

Aug. 8, 1961

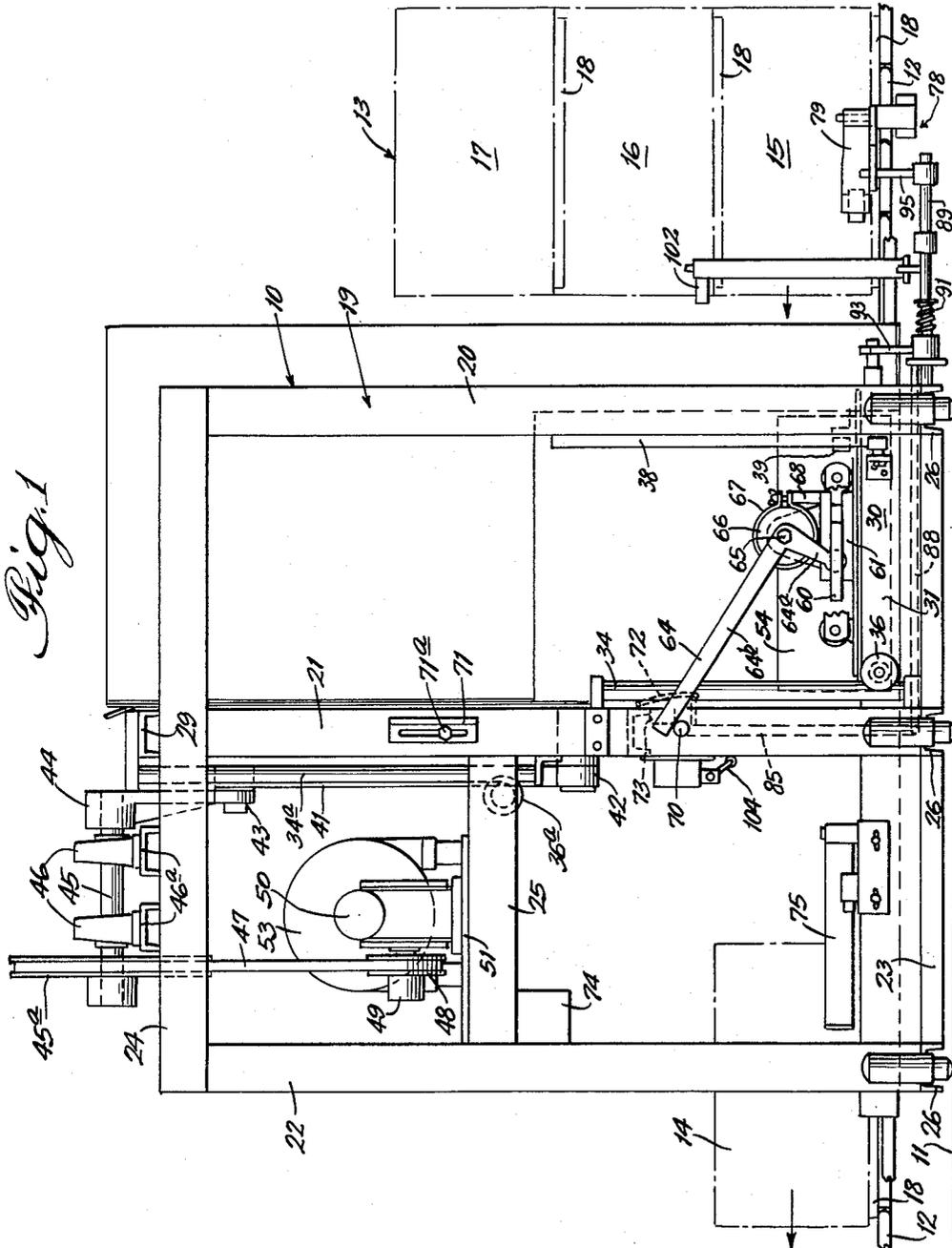
E. E. HAGELINE

2,995,273

UNSTACKING MECHANISM

Filed Aug. 21, 1958

3 Sheets-Sheet 1



*Fig. 1*

