June 30, 1970 H. E. TEMPLE 3,517,835

UNSTACKING MECHANISM

Filed May 6, 1968 4 Sheets-Sheet 1

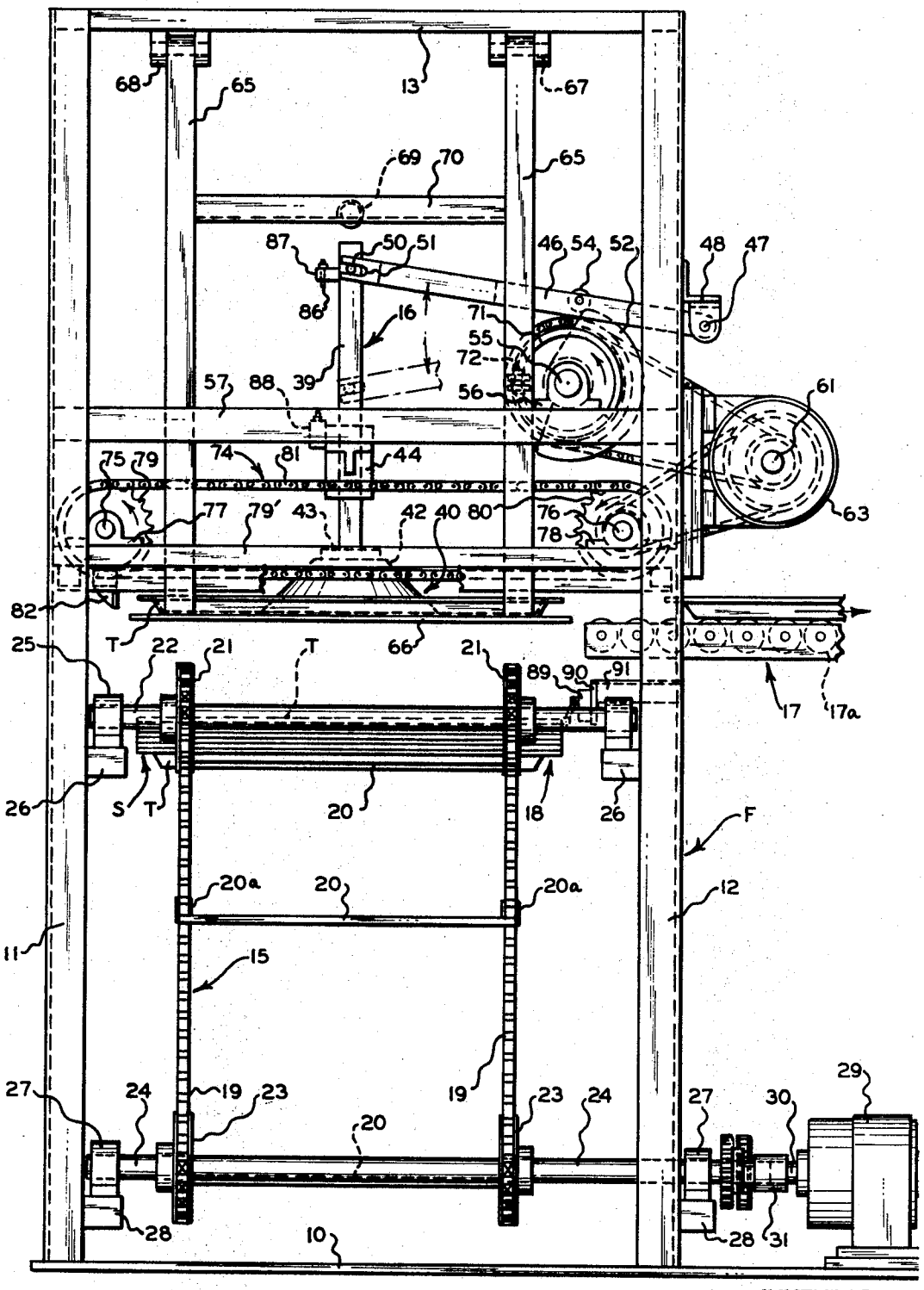


FIG. 1

INVENTOR.
