Aug. 8, 1961

E. E. HAGELINE

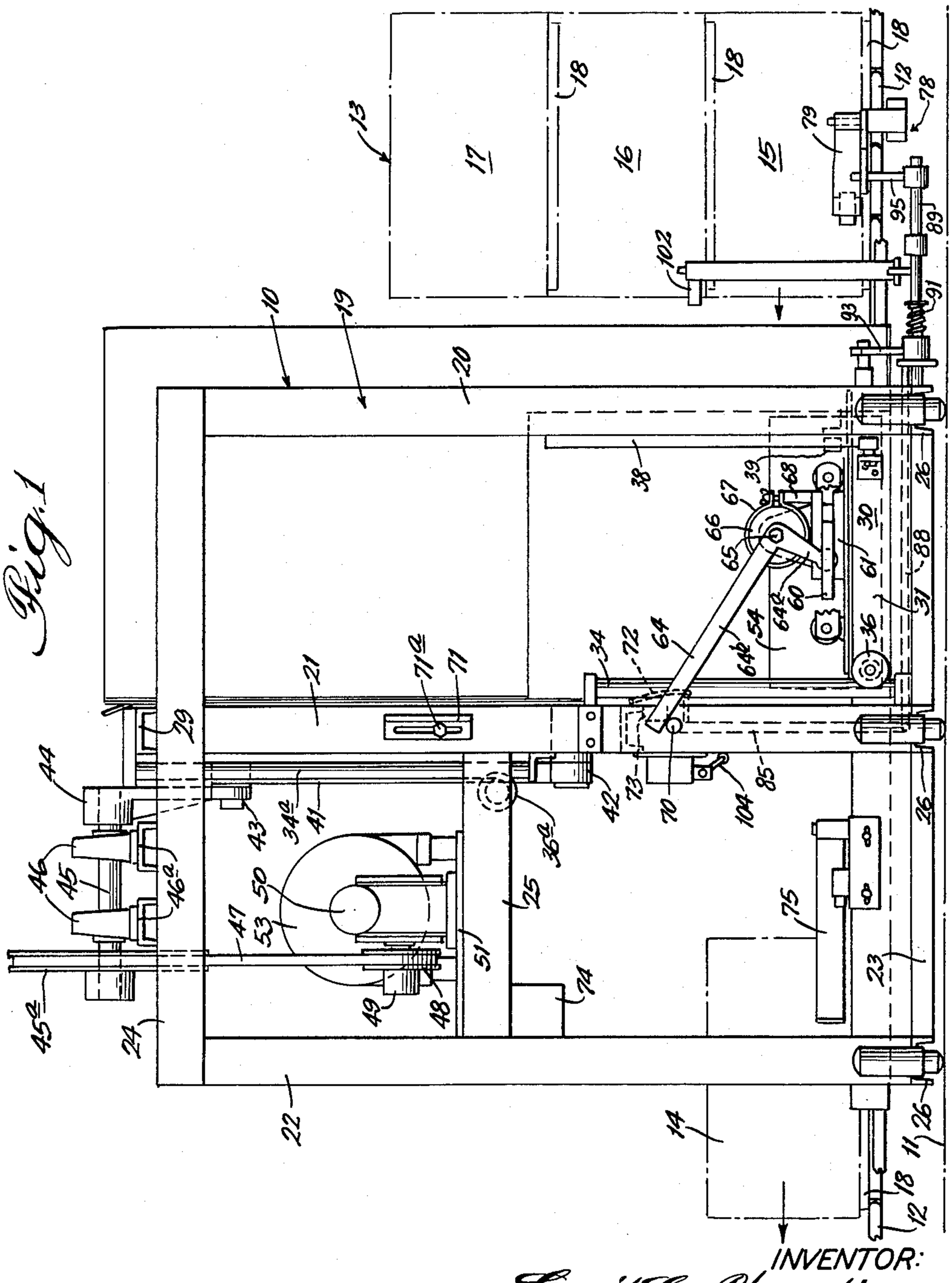
2,995,273

UNSTACKING MECHANISM

Filed Aug. 21, 1958

3 Sheets-Sheet 1

Fig. 1



