United States Patent

[11] **3,568,860**

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[21] Appl. No. **799,727**
[22] Filed **Feb. 17, 1969**
[45] Patented **Mar. 9, 1971**
[73] Assignee **North American Rockwell Corporation**
Pittsburgh, Pa.

[54] **STACKING OR TIERING DEVICE**
10 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **214/6**
[51] **Int. Cl.** **B65g 57/30**
[50] **Field of Search** 214/6.2, 7

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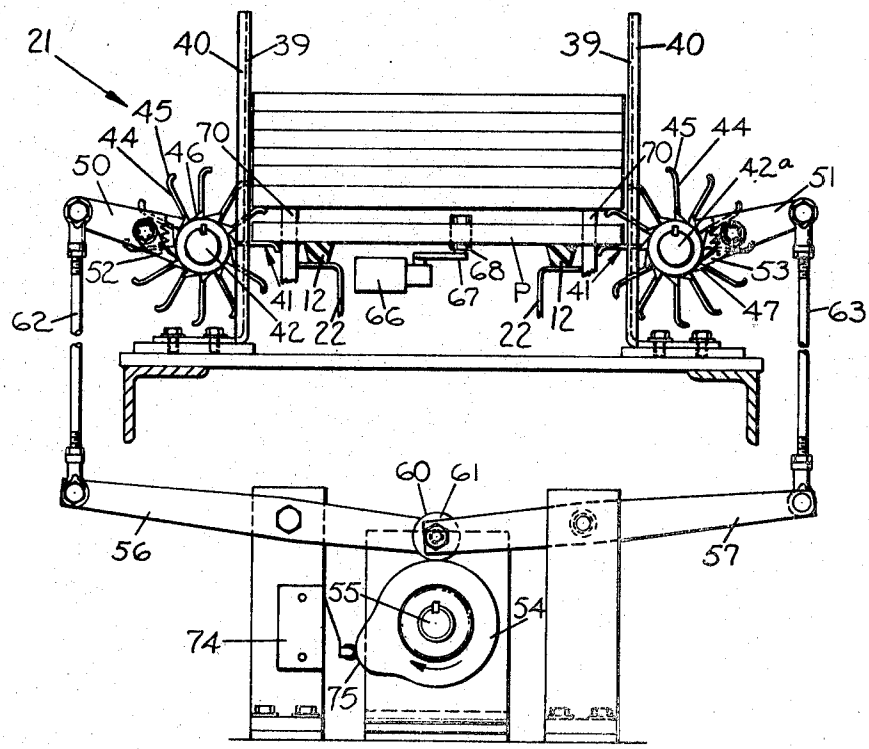
Assistant Examiner—Robert J. Spar
Attorney—John R. Bronaugh

ABSTRACT: A device for forming a stack of relatively thin articles or packages delivered in succession. The device includes a plurality of paddle wheels on opposite sides of a package delivery conveyor with individual blades of a succession thereof on each wheel positioned to underlie the margin of a package delivered by the conveyor. Upon completion of the delivery the paddle wheels are rotated or indexed in a direction to elevate the package by the underlying blades and position succeeding blades for receiving a second package. Upon further indexing movement of the paddle wheels the initial package is again elevated until the blades performing such function withdraw past the edges of the package and permit the package to drop onto the package supported by the blades therebelow. At the same time other blades of the successions are positioned to receive a third package. The operation is continued until a stack of packages of the desired number has been obtained.