HIRAM E. TEMPLE

BY

Learman, Learman & McCulloch

ATTORNEYS

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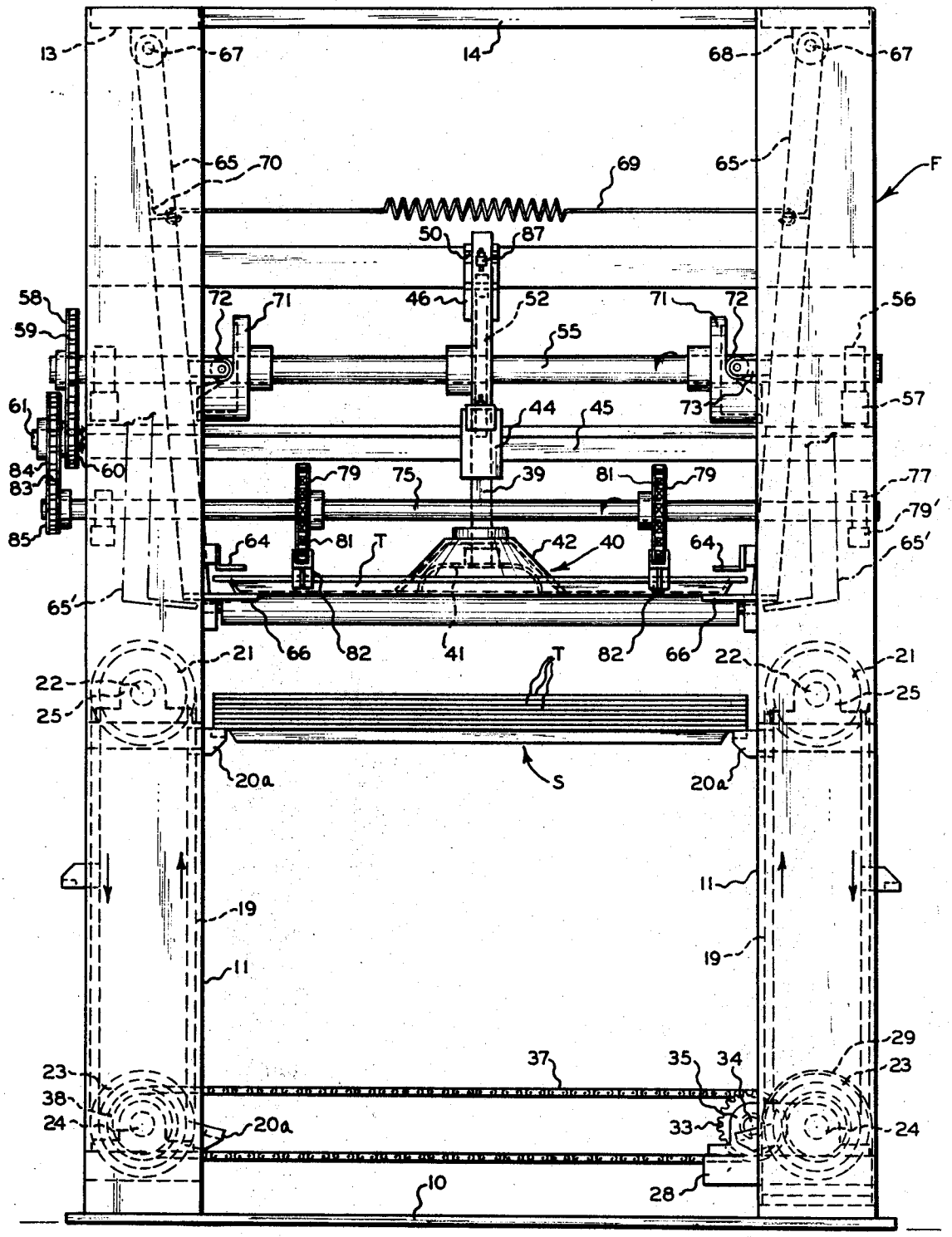


