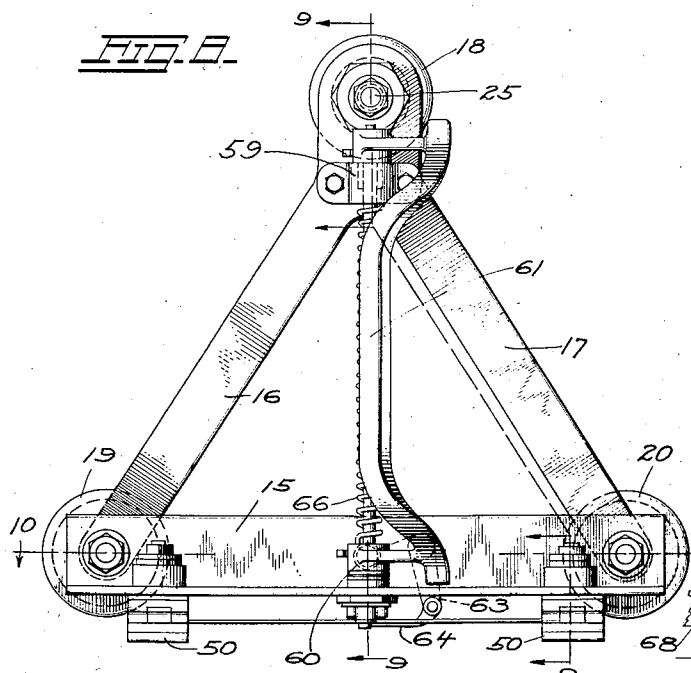


FIG. 10

FIG. 9

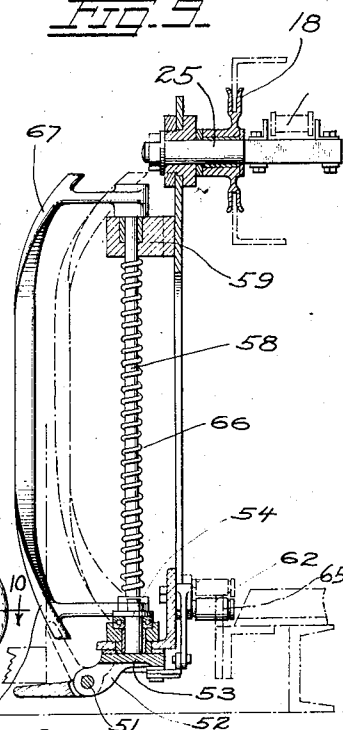
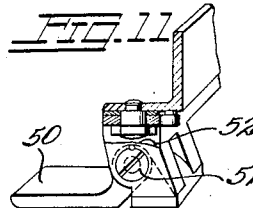


FIG. 11



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TRAY-STACKING MACHINE.

Application filed April 14, 1924. Serial No. 706,287.

This invention relates to a conveying mechanism, and particularly pertains to a tray stacker.

It is the principal object of the present invention to provide an apparatus which may be operated to mechanically stack and unstack trays of fruit, vegetables, cans and the like, said stacking devices being so designed as to be portable, thus enlarging its effective use, and being further novel in the fact that it will stack and unstack from two stacks of trays at all times acting upon the uppermost tray or trays in the stack.

The present invention contemplates the use of a superstructure mounted upon casters to permit it to be moved from place to place, said superstructure carrying a plurality of sets of tray engaging members so designed as to remove the uppermost tray or plurality of trays in a stack of trays and to deposit this tray on top of another stack of trays.

The invention is illustrated by way of example in the accompanying drawings in which:

Fig. 1 is a view in front elevation showing the complete structure with which the present invention is concerned.

Fig. 2 is a fragmentary view in front elevation showing one of the column structures of the invention.

Fig. 3 is a fragmentary view in sectional elevation showing the roller guideways of one of the column structures.

Fig. 4 is a fragmentary view in section and elevation showing one of the caster mountings of the structure.

Fig. 5 is a view in elevation as seen on the line 5—5 of Fig. 1 showing the structural details of one of the columns and the manner in which the tray conveyors are propelled and maintained in an operating position.