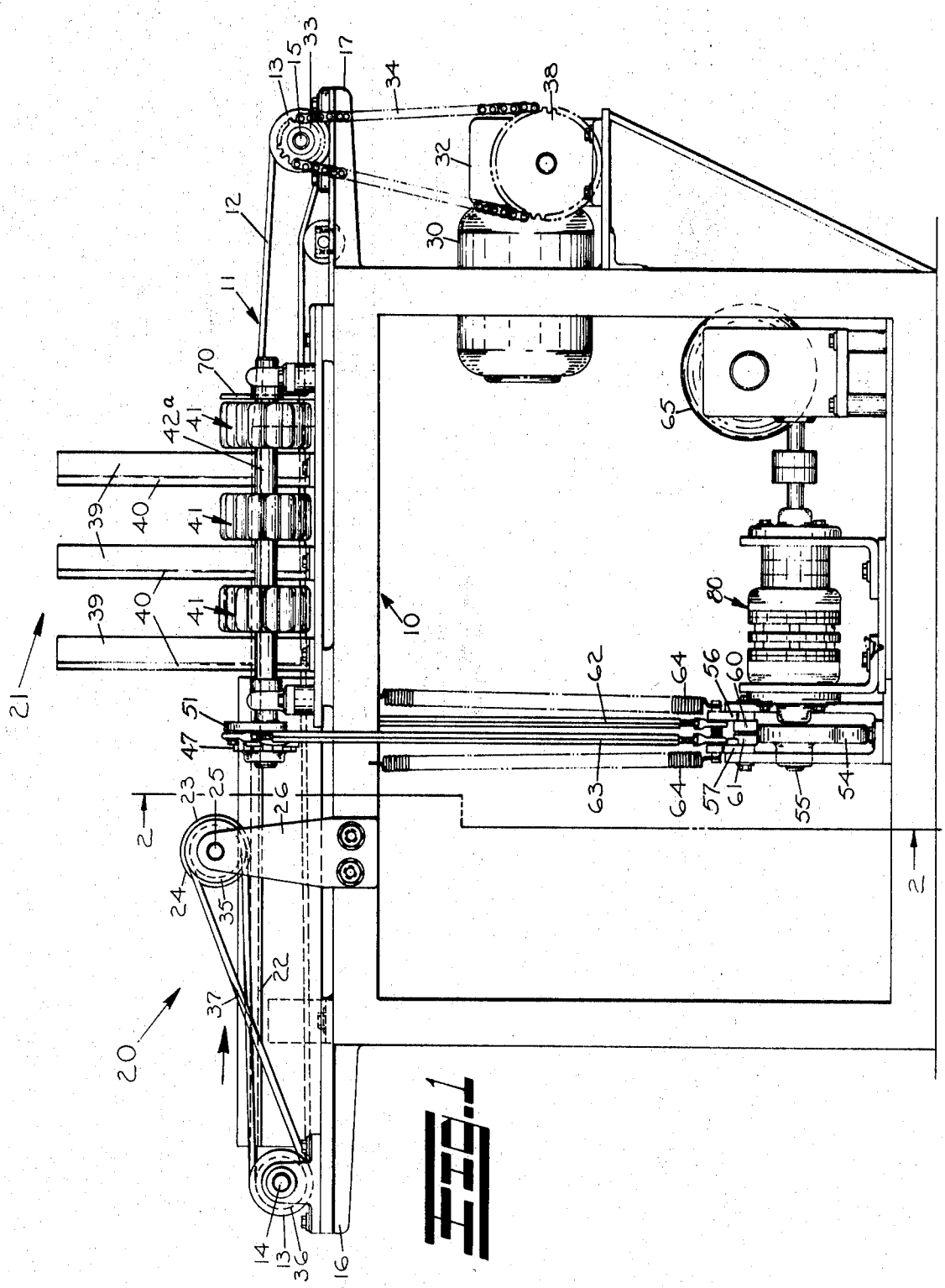

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FIG. 1

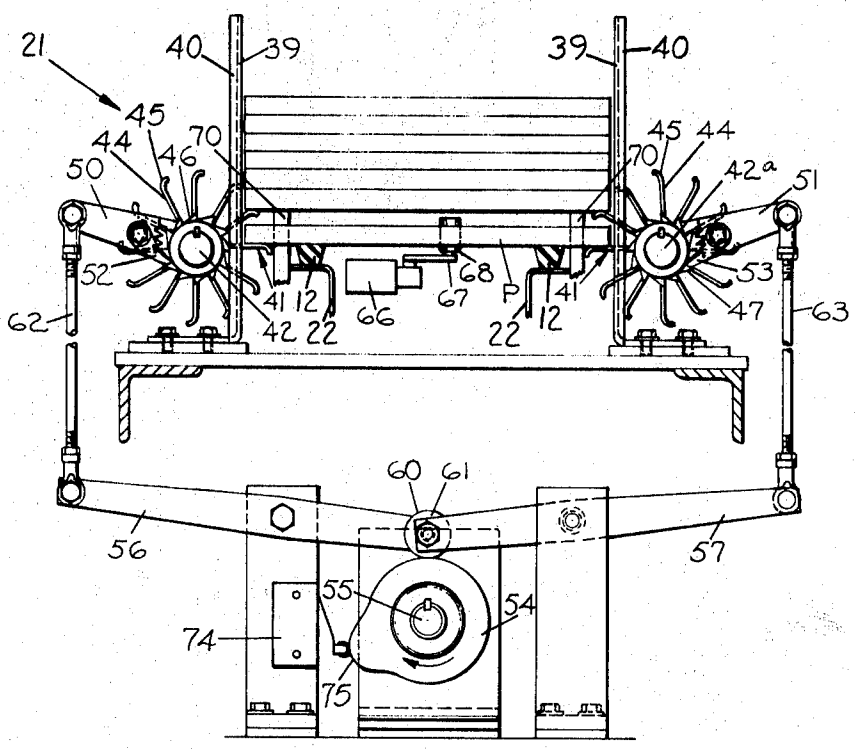
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FIG. 2

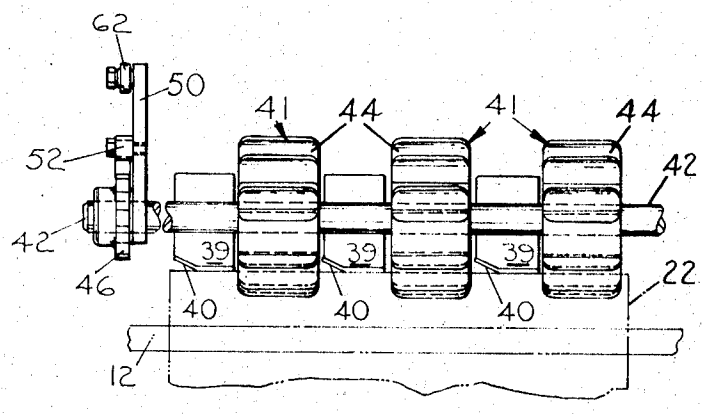
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FIG. 3