FIG. 2

INVENTOR.
HIRAM E. TEMPLE

BY
Learman, Learman & McCulloch

ATTORNEYS

June 30, 1970 H. E. TEMPLE 3,517,835

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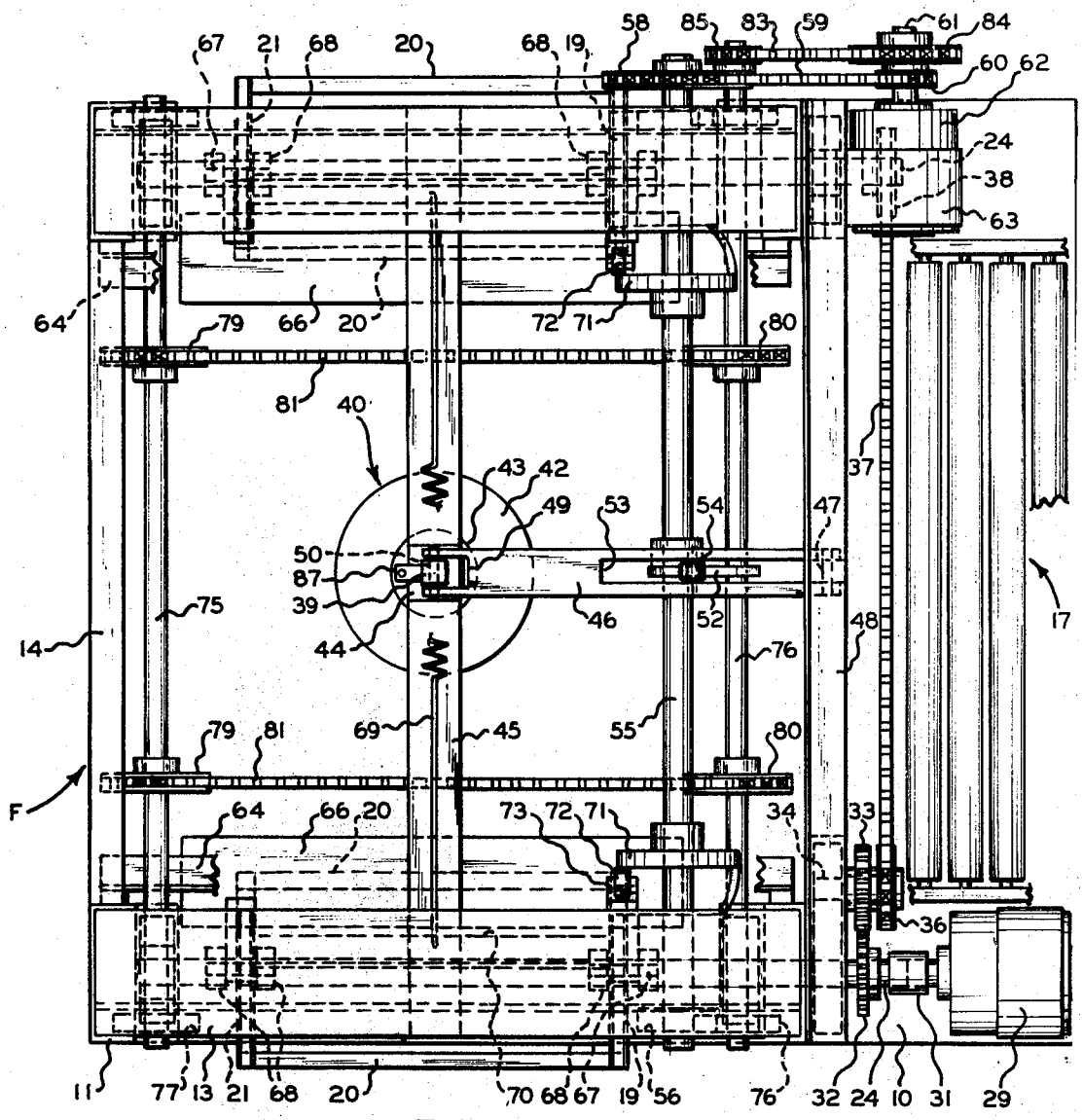