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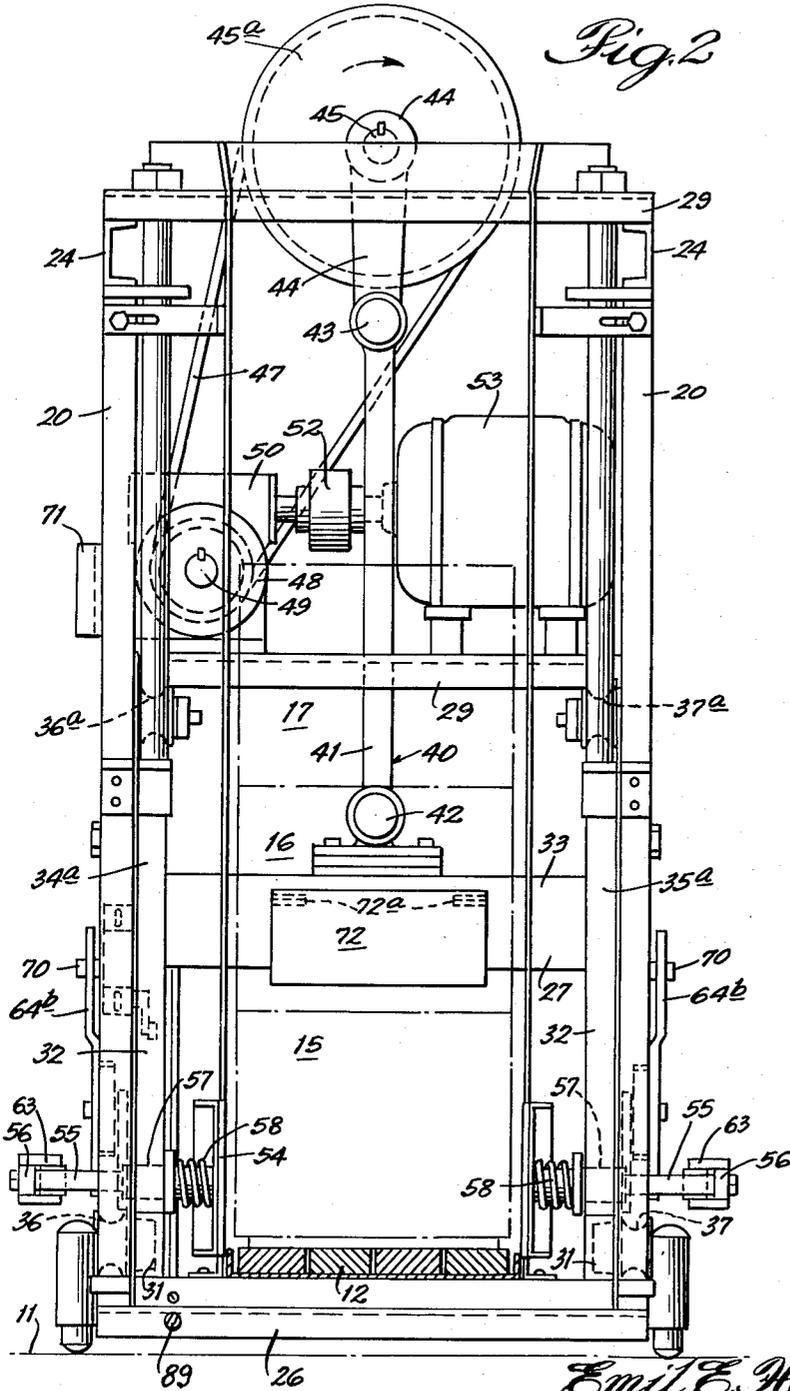
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3 Sheets-Sheet 2



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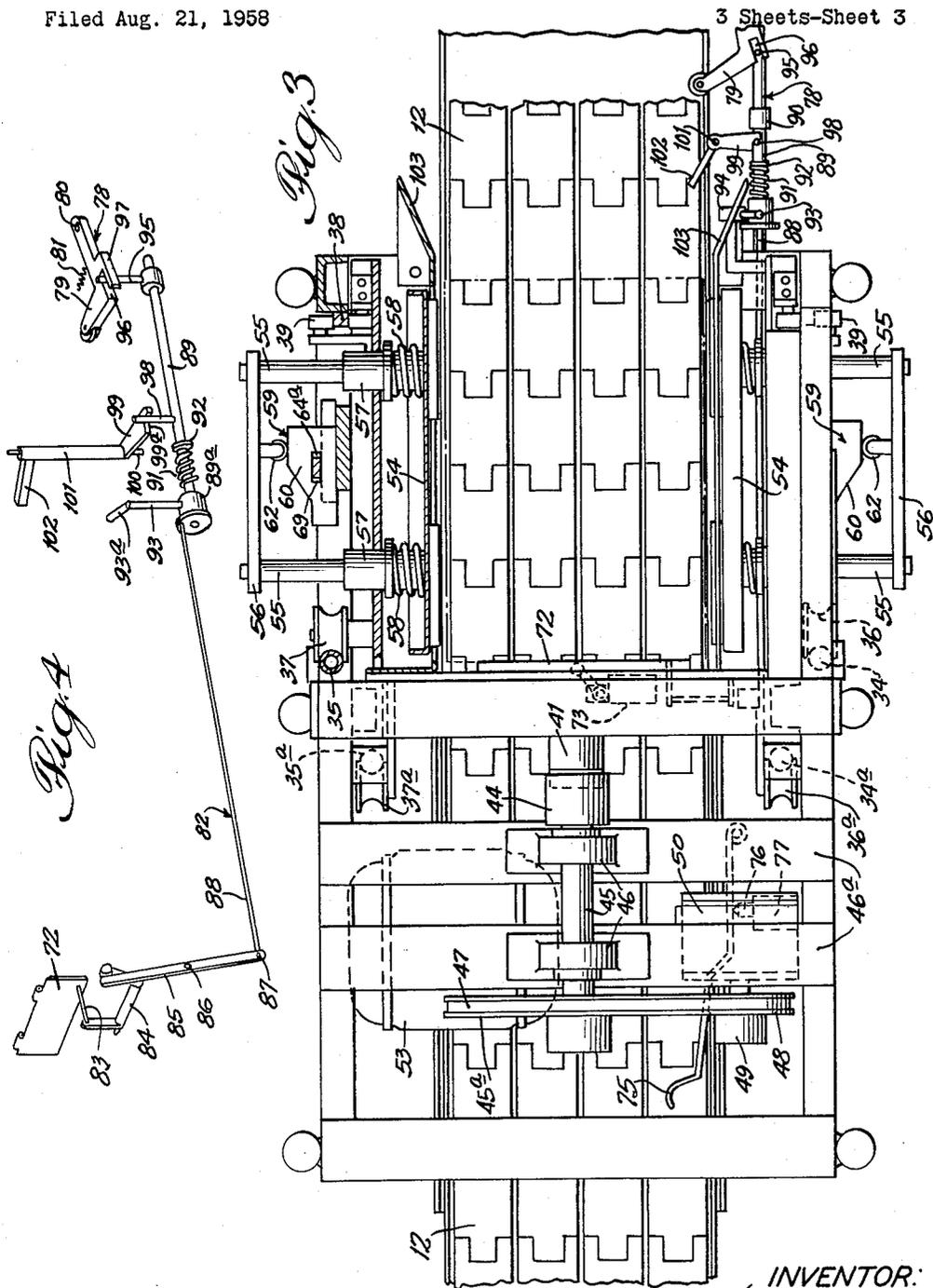
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UNSTACKING MECHANISM

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3 Sheets-Sheet 3



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2,995,273

**UNSTACKING MECHANISM**

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2 Claims. (Cl. 221-11)

This invention relates to an unstacking mechanism and, more particularly, to an unstacking mechanism useful in disassembling a vertical stack of cases or the like.

It is an object of this invention to provide a novel unstacking mechanism. Another object is to provide a destacker for cases or the like. Still another object is to provide a mechanism for disassembling cases which are equipped with elements capable of nesting them together in vertical stacks. Yet another object is to provide a mechanism for unstacking vertically arranged containers or the like which are moved generally horizontally in a continuous fashion and in which the unstacking mechanism serves to halt the progress of the container stack while permitting the advancing means to continue in operation.

A further object of the invention is to provide an unstacking mechanism which cooperates with a moving conveyor and in which the mechanism is operative to elevate all cases in the stack except the lowermost case, thereby permitting the lowermost case to be removed. A still further object is to provide a novel unstacking mechanism which is characterized primarily by having mechanical movements and linkages so that positive control of the various units in the stack is afforded at all times. Other objects and advantages (both general and specific) of the invention may be seen as this specification proceeds.