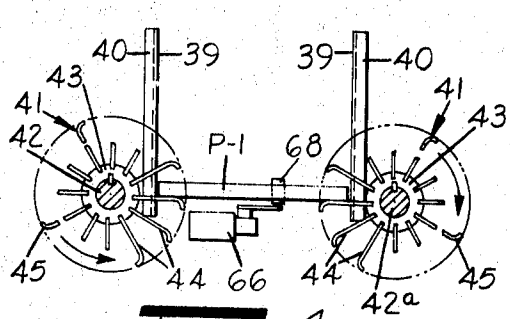

FIG. 4

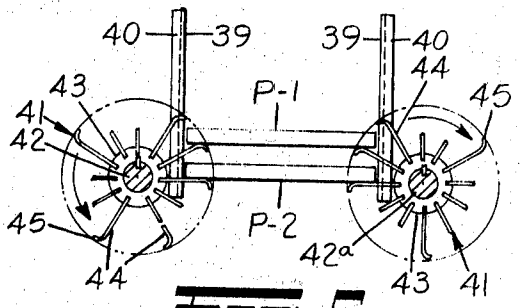

FIG. 5

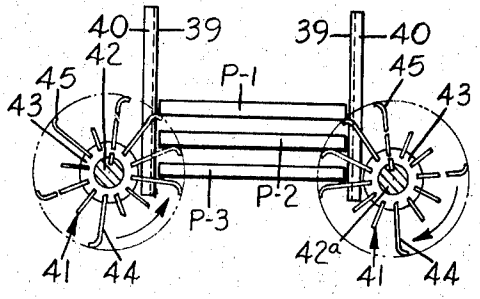

FIG. 6

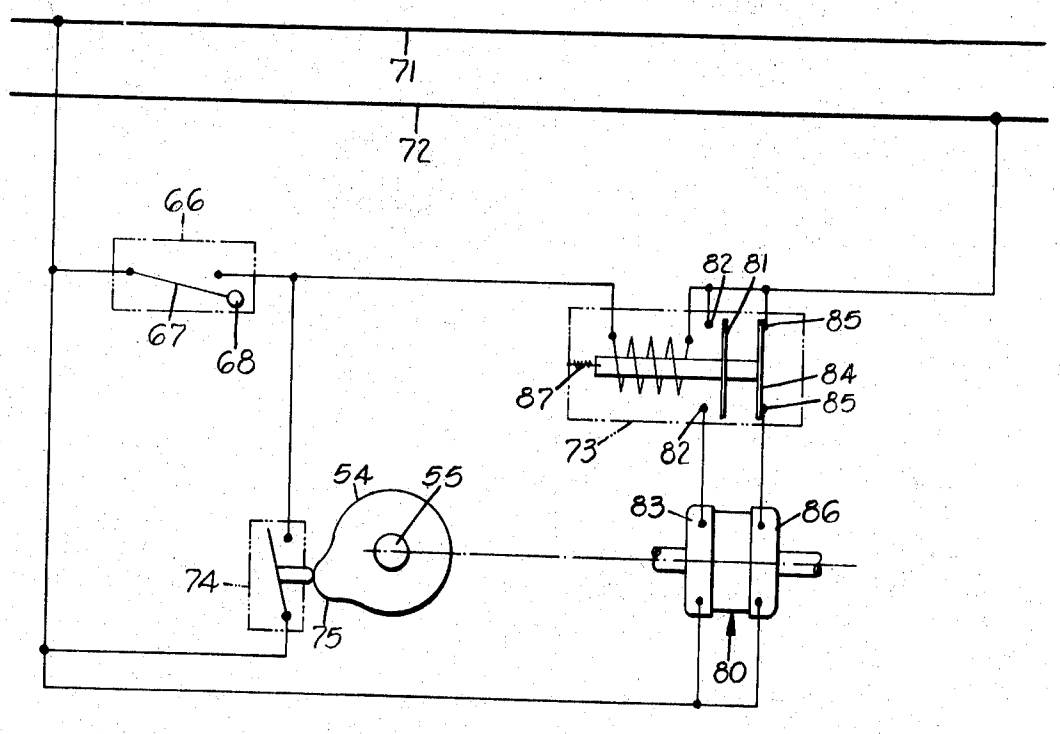

FIG. 7

STACKING OR TIERING DEVICE

SUMMARY OF THE INVENTION

The instant invention has for its principal object the provision of a machine or device for stacking or tiering relatively thin flat objects such as floor and ceiling tiles, wrapped books, paper sheets, shallow filled trays and other flat objects and packages, all of which will be hereinafter referred to as "-packages;" at speeds unobtainable with conventional equipment employing an elevator to lift each individual package above a package retaining gate means, the elevator then returning to its original level to repeat the operation. The machine finds a principal field of use in the formation of stacks of packages constituting case loads or partial case loads which may be shifted directly from the stacking device into a case or to a location removed from the stacking device for assembly with other like stacks to constitute a case load.

Briefly described the device of the instant invention, which attains the above-noted and other objects as will become apparent, comprises a conveyor means adapted to receive the packages from a supply source at a receiving zone and deliver them to a stacking zone. Two or more package elevating means are spaced apart along each side of the stacking zone. Each elevating means is, in effect, a paddle wheel mounted for rotation on an axis lying parallel to the conveyor. The paddle wheels are arranged for simultaneous step-by-step rotation or indexing movements to position a blade of a succession thereof carried by each wheel, in underlying relationship to the margins of the last package delivered by the conveyor to the stacking zone. The indexing of the paddle wheels to position blades thereof as aforesaid simultaneously causes first preceding blades to elevate a last previously delivered package above said conveyor and second preceding blades to elevate a second from the last previously delivered package and any still previously delivered packages stacked thereon, to the point where, due to the rotation of the wheels, the ends of the blades are withdrawn beyond the margins of said second from the last previously delivered package. The withdrawing of the blades permits the last mentioned package and any overlying stack to drop back onto the first from the last previously delivered package. Hence as will be understood each indexing movement of the paddle wheels, assuming a package is delivered to the stacking zone between such movements, adds a package to the bottom of the overlying stack.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of an apparatus in accordance with the instant invention;

FIG. 2 is a sectional view on an enlarged scale taken on the line 2–2 of FIG. 1 looking in the direction indicated by the arrows;

FIG. 3 is a top plan view of a portion of the apparatus illustrated in FIG. 1;

FIGS. 4,5 and 6 are diagrammatic sectional views taken similarly as FIG. 2 and illustration different steps in the operation of the device; and

FIG. 7 is a wiring diagram for the electric system of the device of the instant invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and particularly to FIGS. 1 and 2 the device of the instant invention comprises a frame structure, indicated generally at 10, supporting an endless conveyor, indicated generally at 11, in an elevated position. Conveyor 11 suitably comprises a pair of spaced V-belts 12 carried by pulleys 13 mounted on shafts 14 and 15. The shafts are supported in suitable bearings at opposite ends of the frame structure the bearings being carried by brackets 16 and 17, respectively. The device is divided lengthwise of the conveyor 11 into a package receiving and transfer zone 20 and a package stacking zone 21. A rigid support member 22 carried by the frame structure 10 is mounted to closely underlie each

of the V-belts for substantially the full run thereof. A press roll 23 preferably extends transversely of the V-belts in the receiving and transfer zone the roll suitably having a surface layer 24 of yieldable material such as rubber or the like. Roll 23 is carried by a shaft 25 mounted for rotation in bearings carried by brackets 26 projecting upwardly from the machine frame. The spacing of the press roll 23 from the conveyor belts 12 at the nip between them is so correlated to the thickness of the packages to be conveyed and stacked as to assure that a package will move with the conveyor.

The conveyor 11 comprising the V-belts is suitably constantly driven to move the upper run in the direction indicated by the arrow in FIG. 1 by an electric motor 30 through a speed reduction unit 32, sprockets 33 and 38 secured to an extending end of shaft 15 and to the shaft of the spaced reduction unit respectively, and a sprocket chain 34. Press roll 23 is suitably driven from the conveyor drive by means of a pulley 35 secured to shaft 25, a pulley 36 secured to shaft 14 and a crossed drive belt 37. The relationship between the diameters of pulleys 35 and 36 and the diameter of roll 23 is such that the peripheral speed of the roll is equivalent, or substantially equivalent, to the rate of travel of conveyor 11.

A plurality, three being shown, of upright package confining members 39 are supported by the frame at intervals on each side of the stacking zone, the members 39 on one side being in directly opposed relationship to the members on the other side. The spacing between the opposed members 39 is suitably slightly greater than the widths of the packages to be stacked and members 39 project upwardly for at least the height of the stack of packages to be formed. As shown particularly in FIG. 3 each of the members 39 is provided with an outwardly bent edge or flange 40, the flanges serving to, in effect, cam a package, the leading edge of which may be somewhat out of alignment with the space between the opposed members, into such an alignment.

Package elevating device 41, which are of a paddle wheel construction, are keyed to shafts 42 and 42*a* on opposite sides of the stacking zone for rotation with the shafts. The shafts are carried in suitable bearings supported on the machine frame as illustrated particularly in FIG. 1. The elevating devices 41 are located on their shafts intermediate members 39 on each side of the stacking zone and substantially fill the spaces between them and suitably one of said devices is also mounted on each of said shafts to the right, as seen in FIG. 1, of the member 39 adjacent the rear end of the stacking zone conveyor. Each of the elevating devices consist of a hub 43 (FIG. 4) supporting a succession of radially extending, equally spaced blades 44 the blades terminating in bent ends or flanges 45. The location of the shafts 42, and 42*a* the lengths of blades 44 and the stopped positions of the elevating members are such that when a package P is carried into the stacking zone by conveyor 11 blades of opposed ones of the elevating members will underlie the margins of the package in substantial parallelism and approximately contacting relationship therewith (see FIG. 2). The blades of each elevating device are so angularly positioned that their end portions 45 projecting inwardly of member 39 are spaced apart a distance to freely receive a package margin therebetween as illustrated in FIGS.2,4,5 and 6 so as to not bind upon the package when the elevating device is rotated in a package lifting direction.

Means are provided to rotate or index shafts 42 and 42*a* on opposite sides of the stacking zone in a counterclockwise and a clockwise direction respectively, as viewed in FIGS. 2, 4, and 6 sufficiently to shift the blades 44, which underlie the package margin, from their horizontal position to their first upwardly inclined position, both as shown in said FIGS. and to bring following blades into their horizontal package supporting position. The means for this purpose comprises ratchet wheels 46 and 47 (FIG. 2) keyed or otherwise secured to the shafts 42 and 42*a* respectively for conjoint rotation therewith, each ratchet wheel having a number of teeth equivalent to the number of blades and being so designed that upon advancement of the ratchet wheels one tooth the blades are rotated or

indexed to assume the positions as previously pointed out. The means for advancing the ratchet wheels comprises arms 50 and 51 having hubs mounted for free rocking movement on shafts 42 and 42a, respectively, the arms carrying pawls 52 and 53 respectively suitably spring pressed to maintain end portions thereof in engagement with the ratchet wheels. Arms 50 and 51 are rocked through an arc sufficient to cause the pawls to advance the ratchet wheels one tooth and to return the pawls to their initial positions by a cam 54 having a riser 75 said cam being keyed to a shaft 55, rocker arms 56 and 57 carrying follower rollers 60 and 61, respectively, positioned to ride on the periphery of cam 54, and links 62 and 63 connecting the outer ends of rocker arms 56 and 57 to the outer ends of their respective arms 50 and 51. The rocker arms are urged to rotate in a direction to maintain their followers in contact with the cam by suitable means such as tension springs 64 (FIG. 1) each having one end connected to its associated rocker arm and its other end connected to a fixed element of the machine frame.

Shaft 55 carrying cam 54 is driven through single cycles of rotation by a constantly running motor 65 and a single revolution clutch-brake assembly 80 of conventional type such for example as Model EM 50 manufactured by the Warner Electric Co. of Beloit, Wis. Referring particularly to FIGS. 2 and 7 the clutch element 83 of the clutch-brake assembly 80 is energized to start rotation of shaft 55 through a single revolution by the closing of a normally open microswitch 66 having an operating arm 67 including a projecting finger 68 positioned to be contacted by a package and shifted to close the switch as a package is delivered to its furthest position in the stacking zone as determined by end stops 70.

Switch 66 is included in the electrical circuit of FIG. 7 which additionally includes main power leads 71 and 72 and a relay 73 the latter when energized shifting a movable contactor 81 of the relay from the position shown in FIG. 7, into contact with fixed contacts 82 to energize clutch elements 83, and shifting contactor 84 away from fixed contacts 85 to deenergize brake element 86 of the clutch-brake assembly 80. When the relay is deenergized the movable contactors, under the influence of spring 87, return to the positions of FIG. 7 deenergizing the clutch element and energizing the brake element.

The electrical circuit also includes a normally closed switch 74 adapted to be opened by the riser 75 of cam 54 (FIGS. 2 and 7) previously referred to. Switch 74 is supported from the machine frame in a position to be opened and hence open the circuit to the clutch brake assembly when the latter has completed a cycle of operation. When a second cycle of operation is initiated through the closing of switch 66 by an incoming package the operating arm of switch 74 will ride off the riser 75 of cam 54 to close the switch before switch 66 is permitted to open through the elevation of the package which closed it. Hence the circuit to relay 73 will remain closed until cam 54 again opens switch 74 at the end of the cycle.

In the operation of the apparatus described above a succession of packages P are delivered from a supply thereof by any suitable means such as an infeed conveyor (not shown) to conveyor 11 and to the left, as viewed in FIG. 1 of press roll 23. The delivery rate is normally such that the packages are in end abutting relationship as they are fed into the packaging zone. However for certain items such as ceiling tile which have end configurations which could interfere with the elevating of one relatively to another when the ends are in continuous relationship the rate of delivery is such that the forward package is elevated before the following package reaches the stacking zone.

Referring particularly to FIGS. 4 to 6 inclusive a situation is illustrated in which the stacking zone is initially empty of packages. As the initial package P-1 is fed into the stacking zone by conveyor 11 and approaches its farthest position against stops 70 it strikes finger 68 of switch 66 to close the same (FIG. 4). The closing of switch 66 which as previously explained is included in the operative circuit of the clutch-brake assembly, energizes the clutch element thereof and shaft 55 starts a cycle of rotation. As the riser of cam 54 lifts followers 60 and 61, pawls 52 and 53 rotate their respective ratchet wheels 46 and 47 to in turn rotate shafts 42 and 42a. Rotation of the shafts causes the rotation or indexing of the paddle wheels. The blades of the latter which underlie the margins of the package swing upwardly to elevate the package such elevation continuing until followers 60 and 61 are on the high point of cam 54. In the meantime switch 74 has been permitted to close and as a result the circuit to the clutch-brake assembly remains closed following the opening of switch 66 as previously mentioned. The initial package P-1 is then in the position shown in FIG. 5 and other blades of the paddle wheels are in their horizontal package receiving positions. Continued rotation of shaft 55 thereafter through the remainder of its cycle permits the resetting of pawls 52 and 53. During such resetting operation or as soon as package P-1 is elevated sufficiently to clear a second package P-2 which is preferably in end abutting relationship with package P-1, the second package is conveyed into the stacking zone by conveyor 11 (FIG. 5). Similarly as in the case of package P-1, as it approaches the end stops 70 it contacts the operating arm of switch 66 to again close the same and initiate a second cycle of operation. During the second cycle packages P-1 and P-2 are elevated to the positions illustrated in FIG. 6 and as the flanged ends of the blades supporting package P-1 are withdrawn from beneath the margins of the package the package P-1 is permitted to drop onto package P-2. At the same time and as in the previous case as soon as package P-2 is elevated sufficiently to clear package P-3 the latter package is conveyed into the stacking zone and through contact with the operating finger of switch 66 initiates a third cycle of operation. The apparatus continues to operate through the number of cycles required to build up a stack of the desired number of packages. At this point a suitable loading plunger of conventional type (not shown) may be employed to shift the stack longitudinally of the loading zone directly into a case adapted to receive it or into an assembly area remote from the stacking device for assembly with other like stacks to constitute a case load.

It has been found that with the device of the instant invention to 100 cycles per minute are possible this high speed of operation being permissible due primarily to the elimination of conventional gates and drive mechanisms, the elimination of conventional elevators requiring an idle return stroke, and the minimum amount of elevation required. It further has been found that actually only about 20 percent of the time cycle is required for elevating the packages leaving the remainder for the running in of an additional package and the unloading of the stacked packages.

The impact of the elevated stack falling back on the package beneath it has been found to be very slight. As will be understood the amount of lift as the paddle wheel blades approach their point of withdrawal from the margins of the packages is quite small. Furthermore the speed of the stack as it starts to fall is slow compared to the lift speed of the package beneath it and consequently the rising package meets the dropping stack after the rising package has traveled more than one-half way from the position of the package P-1 in FIG. 4 to the position of package P-1 in FIG. 5.

Having thus described the invention in rather complete detail it will be understood that these details need not be strictly adhered to and that various changes and modifications may be made all falling within the scope of the invention as defined by the subjoined claims.

I claim:

1. In a vertical stacker for packages such stacker including a stacking zone and a package receiving zone, means to deliver packages from said receiving zone to said stacking zone and means to elevate packages delivered to said stacking zone to form an overlying stack thereof, the improvement wherein said elevating means comprises a series of lifting elements on opposite sides of said stacking zone and means to successively move each lifting element of each series in steps from a first

position in underlying marginal contact with a package delivered to said stacking zone to an elevated position such as to permit a succeeding package to enter said stacking zone with a lateral margin in overlying relationship to a succeeding lifting element of said series while said first mentioned lifting element remains in marginal contact with said first mentioned package and to a further elevated but withdrawn package releasing position whereby said first mentioned package may drop onto said second mentioned package.

2. A vertical stacker as defined in claim 1 wherein the lifting elements of each series are supported by a hub member and there is means to rotate said hub members to move said lifting elements through said several positions.

3. A vertical stacker as defined in claim 2 wherein said means to rotate said hub members comprises pawl and ratchet means and actuating means therefor.

4. A vertical stacker as defined in claim 1 wherein said stacking zone is defined by vertically extending frame members on opposite sides of said zone.

5. A vertical stacker as defined in claim 1 wherein there is switch means positioned to be actuated upon the delivery of a package to said stacking zone and wherein said switch means is included in an electrical circuit controlling the operation of said lifting elements.

6. A vertical stacker as defined in claim 1 wherein there is a plurality of series of said lifting elements on each of the opposite sides of said stacking zone and wherein the lifting elements of each series comprise blades projecting radially in equally spaced relationship from a central hub.

7. A vertical stacker as defined in claim 6 wherein said hubs on each of said opposite sides of said stacking zone are carried by and affixed to a common shaft and there is means for rotating said shift to index said blades through said several positions.

8. A vertical stacker as defined in claim 7 wherein said means for rotating said shafts comprises a toothed ratchet wheel affixed to each shaft, a ratchet pawl for each ratchet wheel adapted to rotate its associated ratchet wheel through the distance of one tooth upon an operative stroke of said pawl and there is means for causing operative strokes of said pawl.

9. A vertical stacker as defined in claim 8 wherein said means for causing operative strokes of said ratchet pawls comprises a rockable lever arm supporting each pawl and cam and follower means for rocking said lever arms.

10. A vertical stacker as defined in claim 1 wherein each lifting element of each series comprises a blade projecting radially from a central hub and terminating at its outer end in a relatively narrow flange extending in an outwardly and downwardly direction when said blade is in said first position.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,568,860 Dated March 9, 1971

Inventor(s) PHILIP G. RAWLINS

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 37, change "device" to -- devices --;

Column 2, line 65, after "4," insert -- 5, --;

Column 4, line 42, before "to" insert -- up --; and

Column 6, line 7, change "shift" to -- shaft --.

Signed and sealed this 13th day of July 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER,JR.
Commissioner of Patents