Fig. 6 is a view in elevation showing one of the columns as viewed in the direction of arrows 6—6 indicated in Fig. 1.

Fig. 7 is a view in horizontal section through the machine as seen on the line 7—7 of Fig. 1 and more clearly indicates by dotted lines the relative positions of one of the conveyors to a tray.

Fig. 8 is an enlarged view in elevation showing one of the conveyor members.

Fig. 9 is a view in vertical section through Fig. 8 as seen on the line 9—9 of Fig. 8.

Fig. 10 is a view in horizontal section

through one of the conveyors as seen on the line 10—10 of Fig. 8.

Fig. 11 is a fragmentary view of a modified form of carriage finger as seen in perspective.

Referring more particularly to the drawings, 10 and 11 indicate two parallel vertical column structures rigidly held in spaced parallel relation to each other by suitable structural members as indicated at 12 and 13. These parallel columns carry a plurality of conveyor members 14 which are driven along a rectilinear course of travel in a vertical plane. The conveying members are more clearly shown in Figs. 8 to 10 inclusive, in which it will be seen that a horizontally extending angle bar 15 is connected with hanger arms 16 and 17. These three members when assembled from a triangle at the points of which rollers 18, 19 and 20 are rotatably disposed. The rollers 18 are adapted to move between parallel track members 21 and 22. The track members 21 extend vertically and are connected at their upper and lower ends by track continuations 23 and 24 respectively. The track portions 22 extend in spaced parallel relation to the pair of tracks 21 and operate in conjunction with the track members 21 to provide vertical guides along which the flanged rollers 18 may move.

The rollers 18 are mounted on shafts 25 carried by links of a conveyor chain 26. The conveyor chain pursues a rectilinear course of travel around a pair of upper sprockets 27 and 28 and a pair of lower sprockets 29 and 30 which determine the path of travel of the chain and hold it disposed in spaced relation to the track members 21, 22, 23 and 24. The chain 26 may be driven in either direction through a driving chain 29 and a jack shaft 31'. The jack shaft carries a sprocket 31 around which the driving chain 29 is led. A sprocket 32 is also fixed on this shaft and carries a motor chain 33 leading to a sprocket 34 of a reduction gear set 35. This gear set is shown in Fig. 6 as being driven by a belt 36 leading from a motor 37, associated with one column of the machine. The motor is of the reversible type so that the present invention may be used to stack and unstack trays of material.

The carriage structure generally indicated at 14 in Fig. 5 and upon which is

mounted rollers 18, 19 and 20, is maintained with its cross frame member 15 in a constant horizontal position during the movement of the carriage by the conveyor shaft 26. This is brought about by engagement of the rollers 19 and 20 with a rectangular track 38 comprising vertical sections 39 and 40 and connecting horizontal sections 41 and 42. The point of intersection of these various track members is formed in the shape of a curved track or rail with sufficient arc to permit the rollers 19 and 20 to conform thereto as the carriage changes its direction of travel and without tipping the carriage. Acting in conjunction with the track structure 38 is a centrally disposed rectangular track structure 41 comprising vertical track members 42 and 43 complementary to the vertical tracks 39 and 40 respectively, and horizontally connecting track portions 44 and 45 parallel to the track portions 41 and 42 respectively.

It will be evident from examination of Fig. 5 that as the carriage moves horizontally along its lower horizontal path of travel, both of the rollers 19 and 20 will be traveling along the lower track member 41, and that if the carriage is moving in the direction of the arrow *a* in Fig. 5, it will change its direction of travel to a vertical movement as the shaft hanger 25 passes around the sprocket 29, and the carriage then moves upwardly in the direction of the arrow *b*. During this upward movement roller 19 will travel along the outer rail 40, roller 20 will travel along the inner rail 43, and the upper guide roller 18 will travel along and between the rails 21 and 22.

When the carriage reaches the limit of its upward vertical movement and the hanger shaft 25 passes around the sprocket 27, the roller 18 will travel along the track 23 while rollers 19 and 20 will pass along and between track 42 and the short track section 45. After the hanger shaft 25 has passed around the sprocket 28 the carriage will move downwardly as the pulley 18 passes between the tracks 21 and 22 and the rollers 19 and 20 move along vertical track sections 42 and 39 respectively.

Guide rails 46 and 47 are provided as part of the column structure to form guiding members for the trays 48 which are being handled by the machine.

Carried by each of the carriage structures 14 is a pair of fingers 50. These fingers are mounted for vertical swinging movement around a pin 51 supported in a suitable bearing 52 forming a part of a horizontally swinging member 53. This horizontally swinging member is pivotally mounted relative to the carriage structure on a shaft 54. It will be understood that there are two finger structures and two shafts 54 shown more clearly in Fig. 8 as being disposed near

the opposite ends of the horizontal frame member 15, and by reference to Fig. 10, it will be seen that the fingers when swinging horizontally swing inwardly toward each other and assume positions parallel and beneath the frame member 15. This swinging action is brought about by the movement of two links 55 and 56 which are connected to a lever 57 having opposite extending portions swinging simultaneously around a shaft 58. The shaft 58 is disposed equidistant between the pins 54 and extends vertically to project through an upper bearing 59 as well as a lower bearing 60.

The shaft 58 with its operating lever 57 may be actuated by two methods. In one instance by a vertically disposed tray cam 61 secured to the shaft near its upper and lower ends and adapted to normally stand so as to be engaged by the side of a stack of trays and to be swung to the dotted line position indicated in Figs. 9 and 10. In addition the lever 57 may be rotated by a roller 62 which is carried by a bell crank 63 pivotally mounted upon the horizontal frame member 15. The lower end of this bell crank is connected by a link 64 with the chain 58 so that when the roller 62 on the free end of the bell crank is swung upwardly by engagement with a horizontal cam member 65, and while the carriage is moving along this lower horizontal path of travel, the fingers will be swung to their innermost positions.

A coil spring 66 is disposed around the shaft 58 and acts to normally rotate the shaft 58 and swing the fingers 50 to their outermost positions and the track cam 61 to a position where it will engage the stack of trays. The exact configuration of the track cam is more clearly shown in Figs. 8 and 9 where it will be seen to have inclined upper and lower portions 67 and 68 with an intermediate bow portion adapted to be wedged against the side of a stack of trays and to swing the cam out of the way of the trays and to thus rotate the shaft 58. It will be evident that variations in cam proportions will be required with trays of various heights and containing material which space them different distances apart, and that this design may also be changed to insure that a plurality of the top trays may be picked up if desired.

While the foregoing description has been confined to the construction of one of the columns 10 or 11 and one carriage structure 14 forming a part thereof, it is to be understood that the columns 10 and 11 are substantially in duplicate, and that they each are fitted with carriages arranged in horizontally aligned spaced relation to each other so that the fingers 50 of the two carriages may assume positions beneath and engaging the opposite sides of a tray in a manner to lift the tray while maintaining it in

a horizontal position, and further making it possible to stack and unstack the trays without danger of spilling their contents.

In operation of this invention, it may be desirable to move the entire structure from place to place, and with that idea in view, front wheels 70 are provided as shown in Figs. 1, 5, and 6. These wheels are mounted for swinging movement on fork shafts 71 and may be swung by a lever 72. Caster wheels 73 are disposed at the opposite side of the machine so that the entire structure may be readily moved and accurately guided and positioned. In Fig. 11 of the drawings is shown a form of finger 50 used when only vertical swinging movement of the finger is required, as for example, in the machine only intended to stack trays.

In operation of the present invention, the entire structure is assembled as indicated in Fig. 1 with the complementary carriage structures disposed in horizontal alignment as there shown. The carriages will be driven and will be maintained in their horizontally aligned positions as previously described. Assuming that trays are being stacked at a station marked A in Fig. 5 and unstacked at a station marked B in the same figure, the operation of the carriage mechanism will be as follows:

The carriage will pass horizontally in the direction of the arrow —a— in Fig. 5 until it reaches a position in alignment along opposite sides of the stack of trays. This position will be accurately determined by first stacking the trays so that their corners are properly seated in the angles of the complementary members 46. When the carriage moves to a centrally aligned position along opposite sides of the stack of trays, the direction of the carriage will be changed from horizontal to vertical and the carriage will then travel upwardly in the direction of the arrow —b— in Fig. 5.

Prior to this upward swinging movement, the roller 62 as indicated in Fig. 9 will have been engaged by the straight horizontal cam 65 to swing the fingers 50 inwardly and so that they will clear the opposite sides of the trays. This will also act to swing the cam member 61 inwardly to clear the sides of the trays. The carriages will then move upwardly, and as the operating roller 62 moves away from the cam 65, the tray cam 61 will engage the ends of the trays and will thus be maintained in its inoperative position. This will continue until the cam is moving off of the uppermost tray when the lower inclined face 68 will cause the cam 61 to gradually swing inwardly and simultaneously permit the fingers 50 to swing outwardly under the impulse of the coil spring 66. Before the carriages clear the uppermost tray the fingers 50 will be in position beneath the tray and will engage the same

as the carriage continues its upward travel. It will then be supported by four fingers 50, two upon each side of the tray. The tray will then continue along its upper course of travel, thereafter passing horizontally at the top of the columns and thus will be lowered alongside of the guide angles 57.

As the tray comes to rest on the stack of trays the fingers 50 will be free due to the fact that the lower inclined face 68 of the cam member 61 will strike the tray as it continues downwardly, and will swing the finger horizontally so that it will clear the succeeding trays in the stack. The cam will of course, be in engagement with the ends of the trays in the stack as it continues down to the bottom of the stack, at which time the roller 62 will strike the rail 65, and will continue to hold the fingers in their clearing position while the carriages move horizontally and completely beneath the stack of trays, and until the carriages come into alignment for upward movement along the side of the stack from which the trays are to be removed, at which time the cams 61 will engage the ends of the stack of trays, and will hold the fingers out of engagement therewith until the lower faces 68 of the cams have cleared the uppermost tray in the stack, at which time the fingers 61 will again swing horizontally beneath the uppermost tray in the stack from which the trays are being removed. This will permit the carriages to move free from the trays. Attention is particularly directed to the fact that due to the peculiar rectilinear path of travel followed by the carriages, the structure may be compactly designed and will insure that the trays may be picked from and stacked at points near the ground level, which would not be the case if large sprocket wheels were used at the top and bottom of the structure, as is common practice in conveyor design. It will, therefore, be evident that due to the design here shown, the over-all height of the machine is materially decreased, thus making the device especially adapted for portable use.

It will be evident that there must be a break in the vertical track members 21 to permit the rollers 19 and 20 to cross over the other track, and for that purpose the tracks 21 are broken away as indicated at 80 in Fig. 5.

It will be evident that by driving the mechanism in opposite directions, the structure is capable of stacking and unstacking piles of trays mechanically and without difficulty.

It will thus be seen that the invention here disclosed provides convenient portable means for mechanically stacking and unstacking trays without danger of spilling their contents and with great rapidity due to the

accurate mechanical action of the mechanism.

While I have shown the preferred form of my invention as now known to me, I wish it understood that various changes may be made in its construction without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A tray stacking machine comprising complementary conveying means, carriages carried by said means on a rectilinear path of travel for engaging the opposite ends of a tray, and automatically operating means for causing the carriages to engage and lift trays from the top of a stack of trays.

2. A tray stacking machine comprising complementary conveying means, carriages carried thereby, means on said carriages for engaging the trays of a stack of trays as the carriages move upwardly past said stack, and automatic means carried by the carriages and actuated by engagement with the stack of trays whereby the tray engaging means of the carriages will move beneath the uppermost tray in the stack and lift it from the stack.

3. A tray stacking machine comprising complementary conveying means, carriages carried thereby, means on said carriages for engaging the trays of a stack of trays as the carriages move upwardly past said stack, automatic means carried by the carriages and actuated by engagement with the stack of trays whereby the tray engaging means of the carriages will move beneath the uppermost tray in the stack and lift it from the stack, and means whereby the tray carried by the carriage may be arranged in another stack of superposed trays while the tray engaging means automatically moves away from the trays in the second stack to permit continuous movement of the carriage.

4. A tray stacking machine comprising a pair of continuous conveyors moving in parallel vertical planes at the opposite ends of a stack of trays, complementary carriages carried by said conveyors and fitted with a plurality of tray engaging fingers, means for continuously maintaining said fingers in horizontal alignment during the complete cycle of movement of the carriages, and means for permitting the fingers to swing upwardly from their horizontal positions when the carriages are moving downwardly along the opposite sides of a stack of trays, and means for simultaneously swinging the fingers horizontally when the fingers have reached a position where they will move beneath a tray to be lifted.

5. A tray stacking machine comprising a pair of endless chains having rectilinear

movement in parallel vertical planes, carriage members hung from said chains and adapted to be carried therewith along said rectilinear path of travel, a plurality of fingers mounted on said carriages and pivoted for vertical movement upwardly from a normally horizontal position, means on the carriages, and cooperating means in the vertical operating planes of the conveyor chains for maintaining the fingers in horizontally aligned positions, means permitting the fingers to swing inwardly and horizontally, and operating means adapted to engage opposite sides of a stack of trays to swing said fingers to their inoperative horizontal positions and to release said fingers as the carriages reach the top of the stack and in a position to permit the fingers to swing beneath the uppermost tray of the stack and to lift the tray with the carriages.

6. A tray stacking machine comprising a pair of complementary conveyors each carrying guide rollers spaced from each other in a horizontal plane, a guide roller thereabove and spaced substantially midway between said horizontal rollers, endless conveyor chains moving simultaneously to carry said carriages along substantially rectilinear paths of travel, and supporting rails substantially bridging the distance between the vertical lengths of said chain and to receive the upper rollers of said carriages, whereby the weight of the carriages and their load will be supported in said rails while the carriages move horizontally from one vertical path of travel to the other.

7. A tray stacking machine comprising a pair of complementary conveyors each carrying guide rollers spaced from each other in a horizontal plane, a guide roller thereabove and spaced substantially midway between said horizontal rollers, endless conveyor chains moving simultaneously to carry said carriages along substantially rectilinear paths of travel, and supporting rails substantially bridging the distance between the vertical lengths of said chain and to receive the upper rollers of said carriages, whereby the weight of the carriages and their load will be supported in said rails while the carriages move horizontally from one vertical path of travel to the other.

8. A tray stacking machine comprising a pair of endless conveyor chains adapted to move in parallel vertical planes and along rectilinear paths of travel, carriages pivotally suspended from said chains, said carriages having a horizontally extending tray engaging portion at the ends of which guide rollers are carried, and a third guide roller carried on the pivotal mounting of the conveyor chain, and a horizontal track-way along which the horizontally aligned rollers of the carriage pass while the carriage is

moving from one tray station to another, vertical trackways along which the horizontal rollers pass as the carriage is being moved in one vertical direction in the machine, vertical trackways along which the horizontally aligned rollers pass as the carriage is moving in the opposite vertical direction, vertical trackways between which the upper carriage roller passes while the carriage is moving along its opposite vertical path of travel, and a horizontal trackway receiving said upper roller and supporting the weight of the carriage while the carriage is being transferred from one vertical path of travel to the other.

9. A tray stacking machine including a conveyor unit comprising a vertically disposed frame structure, four sprockets arranged in pairs and the pairs equally spaced from each other, a continuous chain passing around all of said sprockets, means for driving the same, a conveying carriage supported from the chain carried therewith, means for maintaining said carriage in horizontal

alignment while following the rectilinear path of travel of the chain, and means for supporting the weight of the carriage while moving horizontally from one sprocket of the upper pair to the other sprocket of the same pair.

10. A tray stacking machine including conveying means comprising a vertically disposed frame, sets of sprockets arranged in two parallel and vertical planes, sprocket chains one led around each set of sprockets in each parallel plane and pursuing a substantially rectilinear path of travel around said sprockets, means for driving said sprockets, complementary carriages mounted on said chains and designed to support a load between the planes of the chains and to convey said load in the rectilinear path of travel of the chains, and means for supporting the weight of the carriages and their load while said carriages are moving horizontally in their rectilinear path of travel.

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