This invention will be explained in conjunction with the accompanying drawing, in which:

FIG. 1 is an elevational view of an unstacking mechanism embodying the teachings of this invention; FIG. 2 is a side elevational view of the mechanism seen in FIG. 1; FIG. 3 is a top plan view, partially in section, of the mechanism; and FIG. 4 is a fragmentary perspective view of a stop mechanism provided at the entering end of the unstacking mechanism.

Referring now to the drawing, the numeral 10 designates generally an illustrative embodiment of the invention relating to an unstacking mechanism. The unstacking mechanism 10 is shown supported on a floor 11 which also supports a chain conveyor 12 and a stack of cases generally designated 13 carried by conveyor 12. Conveyor 12 is seen to pass through the unstacking mechanism 10, the leaving end of conveyor 12 supporting a single case 14. In order to further aid in explaining the operation of the invention, the cases in stack 13 are also numbered, the lowermost case being given the numeral 15, the case second from the bottom being given the numeral 16, and the uppermost case in the stack of three cases having the numeral 17 applied thereto.

The cases 14-17, as illustrated, can be cases for supporting milk bottles, or the like, and are equipped with a depending perimetric rib 18 which serves to nest the cases one within the other, in a fashion well known to those skilled in the art. In the general operation of the device herein to be disclosed, the cases 16 and 17 are elevated relative to case 15 by the unloading mechanism 10, permitting chain conveyor 12 to carry case 15 out of the mechanism 10 and into the position of case 14. Subsequently, the depleted stack is repositioned on conveyor 12 and case 17 elevated relative to case 16, whereupon case 16 is carried by conveyor 12 to the position of case 14, ad seriatim. As the last case of a stack is removed from the mechanism, the mechanism 10 is deactivated until energized by the entry of a subsequent stack of units into unstacking position.

For this purpose, the mechanism 10 is equipped with

a generally rectangular frame generally designated 19 which, in the illustration given, is a channel network having vertical column members 20, 21 and 22 on each side of chain conveyor 12. The vertical column members 20-22 on each side of the machine are rigidly united by means of longitudinally-extending horizontal members 23 and 24. Vertical column members 21 and 22 are additionally rigidified by longitudinally-extending member 25. The side frameworks provided by elements 20-25 are tied together by transverse members 26, 27, 28 and 29 (seen best in FIG. 2).

Mounted for vertical reciprocation within frame 19 is a subframe, designated generally by the numeral 30. Subframe 30 includes a pair of spaced-apart, longitudinally-extending side members 31 (arranged on opposite sides of frame 10) and which are equipped with vertically-extending members 32 connected together by means of transverse member 33. Each vertical column member 21 is equipped with a pair of guide posts 34 and 35 (seen best in FIG. 3), and subframe 30 carries grooved rollers 36 and 37 which bear against guide posts 34 and 35, respectively, to aid in guiding the subframe 30 during its vertical movement. A second pair of guide posts 34a and 35a cooperate with rollers 36a and 37a in further stabilizing subframe 30.

Each vertical column member 20 is equipped with a vertical bearing strip 38 which, in cooperation with rollers 39 mounted on members 31, further serve to stabilize and guide subframe 30 during its vertical movement.

Vertical movement of subframe 30 within frame 10 is achieved by virtue of a motor-operated crank mechanism, designated generally by the numeral 40, and which includes a crank member 41 rotatably secured at one end thereof as at 42 cross-member 33. The other end of crank member 41 is pivotally secured as at 43 to a bell crank 44, which in turn is key-seated on a longitudinally-extending shaft 45. Shaft 45 is supported for rotation in a pair of pillow blocks 46 mounted on cross-members 46a of frame 10.

Shaft 45 is equipped with a sprocket 45a non-rotatably secured thereto as by keying, and which is engaged by a chain 47. Chain 47 is energized by a sprocket 48 mounted on an extended shaft 49 of a speed-reducing mechanism 50 supported on a plate 51 carried by members 25 of frame 10. The speed reducer is coupled by means of an electrical clutch 52 to an electric motor 53, also supported on plate 51. The electrical connections to motor 53 are not shown, but it will be understood that conventional wiring can be readily employed.

Means are provided on each longitudinal member 31 of subframe 30 for gripping a case second from the bottom of a stack 13, such as case 16. The gripping means illustrated include a pair of spaced-apart, opposed gripping pads 54. Pads 54 are mounted on the ends of shafts 55, two shafts 55 being connected to each pad 54. Shafts 55 are connected together at their ends remote from pad 54 by means of a crossbar 56. Shafts 55 are slidably mounted in bushings 57, which are rigidly anchored in place on members 31 as by welding. A coil spring 58 is mounted on each shaft 55 between its associated bushing 57 and gripping pad 54. The springs 58 are operative to urge their associated pad 54 away from the rigidly mounted bushings and, therefore, urge the oppositely-disposed pads 54 toward each other to clamp a case or other stacked unit therebetween.

The pads 54 are maintained apart at a spaced distance greater than the width of a case or other unit to be clamped therebetween through the operation of a spring-retarding mechanism designated generally by the numeral 59 (best seen in FIG. 3), and which includes a cam 60 slidably mounted in a bearing block 61 secured to member 31. Cam 60 presents a contoured surface against

which a cam follower roller 62 bears, cam follower roller 62 being rotatably mounted within spaced-apart arms 63 secured to crossbar 56.

Sliding movement of cam 60 is achieved by means of cam arm 64 which is pivotally mounted on block 61. Secured to cam arm 64 is a shaft 65 to which is affixed a brake drum 66, brake drum 66 being in frictional engagement with an annular brake band 67 which is supported on a post 68, also secured to block 61. One portion of lever arm 64, that portion being designated 64a, engages a slot 69 in cam 60 (best seen in FIG. 3). The other portion of cam arm 64b (cam arm 64 being generally L-shaped) is longitudinally extended and, during the vertical travel of subframe 30, moves between stops 70 and 71 secured to vertical column member 21. In the position shown, cam arm 64 so positions cam 60 as to compress springs 58. As subframe 30 moves upwardly, portion 64b of cam arm 64 encounters stop 71. Further upward movement of subframe 30 results in a pivotal (counterclockwise) movement of arm 64, which moves cam 60 to the right and allows springs 58 to urge the gripping pads 54 toward each other and into a clamping relation.

Pivotally mounted on cross-member 27 is a switch-actuating plate 72 by hinges 72a. Plate 72 is maintained normally in the position shown by its connection with electric switch element 73 (best seen in FIG. 3). Electrical connections between electric switch 73 and junction box 74 mounted on frame 10 are not shown, but provide means for transmitting a signal from switch 73 to electric clutch 52. Thus, depression of plate 72 by a stack of units to be unstacked, initiates movement of subframe 30 by virtue of the activation of electric clutch 52 and coupling the rotative motion in motor 53 to speed reducer 50.

Also pivotally mounted on frame 19 is switch arm 75 (see FIG. 3), which is operative to depress element 76 of electric switch 77. Switch 77 functions to reactivate clutch 52 during an unstacking operation. The clutch 52 is deactivated during the downward movement of a stack of cases and for a time sufficient to permit the lowermost case to issue from the mechanism.

The numeral 78 designates generally a stop mechanism for preventing a case from entering the unstacking mechanism 10 whenever the gripping pads 54 are actuated, i.e., in engagement with a case or about to engage a case by virtue of the depression of switch-actuating plate 72. The stop means 78 includes a stop member 79 which is pivotally mounted as at 80 on a stationary frame portion (not shown) of the conveyor 12. Stop member 79 is normally urged into a case-stopping position by means of a coiled spring 81 interconnected between the stationary frame of the conveyor and stop member 79.

Stop member 79 is responsive to the position of switch plate 72 through a linkage generally designated 82. The linkage 82 includes an abutment member 83 which is suitably mounted in guide means (not shown) on frame 19. A cross-link 84 is pivotally connected to abutment member 83, and, in turn, cross-link 84 is pivotally connected to a lever 85 pivotally supported as at 86 on column 21. Lever 85 is also pivotally connected as at 87 to a push-rod 88, which is disposed for longitudinal movement relative to conveyor 12. Through the linkage system 82 just described, it will be noted that the push-rod 88 will be moved in a direction away from mechanism 10 whenever switch plate 72 is depressed.

Axially aligned with push-rod 88 is a bar 89 mounted for sliding and rotating movement in bearings 90, only one of which is shown and that in FIG. 3 for simplification of the drawing. Bearings 90 can be connected to either frame 19 or the conveyor frame so as to maintain bar 89 in longitudinal alignment with push-rod 88, it being understood that conveyor 12, and, therefore, its stationary side framing, is fixed relative to frame 19. Movement of rod 88 away from mechanism 10, therefore,

induces a corresponding movement of bar 89. The position of bar 89 remote from frame 19 occurs whenever switch plate 72 is depressed as during the actuation of the gripping pads 54. Upon deactivation of switch-plate 72, push-rod 88 no longer exerts a positive longitudinal force on head 89a of bar 89 and spring 91, which is attached between a stop 92 on bar 89 and head 89a operates to move bar 89 to a position close to frame 19. This movement induces a corresponding movement of push-rod 88, which in turn moves abutment member 83 into a position adjacent switch-plate 72 and conditions the linkage system 82 and the stop mechanism 78 in a condition responsive to depression of switch-plate 72.

Head 89a is equipped with an upwardly-extending striking bar 93 which is engageable with a caster or roller 94 supported on subframe 30. The downward movement of subframe 30 causes roller 94 to temporarily engage the striking bar projection 93a and rotate bar 89 in the direction shown by the curved arrow in FIG. 4. The rotational movement of bar 89 operates to pivot stop member 79 in a counterclockwise fashion. For this purpose, bar 89 is equipped with an upwardly-extending lug 95 that is received within a slot 96 in stop member 79 provided by equipping stop member 79 with a stepped arm 97.

For roller 94 to engage striking bar 93, it is necessary for push-rod 88 to be in its retracted position, i.e., the position occurring when no case bears against switch-plate 72. When no case bears against switch-plate 72, the mechanism 10 is in a condition ready for receiving a stack of cases to be unstacked. In this condition, the subframe 30 is at its lowermost position, and clutch 52 is disengaged. Since the engagement of roller 94 with projection 93a is only temporary, means are provided to maintain the bar 89 in a rotated position from that shown. For this purpose, bar 89 is equipped with an upright post 98 which is adapted to engage a latch 99. Latch 99 can be pivotally mounted on the conveyor frame as at 100. Latch 99 is urged to the position shown in the drawings by a spring, or the like, that can be housed with pivot point 101.

When subframe 30 is approaching an inoperative state, as would be the instance where the last case of a stack is being deposited on conveyor 12 from pads 54, roller 94 temporarily engages striking bar 93. This engagement is made possible because: (1) push-rod 88 is retracted (switch-plate 72 no longer being depressed); and (2) spring 91 is operative to force bar 89 toward mechanism 10 and therefore align striking bar 93 for engagement with roller 94. Striking bar 93 is temporarily engaged by roller 94 to rotate bar 89 in the direction of the curved arrow in FIG. 3. Latch 99, under the influence of its spring, pivots in a counterclockwise fashion to present a holding surface or notch 99a against post 98. The temporary engagement of roller 94 with striking bar 93 thus acts as a "cocking" action for latch 99. Once the rotation of latch 99 has occurred, it is effective to maintain bar 89 in the rotated position shown. In this position, stop member 79 is retracted and inoperative to stop cases from passing it. This condition will persist so long as no stack of cases passes by latch 99. For this purpose, latch 99 is equipped with an inwardly-directed arm 102 which is engaged by the second of a stack of cases (as best seen in FIG. 1). This arm permits the passage of a single case, but not of a stack.

Upon the engagement of a case with latch 99, latch 99 is pivoted in a clockwise fashion to remove its holding action from post 98, which thereupon permits stop member 79 to pivot in a counterclockwise direction and act as a stop for a successive case or stack of cases. Because the spacing between latch 99 and the stop member 79 is less than the length of a case, the stop member 79 is effective to retard advance of subsequent cases even though they may be in contacting relation with a case that has been permitted to pass by the stop member 79.

When the cases are in abutting relation, the smooth top surface of conveyor 12 permits the case that is engaging latch 99 (and which is operative to disengage the hold-down action of latch 99 from post 98) to move laterally under the influence of stop member 79 so that stop member 79 is in position to retard the advance of a subsequent case irrespective of how close it may be to the case passing the stop. A case thus laterally displaced may be centered for entry into the unstacking mechanism 10 by means of the angled centering guide 103 provided as part of frame 19 and which abuts the sides of conveyor 12.

The stop member 79 remains in extended or case-stopping position until the subframe 30 has stopped unstacking case and the latch 99 has been cocked by the action of roller 94.

To oppose the action on subframe 30 tending to distort or move the same by virtue of the reaction on push-rod 88 of rotating bar 89, a guide roller 104 is provided on column 21, as shown in FIG. 1.

The operation of the unstacking mechanism can be further understood by a consideration of the following:

#### Operation

As a stack of cases or other units is brought into mechanism 10 by the operation of conveyor 12, the case 16 second from the bottom is urged against plate 72 to rotate it inwardly and thereby actuate switch 73. Herein it is to be appreciated that if the conveyor is advancing only a single unit, the unstacker will not function and the conveyor will advance the case straight through the mechanism 10 without interference. However, upon the actuation of switch 73, clutch 52 is activated and the motion of motor 53 is transmitted through speed reducer 50, sprocket 48, chain 47, sprocket 45a to shaft 45. The rotation of shaft 45 through bell crank 44 and crank arm 41 causes subframe 30 to move upwardly. Stops 71, which are positionable vertically on member 21 by virtue of bolts 71a, are engaged by portion 64b of lever arms 64. Further upward movement of subframe 30 pivots lever arms 64 counterclockwise and moves cams 60 to the right, allowing the shafts 55 to move inwardly under the urging of compression springs 58 and thereby clamp case 16 with pads 54. The resilient mounting of pads 54, as in the illustration given, by springs 58, permits the pads to accommodate their spacing to cases of various widths.

Stops 71 are so positioned that the inward movement of shafts 55, and, therefore, gripping pads 54, occurs shortly before the end of the upward movement of subframe 30. Continued upward movement of subframe 30 after gripping pads 54 have engaged case 16 raises case 16, and any additional cases such as 17 supported thereabove, and out of nesting relation with case 15, permitting case 15 to be advanced by conveyor 12 out of mechanism 10.

Plate 72 is still depressed to actuate switch 73 inasmuch as case 16 has been moved vertically only a short distance. This maintains clutch 52 in an active condition and continues the rotation of shaft 45 and the operation of bell crank 44. Shortly after the commencement of the downward movement of subframe 30, clutch 52 is deactivated by switch means housed in junction box 74, thereby stopping subframe 30 in a position spaced upwardly of its lowermost position. This permits case 15 to be advanced by conveyor 12 and out of mechanism 12. The downward movement of subframe 30 is re-initiated by the engagement of switch arm 75 by case 15, now in the position designated 14 in FIG. 1 and issuing from mechanism 10. Thereafter, subframe 30 continues downwardly and near the bottom of the downward stroke, lever arm 64 engages stop 70 which shifts cam 62 to the left and retracts gripping pads 54 from case 16, allowing it to drop a slight distance into position on conveyor 12. Case 16, now being in the bottommost position, is maintained within housing 10 by virtue of case 17, now the number

two case, which, in turn, is prevented from moving out of mechanism 10 by its engagement with plate 72. The continued depression of plate 72, now by case 17, re-initiates a cycle of upward and downward movement of subframe 30. When the last case, i.e., case 17, in the instance of a stack of cases 13 three high, is deposited on conveyor 12, there is no longer any case oriented to depress plate 72, so the mechanism is stopped.

From the foregoing, it is to be seen that the gripping pads 54 in effect follow a rectilinear path, first moving upwardly a substantial distance, thereafter moving inwardly a distance sufficient to grasp a case positioned therebetween, and thereafter moving upwardly a short distance sufficient to grasp a case positioned herebetween, and thereafter moving upwardly a short distance necessary to permit the bottommost case to pass freely under the clamped second case. The downward movement is interrupted for a time dependent upon the time required for the disengaged bottom case to issue from the mechanism. Thereafter, the downward movement of the pads associated with the reciprocally-mounted subframe 30 is continued until shortly before the end of the downward stroke, at which time the gripping pads 54 are moved outwardly. The weight of the subframe 30 is sufficient to cause the subframe to drop into a position of rest on frame 19 even though electric clutch 52 is disengaged, as would be the instance where the last case of a stack had been dropped from between the retracted clamping arms 54.

While in the foregoing specification a detailed description of an embodiment of the invention has been set forth in considerable detail for the purpose of illustration, various changes in the details thereof may be made by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. In case de-stacking apparatus, a horizontally-disposed conveyor having a smooth upper surface to slidably support cases thereon, a rigid framework astride said conveyor arranged to have cases on said conveyor transported therethrough, said framework comprising a set of three aligned, spaced-apart column members on each side of said conveyor, beam members connecting said column members to form said rigid framework, one of said beam members extending across said conveyor and connecting the middle of each set of column members, said one beam member being positioned above said conveyor a distance intermediate the height of a case second from the bottom of a stack of cases transported by said conveyor, a switch member continuously engageable by said second case pivotally mounted on said one beam member and on the side thereof adjacent the case entering-end of said framework, said middle column members each being equipped with vertically-extending tracks on opposite sides thereof, a wheel-equipped carriage reciprocally mounted on said tracks, guide means on the end of said carriage adjacent the entering-end of said framework, said guide means slidably engaging the column members adjacent the entering-end of said framework, motor means on said framework between said middle column members and the column members adjacent the leaving-end of said framework, crank and clutch means connecting said motor means with said carriage, said clutch means being energized to couple said motor means and crank means by engagement of said second case with said switch member, said crank means being connected to a portion of said carriage adjacent said middle column members, opposed gripper pads on said carriage for gripping said second case and equipped with spring means for urging said gripper pads horizontally toward each other, means on said framework for engaging said gripper pads to oppose said spring means and restrict the urging thereof during initial upward movement of said carriage to a height suitable for gripping said second case, a linkage system mounted on one of said middle

column elements and having a portion engageable with said switch member, said linkage system including a stop member positioned beside said conveyor spaced from said entering-end column members and operative to retard cases from entering said framework, said stop member being pivotally mounted relative to said conveyor and effective to move in a horizontal arc over said conveyor, said linkage system being equipped with latch means for supporting said stop member out of the path of a case transported on said conveyor, said linkage system including an unlatching arm engageable by a case passing said stop member and operative to unlatch said latching means, said arm being positioned a spaced distance from said stop member, said spaced distance being less than the length of a case, and an energizing element positioned beside said conveyor spaced from said leaving-end column members and effective to actuate said carriage for downward movement when said energizing element is contacted by a case exiting from said framework.

2. In case de-stacking apparatus, a horizontally-disposed conveyor having a smooth upper surface to slidably support cases thereon, a rigid framework astride said conveyor arranged to have cases on said conveyor transported therethrough, said framework comprising a set of three aligned, spaced-apart column members on each side of said conveyor, beam members connecting said column members to form said rigid framework, one of said beam members extending across said conveyor and connecting the middle of each set of column members, said one beam member being positioned above said conveyor a distance intermediate the height of a case second from the bottom of a stack of cases transported by said conveyor, a switch member continuously engageable by said second case pivotally mounted said one beam member and on the side thereof adjacent the case entering-end of said framework, said middle column members each being equipped with vertically-extending tracks on opposite sides thereof, a wheel-equipped carriage reciprocally mounted on said tracks, guide means on the end of said carriage adjacent the entering-end of said frame-

work, said guide means slidably engaging the column members adjacent the entering-end of said framework, motor means on said framework between said middle column members and the column members adjacent the leaving-end of said framework, crank and clutch means connectng said motor means with said carriage, said clutch means being energized to couple said motor means and crank means by engagement of said second case with said switch member, said crank means being connected to a portion of said carriage adjacent said middle column members, opposed gripper pads on said carriage for resiliently gripping only said second case on the upward movement of said carriage, control means for said clutch means for halting said carriage adjacent the top of its travel, an energizing element positioned beside said conveyor spaced from said leaving-end members and effective to actuate said carriage for downward movement when said energizing element is contacted by a case exiting from said framework, and a stop member coupled to said switch member and positioned beside said conveyor spaced from said entering-end column members and operative to retard cases from entering said framework whenever said switch member is contacted by a case.

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UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 2,995,273

August 8, 1961

Emil E. Hageline

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1 to 3, for "Emil E. Hageline, of Chicago, Illinois, read -- Emil E. Hageline, of Chicago, Illinois, assignor to Warren DuBroff --; line 12, for "Emil E. Hageline, his heirs" read -- Warren DuBroff, his heirs --; in the heading to the printed specification, line 3, for "Emil E. Hageline, 3138 Parnell Ave., Chicago, Ill." read -- Emil E. Hageline, Chicago, Ill., assignor to Warren DuBroff --.

Signed and sealed this 6th day of February 1962.

(SEAL)

Attest:

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Attesting Officer

DAVID L. LADD  
Commissioner of Patents