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UNSTACKING MECHANISM

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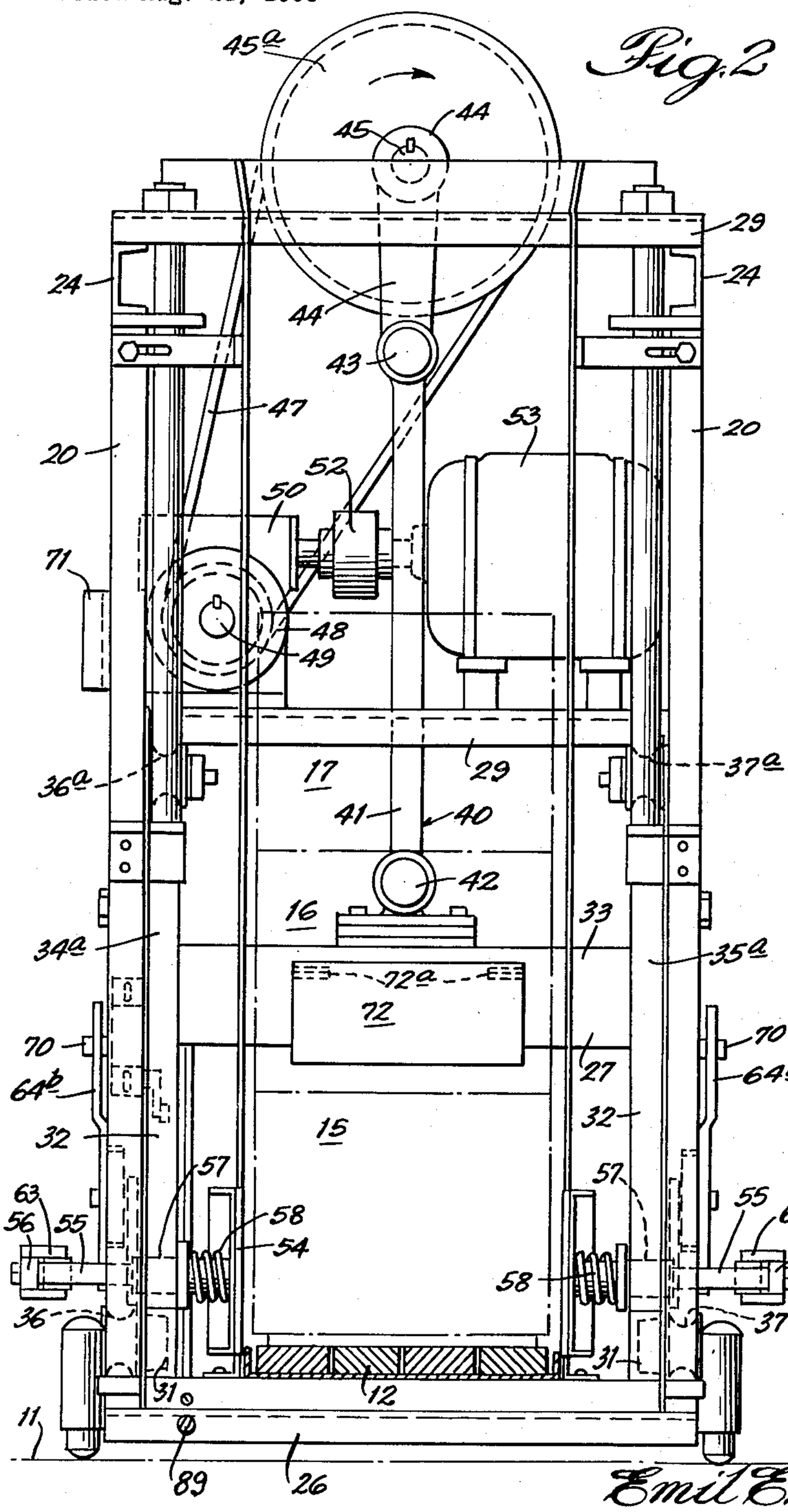
Fig. 2