FIG. 3

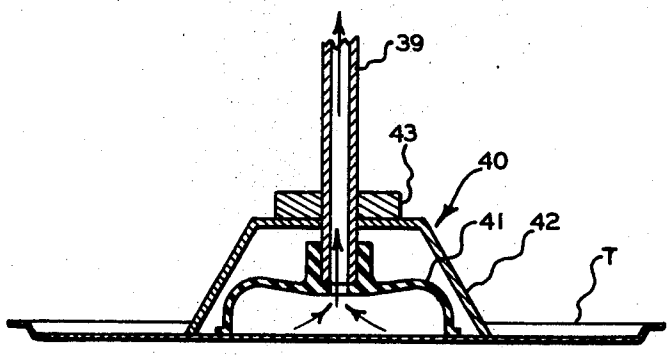


FIG. 4

INVENTOR.
HIRAM E. TEMPLE

BY
Learman, Learman & McCulloch

ATTORNEYS

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UNSTACKING MECHANISM

Filed May 6, 1968 4 Sheets-Sheet 4

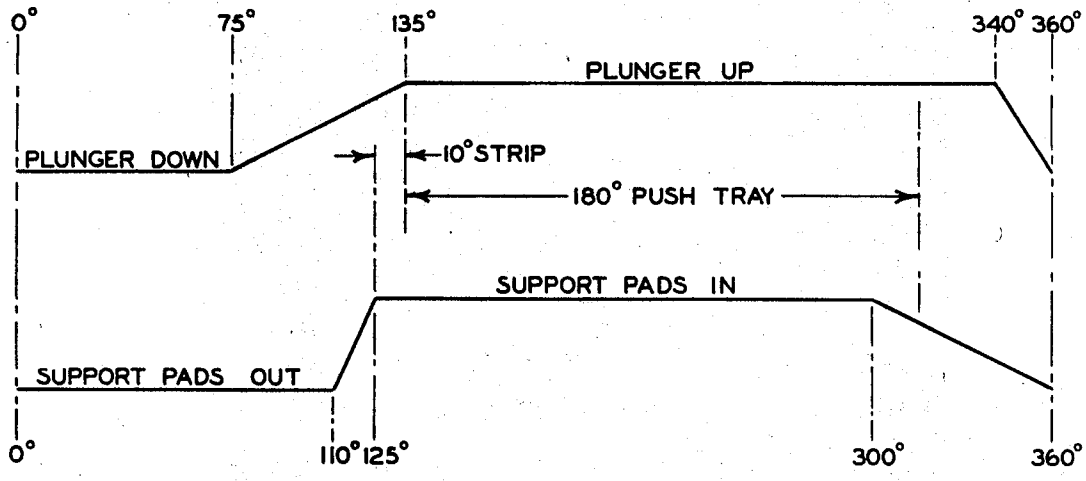


FIG. 5

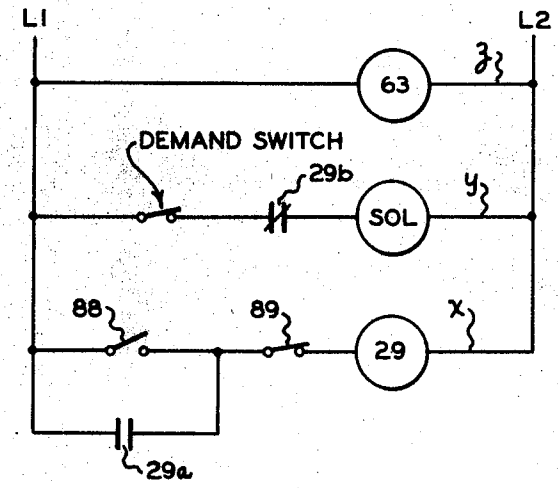


FIG. 6

INVENTOR.
HIRAM E. TEMPLE

BY
Learman, Learman & McCulloch

ATTORNEYS

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3,517,835

UNSTACKING MECHANISM

Hiram E. Temple, Rosemead, Calif., assignor to Baker Perkins Inc., Saginaw, Mich., a corporation of New York

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Int. Cl. B65g 59/04
U.S. Cl. 214—8.5 12 Claims

ABSTRACT OF THE DISCLOSURE

Unstacking mechanism for removing plastic and/or metal trays from vertically indexed stacks of trays, presented in vertically stacked groups to an unstacking station; a vertically moving lift plunger reciprocable downwardly to the stack and upwardly from the uppermost tray in the stack to a raised position above the stack; a magnetizable lift cup having a lost motion connection with the plunger; a resilient suction cup on the plunger within the magnetizable cup, a motor driven, cam actuated arm swingable in a vertical plane to move the plunger upwardly and downwardly; motor driven cam actuated pivoted levers having support pads thereon, swingable inwardly and outwardly in timed relation with the movement of the arm to support an unstacked tray above the stack; stripper members above the pads for removing a tray raised by the plunger from the magnetizable cup or suction cup; and a transfer sweep member for moving the tray along the support pads to a takeaway conveyor.

One of the prime objects of the present invention is to design an unstacker which may be employed in a bakery, for instance, for handling trays which may be formed with an unbroken plastic bottom or with a metallic wire mesh bottom and which may be presented to the mechanism in vertical stacks which may include both the plastic trays and the steel mesh trays in random order.

Another object of the invention is to design highly reliable and efficient unstacking mechanism of the character described which is well suited to high speed operation adjacent a production line to automatically supply such trays individually to mechanism which loads packaged bread, for instance, on the trays.

Other objects and advantages of the invention will be pointed out specifically or will become apparent from the following description when it is considered in conjunction with the appended claims and the accompanying drawings, in which:

FIG. 1 is a side elevational view showing the mechanism in the process of raising a tray from a stack;

FIG. 2 is a left end elevational view thereof;

FIG. 3 is a top plan view thereof with certain parts broken away in the interest of clarity;

FIG. 4 is an enlarged, fragmentary, sectional elevational view illustrating the lifter cup assembly;

FIG. 5 is a diagrammatic view indicating typical relative positions of the lift plunger and pan support pads during a cycle of movement;

FIG. 6 is a schematic representation of typical electrical control circuitry which may be employed.

Referring now more particularly to the accompanying drawings wherein a preferred embodiment of the invention only is shown, a letter F generally indicates the frame of my unstacking machine, which comprises a base **10**, a pair of vertical left end support posts **11** and a pair of similar right end support posts **12** (FIG. 1), upper connecting side members **13** and upper connecting end members **14**. Elevator mechanism generally designated **15** is

provided on the frame F for lifting stacks S of nested, rectangular trays T to an unstacking mechanism generally designated **16** which operates to successively remove the uppermost tray from a tray stack S and deliver it to a discharge conveyor generally designated **17**. The elevator mechanism **15** indexes to present the stacks of trays S to an unstacking station **18** and, when each of the trays T in the stack S has been lifted and discharged to the conveyor **17** during an elevator dwell period, indexes to present the next stack to the unstacking station **18**.

THE ELEVATOR MECHANISM

As FIGS. 1 and 2 indicate, the elevator mechanism **15** includes pairs of spaced apart chains **19** mounting spanning support bars **20** which are carried in spaced apart relation thereon, the bar **20** mounting tray support lugs **20***a*. The stacks S of trays T may be applied to the bars **20** manually or in a production bakery will be supplied by machinery automatically when the indexing chains **19** are in the dwell period. The chains **19** are supported by upper sprockets **21** fixed on upper support shafts **22**, and lower sprockets **23** fixed to lower support shafts **24**. As FIG. 1 indicates, the shafts **22** are journaled in bearings **25** supported by blocks **26** projecting from the channel members **11** and **12**, and the lower shafts **24** are journaled in bearings **27** provided on blocks **28** which also project from the end members **11** and **12**.

Provided to drive the elevator mechanism **15** is a gear head electric motor **29** having its output shaft **30** coupled, as at **31**, to one of the shafts **24**. A gear **32** fixed on the one shaft **24** is in mesh with a gear **33** (FIG. 3) provided on a stub shaft **34** supported by a bearing **35** mounted on outboard support block **28** in FIG. 1 which, as FIG. 3 indicates, also mounts a sprocket **36** for driving the opposite shaft **24** through a connecting chain **37** trained also around a drive sprocket **38** on the opposite shaft **24**.

THE UNSTACKING MECHANISM

As FIG. 4 particularly indicates, the unstacking mechanism includes a vertically reciprocable plunger **39** on which a vertically yieldable support cup assembly generally designated **40** is provided. Mounted in fixed position on the lower end of plunged **39** is a resilient rubber suction cup **41**, which may be of the type used on plumbers' plungers, and, surrounding the cup **41**, is a magnetizable cup **42** mounting a permanent magnet ring **43** of a type which is commercially available and maintains the cup **42** constantly magnetized. Both the cup **42** and ring **43** fixed thereto are freely slideable vertically on the plunger **39** for a purpose which will be later explained. The tubular plunger **39**, which in FIG. 1 may be considered to be closed at its upper end, is mounted for reciprocating vertical movement in a slide bearing **44** supported on a cross rail **45**.

An arm **46** pivotally supported as at **47** on a bracket **48** which spans the vertical end post **12** is bifurcated at one end, as shown at **49** in FIG. 3, to pass the upper end of the plunger **39**. Provided in the upper end of the plunger **39** is a pin **50** which extends from both sides of the plunger **39** and is received in elongate slots **51** provided in the free end of arm **46**. With this connection of plunger **39** to the arm **46**, the arm **46** moves the post **39** upwardly and downwardly but the plunger **39** is able to move in a purely vertical path because the ends of pin **50** are capable of moving in the slots **51** to compensate for the arc traveled by the free end of the arm **46**. The movement of arm **46** is controlled by a cam **52** which can extend up into a slot **53** provided in the arm **46** and is engaged by a follower roller **54** carried by the arm **46**. As FIG. 1 particularly indicates, the cam **52** is fixed on a cam shaft **55** journaled in

bearings **56** provided on cross members **57** which span the vertical posts **11** and **12**, as shown in FIG. 1.

A sprocket **58** (see FIG. 3) mounted on the shaft **55** is driven via a chain **59** by a sprocket **60** mounted on a stub shaft **61** extending from a single revolution clutch **62** which is driven by a gear head motor **63**.

Mounted in the path of a tray T being raised upwardly by the cup assembly **40** are a pair of stripper bars **64** connected with frame F which halt a tray T while the plunger **39** with its cup assembly **40** continues to move upwardly. To support the tray T when it has been stripped from the cup assembly **40**, a pair of arms or lever frames **65** are provided which have elongate support pads **66** projecting inwardly at their lower ends (see FIG. 2). The arms **65** are pivotally supported, as at **67**, from bracket members **68** mounted on the frame members **13** and normally are maintained in the "swung in" position in which they are shown in FIG. 2 by a spring **69** connected between cross brace members **70** which span the frames **65**. The pairs of frames **65** are, however, movable laterally outwardly to the positions indicated at **65'** in FIG. 2 by cams **71** mounted on the cam shaft **55**. The cams **71** are engaged by follower rollers **72** mounted on blocks **73** which extend inwardly from the frames **65**.

Mounted in position above the support pads **66** when they are swung to the "in" position shown in FIG. 2 is a transfer or sweep assembly generally designated **74** which is provided for moving a tray T from the support pads **66** over to the discharge conveyor **17** which may have powered rolls **17***a*. The sweep assembly **74** includes a pair of shafts **75** and **76** journaled in bearings **77** and **78** provided on frame cross members **79'**. Provided on the shaft **75** are pairs of sprockets **79** and provided on the shaft **76** are a pair of sprockets **80** and, as shown in FIG. 3, the sprockets on shafts **75** and **76** are connected by endless chains **81**. Tray engaging sweep members **82** depend from the chains **81** in position to engage a tray T supported by the pads or guides **66** and move it across to the discharge conveyor **17** when the sprockets **79** and **80** are revolved counterclockwisely in FIG. 1. The shaft **76** is driven by the gear head motor **63** via a chain **83** trained around a sprocket **84** (see FIGS. 2 and 3) provided on shaft **61** and a sprocket **85** fixed on shaft **76**.

THE CONTROL SYSTEM

Provided on the upper end of the plunger **39** is a switch actuator **86** adjustably mounted on a projecting block **87** and adapted to engage and actuate a normally open limit switch **88** provided in the circuit line *x* with motor **29**, as shown in FIG. 6. The limit switch **88** is so positioned with respect to the actuator **86** that it is actuated only when the lift cup assembly **40** engages the bottom of the lowermost tray T of a stack S. When the switch **88** is closed, the motor **29** in circuit line *x* is energized and motor relay switches **29***a* and **29***b* are closed and opened, respectively. Motor **29** is driven to index the next bar **20** the required distance to present the next stack S of trays T to the unstacking station **18**. Also provided in circuit line *x* in series with motor **29** is a normally closed switch **89** mounted on a bracket **90** depending from a horizontal brace member **91**. A solenoid SOL for engaging the single revolution clutch **62** is connected in a circuit line *y* in series with the switch **29***b* and a demand switch calling for more pans to be delivered to the system on discharge conveyor **17**. The motor **63** is in a circuit line *z* and is driven continuously. When the last tray has been removed, switch **29***b* is opened to deenergize the solenoid and the clutch **62** stops the plunger **39** in "up" position until the next stack of trays T is in position to be unstacked at station **18**.

THE OPERATION

In operation, it will be assumed that a new stack S of trays T has just been delivered to the unstacking station **18** and switch **89** has been actuated. At this time solenoid SOL is energized and shafts **55** and **76** are driven. At the beginning of the cycle the cams **52** and **71** maintain the plunger **39** in the "up" position and the support pads **66** in the "in" position to support the last tray T unstacked. Sweeps **82**, however, which were stopped in the position shown in FIG. 1, move to the right in FIG. 1 to slide the tray T along the guides **66** and deliver it to the discharge conveyor **17**. When the tray T clears the cup assembly **40**, the plunger **39** commences to lower until the cup assembly **40** engages the uppermost tray T. If that tray is a solid plastic tray, suction cup **41** is deformed and the tray T is lifted by the cup **41** on the "up" stroke of plunger **39**. When the tray T so lifted is moved past the supports **66**, which in the meantime have been swung outwardly to the position indicated in chain lines at **65'** in FIG. 2, it engages the stripper bars **64** and is removed from the suction cup **41**. As this occurs, the cams **71** permit the support pads **66** to be drawn inwardly by spring **69** to form a platform on which the unstacked trays T may rest. The cycle is then repeated until all trays T in a stack S have been removed, whence switch **29***a* opens and stops the plunger **39** in the "up" position, the support pads **66** in the "in" position, and the sweeps **82** in the rear position shown in FIG. 1.

If the particular tray T being lifted were a steel wire mesh tray, it would be lifted by the magnitized cup **42**, of course, rather than the suction cup **41**. With the lost motion connection between the magnetized cup **42** and the plunger **39**, the cup **42** with its permanent magnet **43** is free to be displaced upwardly on the plunger **39** when the uppermost tray T of a stack S is engaged and then is free to slide vertically downwardly on the plunger shaft **39** under the influence of gravity to engage the next uppermost tray T in the stack S. The rubber suction cup **41** also has a certain amount of vertical yieldability so long as the vertical height of stacks S remains within predetermined limits.

Of course, the upper end of tubular plunger **39** may be connected to a vacuum source such as a suction pump, and the stripping of the tray T could be accomplished by a valve which discommunicated the vacuum source when the plunger **39** had traveled upwardly far enough to dispose the tray T being lifted above the support pads **66**.

It is to be understood that the drawings and descriptive matter are in all cases to be interpreted as merely illustrative of the principles of the invention, rather than as limting the same in any way, since it is contemplated that various changes may be made in the various elements to achieve like results without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. Unstacking mechanism for sequentially unstacking a stack of trays which may randomly be of different character comprising: means for supporting a plurality of vertically stacked trays; a lift assembly having a path of movement from a first position above said trays down to a lower position adjacent the uppermost tray; suction applying and magnetic force applying tray support means for said lift assembly arranged to facially engage an uppermost tray and lift it upwardly; said magnetic force applying tray support means comprising magnet material and being vertically yieldable when it engages said uppermost tray, relative to said suction applying tray support means; means for receiving the tray from one of said suction applying and magnetic force applying tray support means and moving it to a remote location; and means for moving the lift assembly between said positions.

2. The combination defined in claim **1** in which the suction applying tray support means comprises a resilient suction plunger cup which, when pressed against a tray and deformed, adheres to the tray.

3. The combination defined in claim 1 in which the means for moving the lift assembly comprises: cam means; motor means driving said cam means; and a pivotally mounted arm supported to pivot in a generally vertical plane and connected to said lift assembly; follower means on said arm riding on said cam.

4. The combination defined in claim 3 in which laterally movable tray support means are movable from a position out of the vertical path of a tray being lifted "in" to a position beneath said tray to support the tray in raised position; and second cam means driven by said motor means for moving the laterally movable tray support members in timed relation with said arm.

5. The combination defined in claim 4 in which stripper means is supported in the vertical path of a tray being lifted to prevent the tray from being lifted beyond a predetermined location on the lift assembly; and said second cam means moves the laterally movable tray support means in under the tray to support it before it is released to fall.

6. The combination defined in claim 4 in which said laterally tray support means comprise a pair of generally vertically extending, pivotally mounted arm members having support pads on their lower ends.

7. The combination defined in claim 6 in which a transfer member has a path of movement along said pads to move a tray from said pads to a location away from the stack.

8. The combination defined in claim 7 in which said transfer member comprises a sweep carried on endless chain means having a transfer run extending generally parallel with and above said pads.

9. Unstacking mechanism for sequentially unstacking a stack of trays which may randomly be of different character comprising: means for supporting a plurality of vertically stacked trays; a lift assembly having a path of movement from a first position above said trays down to a lower position adjacent the uppermost tray; first vertically yieldable, suction applying, tray support means normally fixed on said lift assembly in position to facially engage an uppermost tray and lift it upwardly; second vertically yieldable magnetic force applying tray support means for said lift assembly arranged to facially engage an uppermost tray and lift it upwardly; means for receiving the tray from one of said first and second tray support means and moving it to a remote location; and means for moving the lift assembly between said positions; said magnetic force applying tray support means having a lost motion connection with said lift assembly permitting said magnetic force applying tray support means to move upwardly relative to said suction applying tray support means when said magnetic force applying means engages the uppermost tray.

10. Unstacking mechanism as set forth in claim 9 wherein said magnetic force applying tray support means includes a magnetized cup; and said suction applying tray support means comprises a resilient suction cup provided inside said magnetized cup for handling non-magnetizable trays.

11. The combination defined in claim 9 wherein said lift assembly includes vertically movable support means mounting said magnetic force applying and suction applying tray support means for movement from a raised position to a lowered tray engaging position; said magnetic force applying means normally extending below said suction applying tray support means and being vertically movable on said support means to a raised position to permit said suction applying tray support means to engage said uppermost tray after said magnetic force applying tray support means has engaged said uppermost tray.

12. The combination defined in claim 9, including tray support means movable from a position out of the vertical path of a tray being lifted "in" to a position beneath said tray to support the tray in the raised position.

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GERALD M. FORLENZA, Primary Examiner

G. E. ABRAHAM, Assistant Examiner

U.S. Cl. X.R.

294—64, 65.5