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UNSTACKING MECHANISM

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Fig. 4

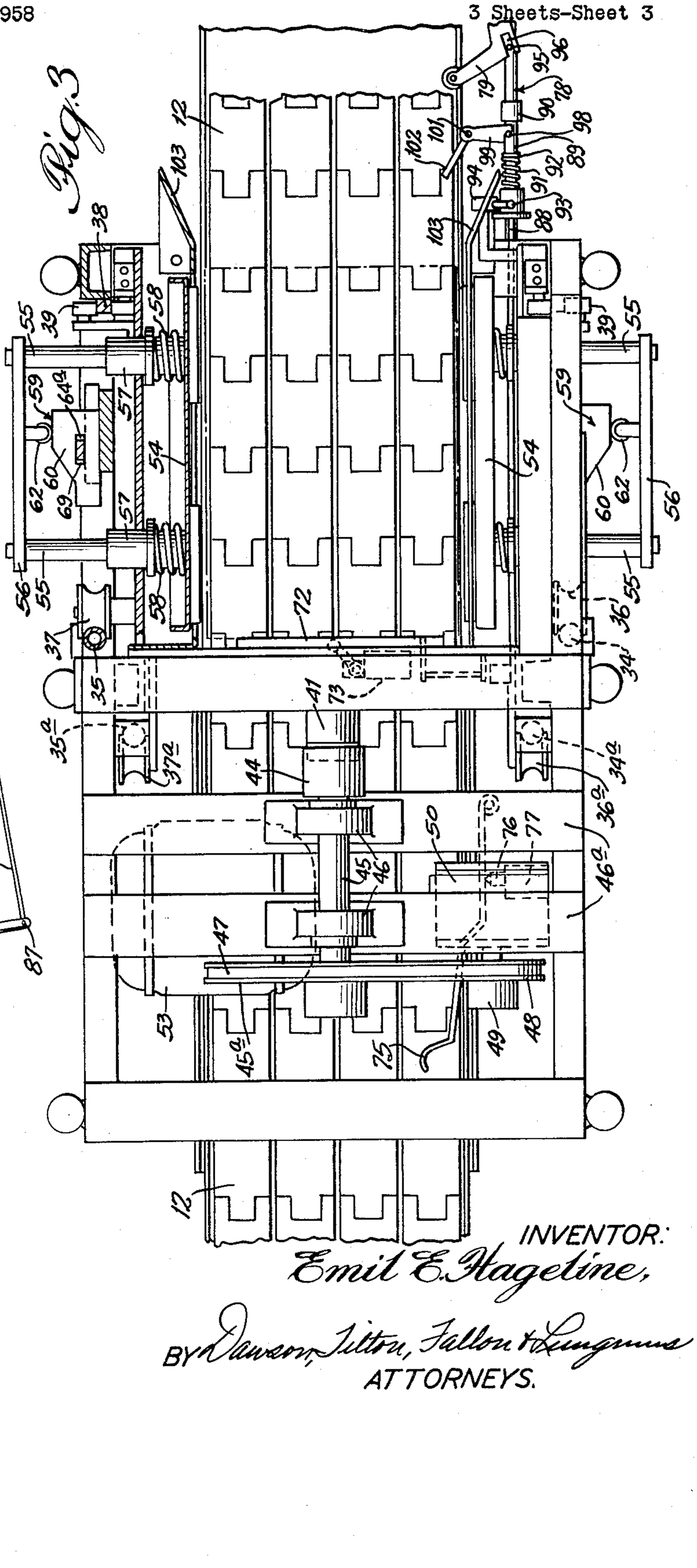

Fig. 3

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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 **34***a* and **35***a* cooperate with rollers **36***a* and **37***a* 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 **46***a* of frame **10**.

Shaft **45** is equipped with a sprocket **45***a* 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 **64***a*, engages a slot **69** in cam **60** (best seen in FIG. 3). The other portion of cam arm **64***b* (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 **64***b* 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 **72***a*. 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 **89***a* of bar **89** and spring **91**, which is attached between a stop **92** on bar **89** and head **89***a* 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 **89***a* 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 **93***a* 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 **93***a* 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 **99***a* 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 retraced 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 **45***a* 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 **71***a*, are engaged by portion **64***b* 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 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 reciprocably-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 reciprocably 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 reciprocably mounted on said tracks, giude 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 connectnig 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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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:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents