United States Patent

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[54] BAG COLLATING AND STACKING APPARATUS
38 Claims, 16 Drawing Figs.

[52] U.S. Cl. ..... 214/6.5, 214/1 Q, 214/6 BA, 214/8.5 SS
[51] Int. Cl. B65g 57/30
[50] Field of Search ..... 214/6.2, 6 P, 6 K, 6 H, 6 C, 6 S, 6.5, 7, 1 Q, 8.5 A, 8.5 SS; 93/93.3

[56] References Cited

UNITED STATES PATENTS

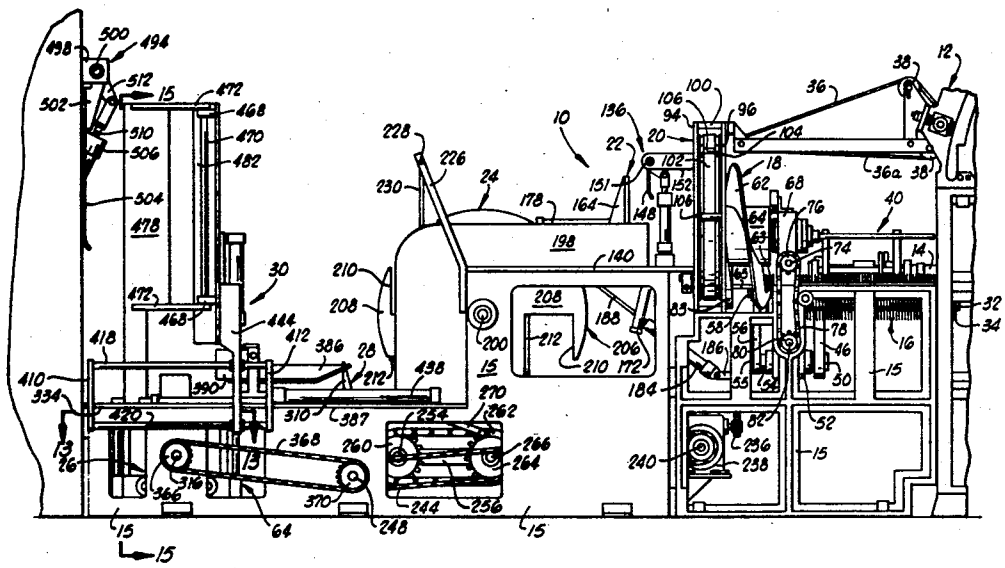
2,984,838	5/1961	Parker	214/6 KX
3,107,793	10/1963	Frank	214/6 (.2)
3,115,090	12/1963	Elander	214/6.5 X
3,124,059	3/1964	Labombarde	93/93.3 UX
3,231,100	1/1966	Faeber	214/6 K
3,363,781	1/1968	Magnetti	214/6 (.2)
3,404,609	10/1968	Hartbauer et al.	214/6.5 X
3,422,968	1/1969	Martin	214/6 K
3,450,275	6/1969	Carlen, Jr.	214/6.5
3,466,839	9/1969	Temple	214/6 (.2) X
3,500,980	3/1970	Calistrat	214/6 (.2) X

FOREIGN PATENTS

1,005,370	9/1965	Great Britain	214/6 K

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ABSTRACT: Apparatus for collating and stacking bags in vertically superimposed hands, the apparatus including a conveyor for receiving aligned bags from a bag forming machine and moving them in consecutive sequence away from the forming machine. A pair of spiral augers cooperate with the conveyor to periodically remove a preselected number (hand) of aligned bags therefrom and convey these bags into a turntable assembly. The turntable assembly periodically turns to alternate positions to face the bottoms of the bags first in one direction, and then in an alternate direction. A mechanism then forces the bags from the turntable assembly onto a tilting box assembly. This assembly tilts through an angle to move the bags from a vertical status to a horizontal status. Pushing mechanism then pushes the bags from the tilting box assembly into a rotating unit assembly which, upon actuation, delivers the bags to a transfer unit which conveys each successive hand of bags into a bag lifter assembly. The bag lifter assembly periodically lifts a stack of vertically superimposed hands of bags upwardly to permit a new hand to be delivered beneath the stack by the transfer unit, and then the lifter assembly lowers the lifted stack onto the new hand. Finally, after the stack of bags within the bag lifter assembly has come to contain a desired number of hands, a banding press loader assembly is automatically actuated to load the stack of bags from the lifter assembly into a banding press.



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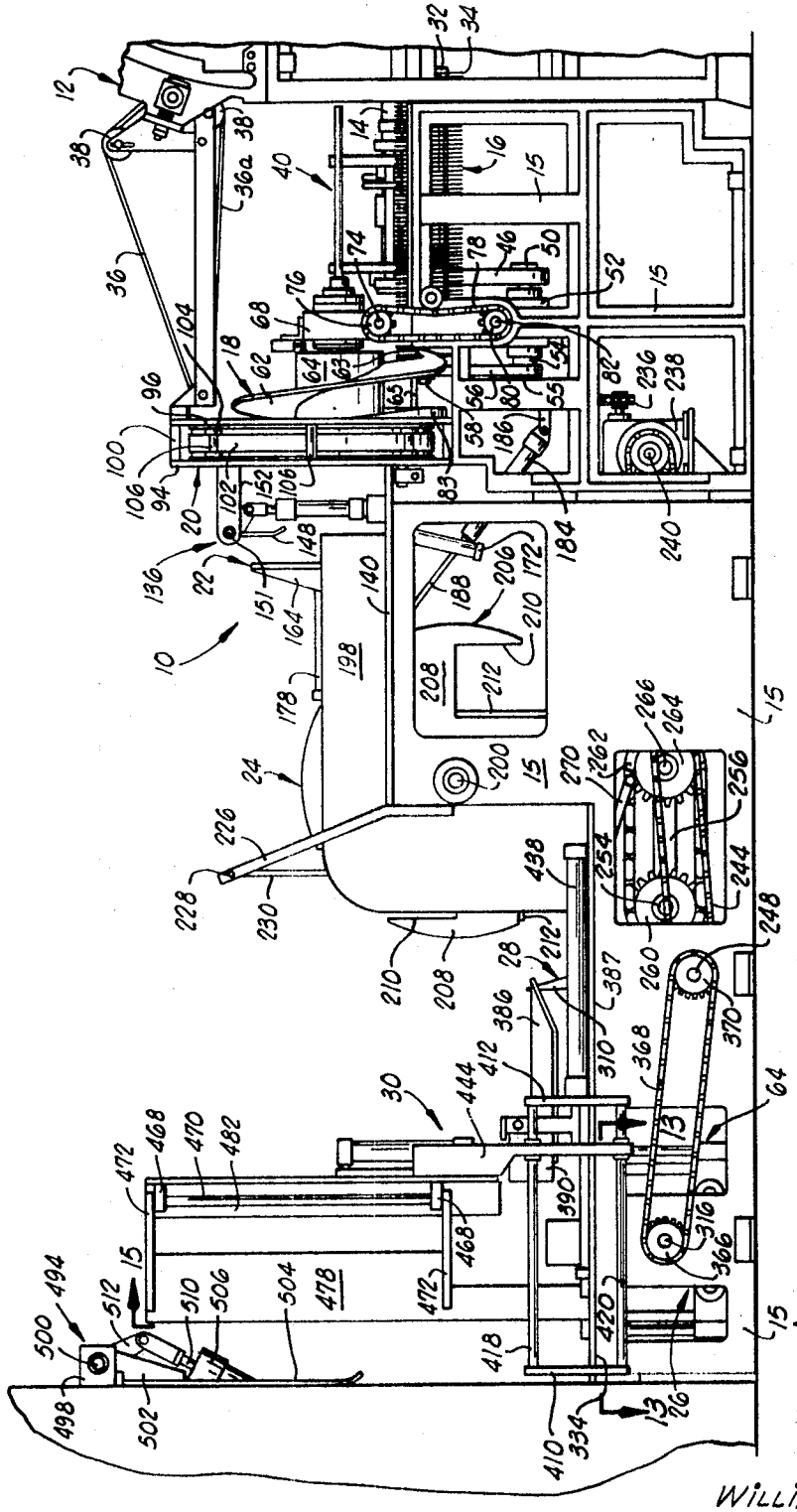


FIG. 1

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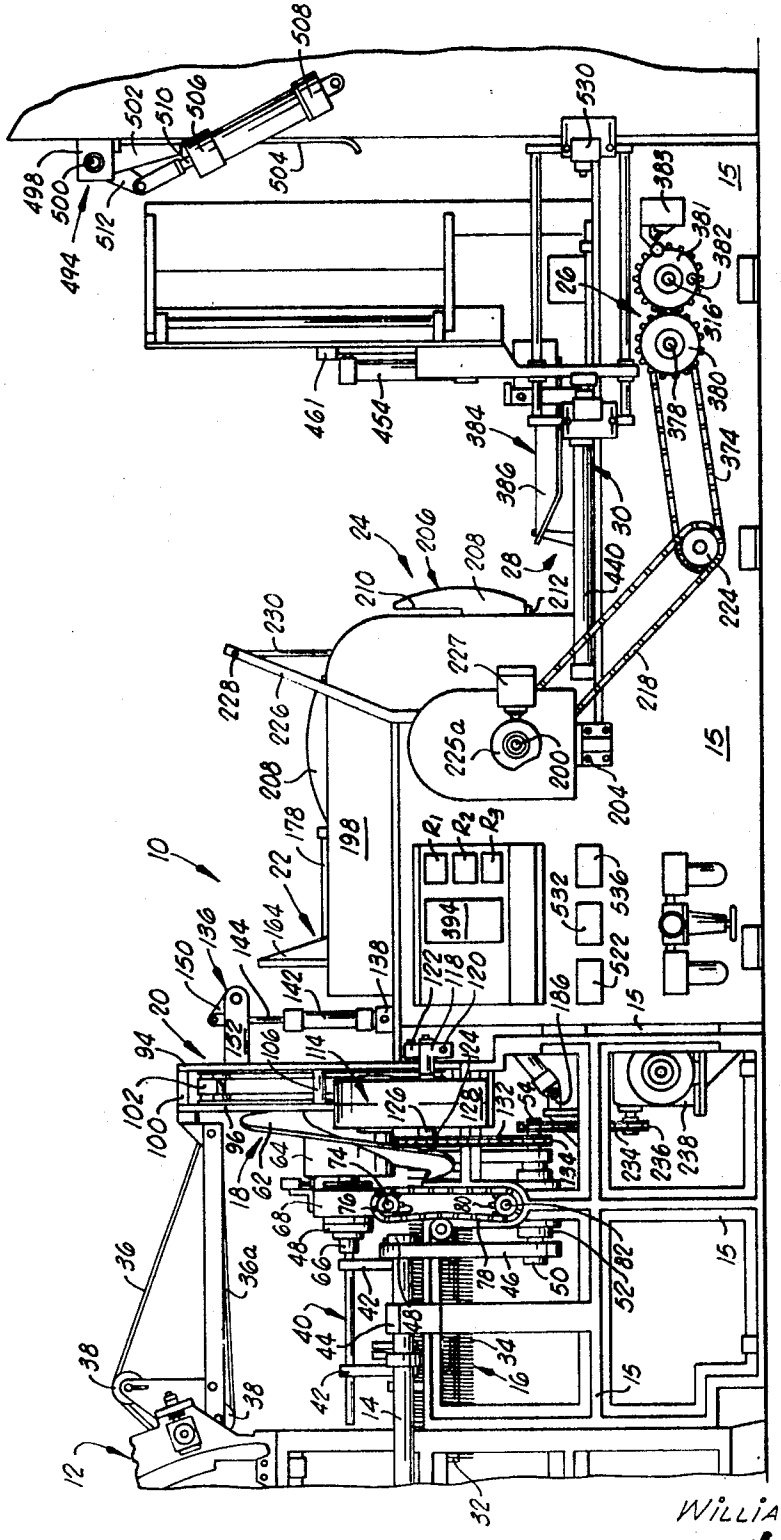
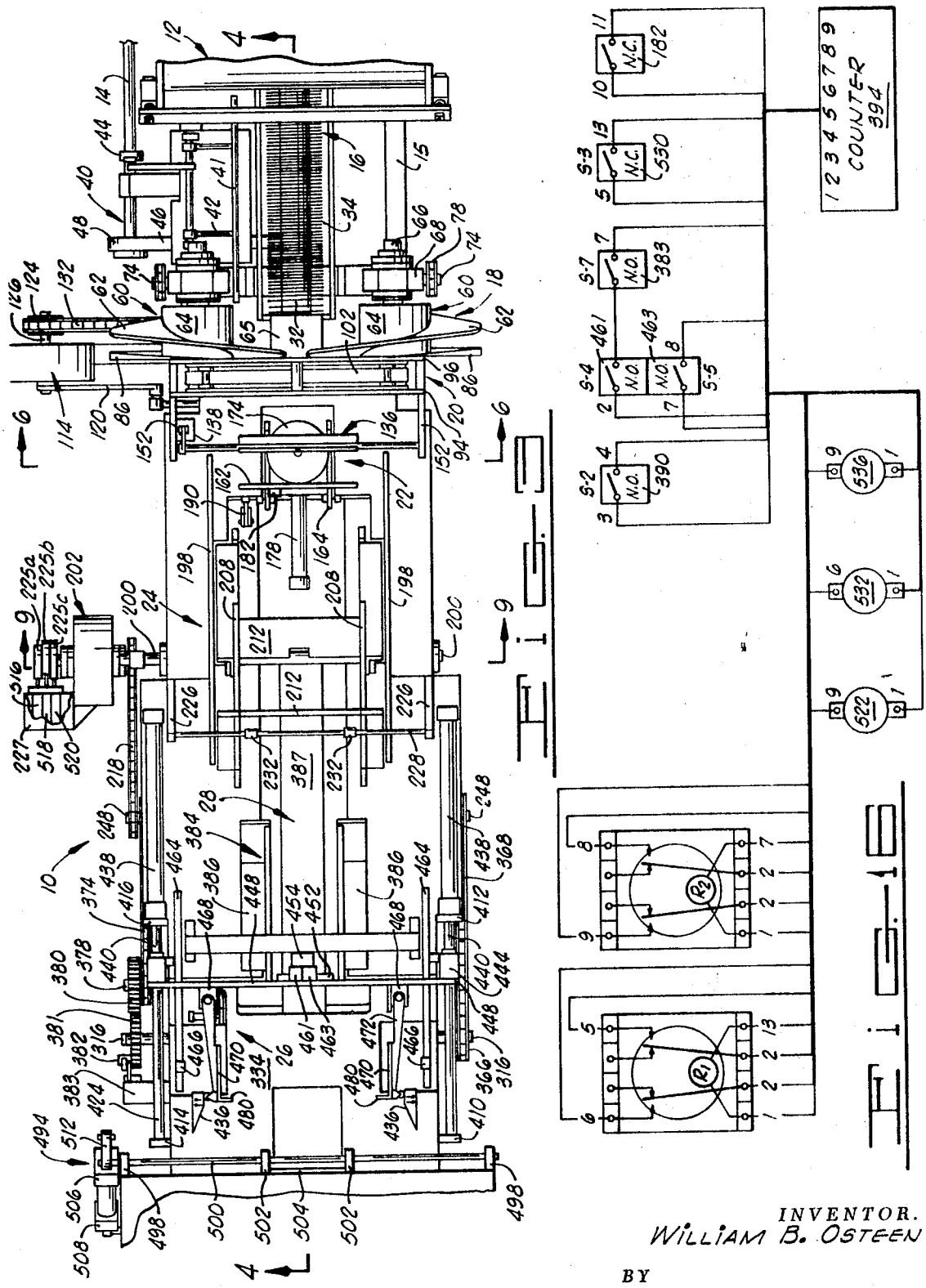


Fig. 2

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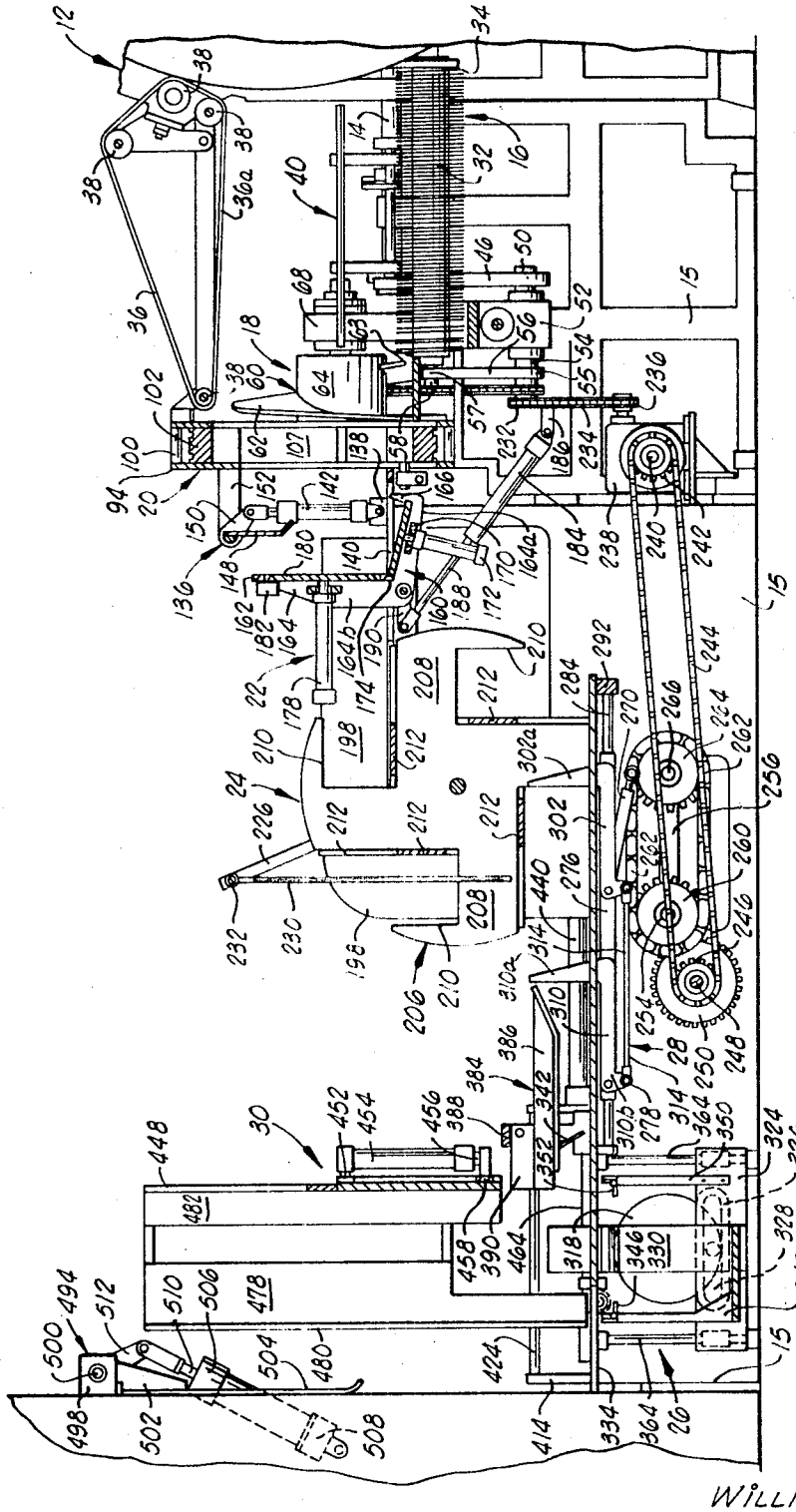


Fig. 4

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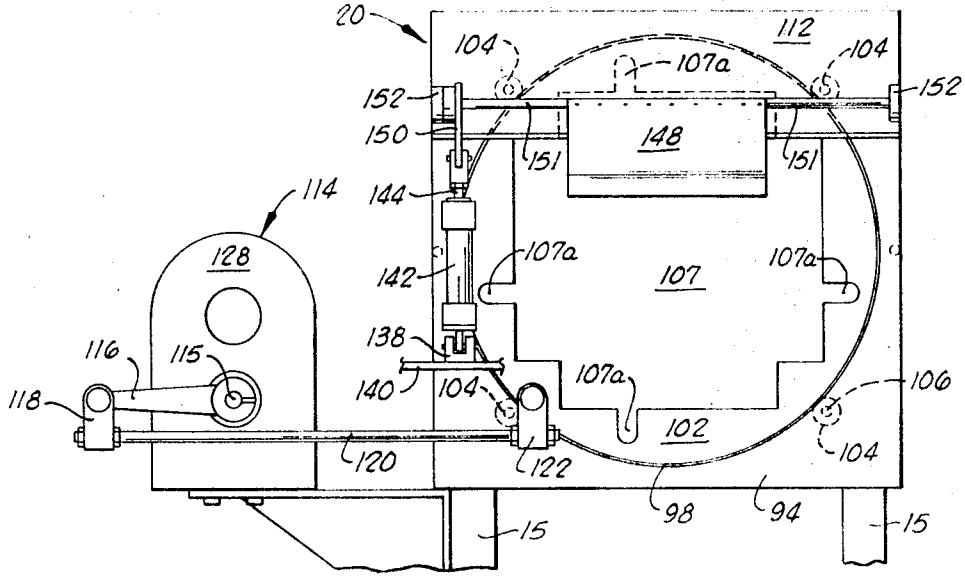


FIG. 6

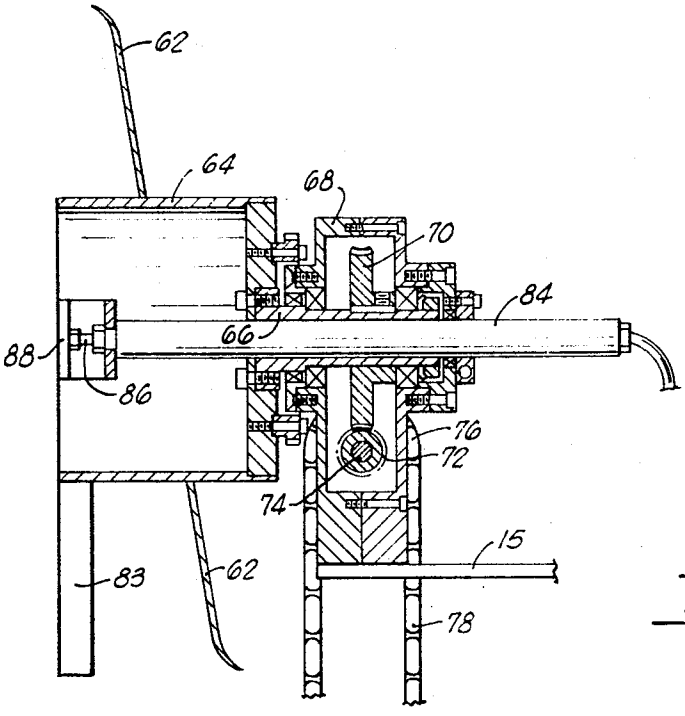


FIG. 5

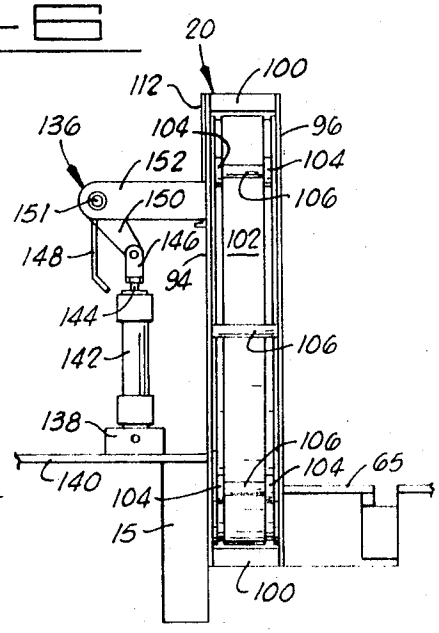


FIG. 7

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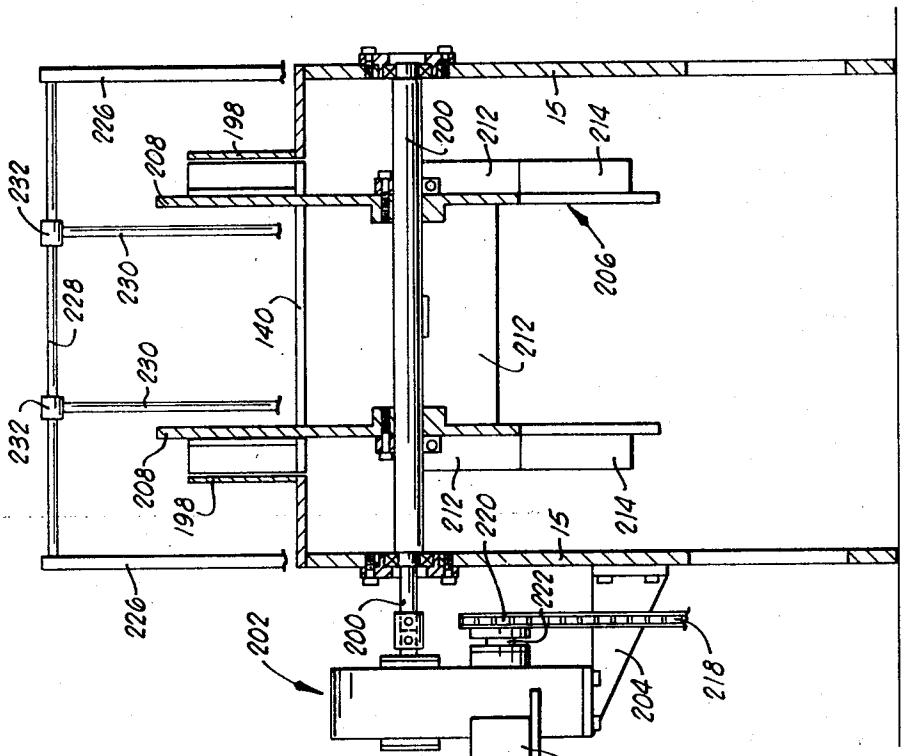


Fig. 3

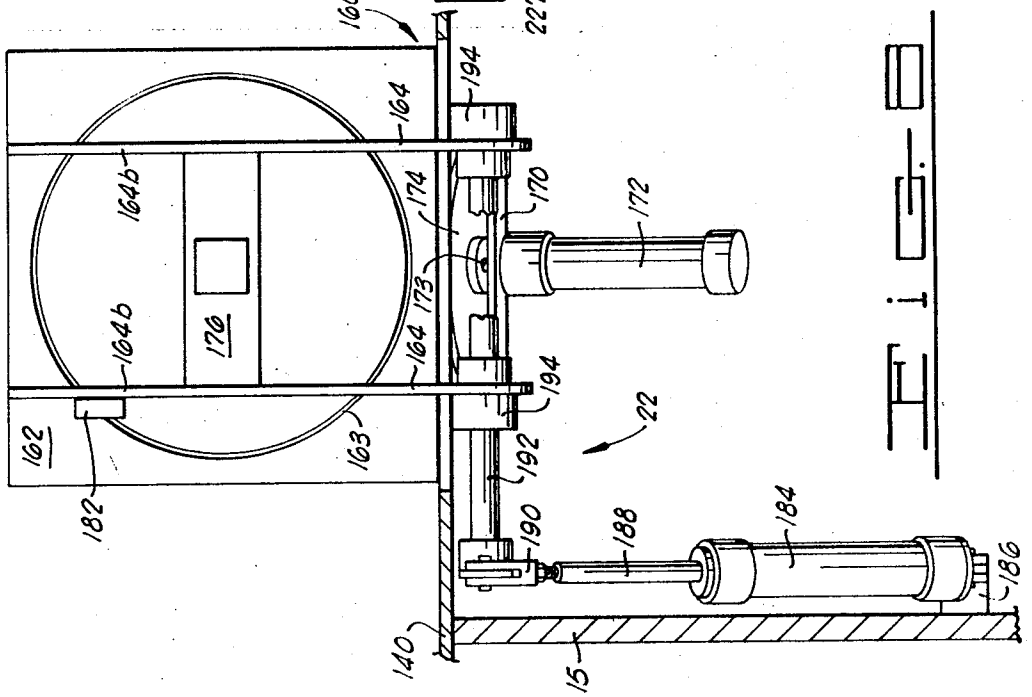


Fig. 4

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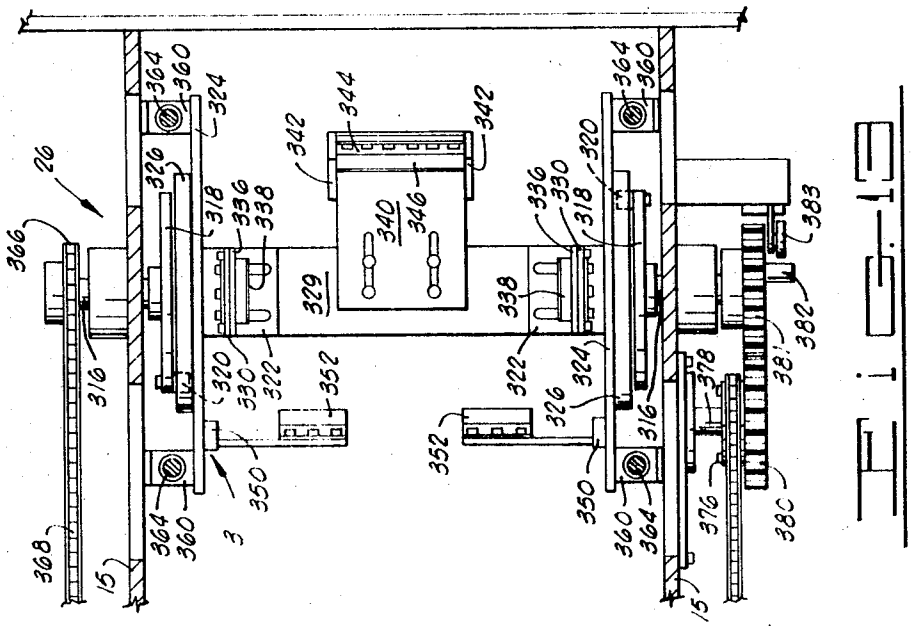


Fig. 9

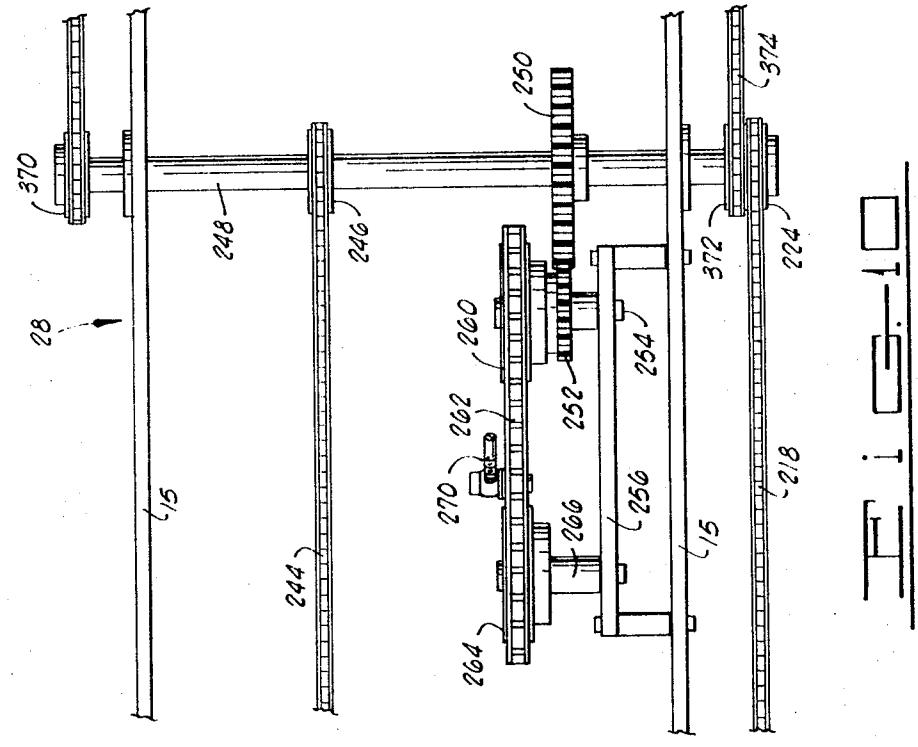


Fig. 10

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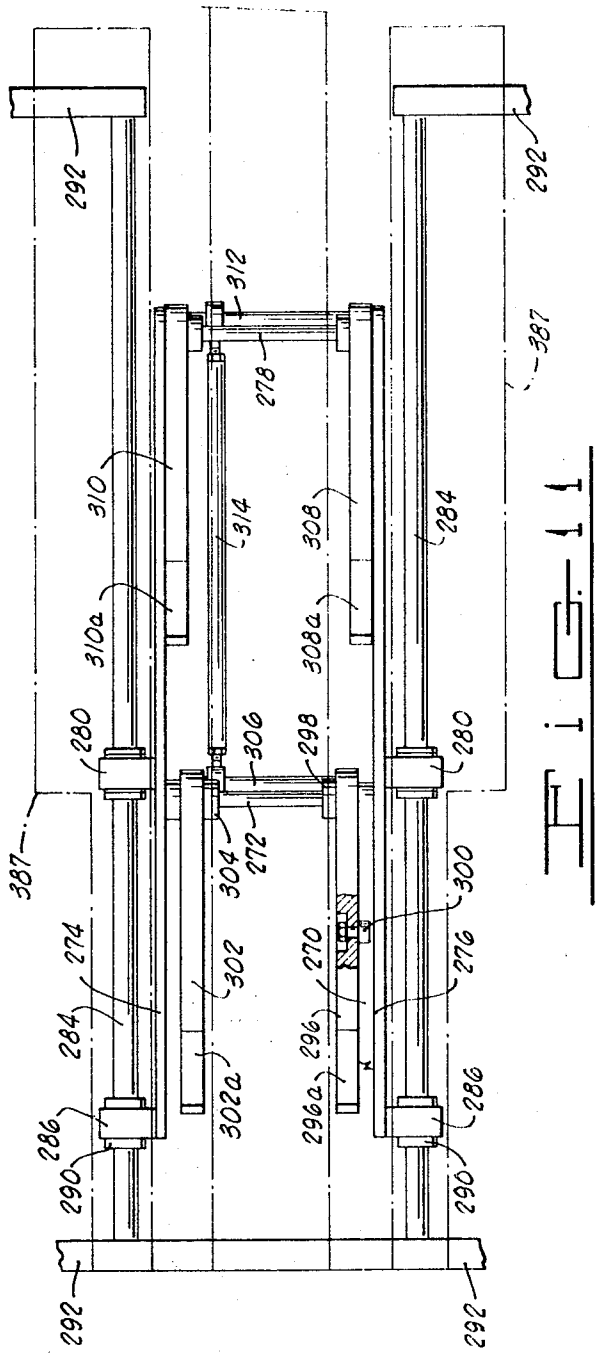


Fig. 11

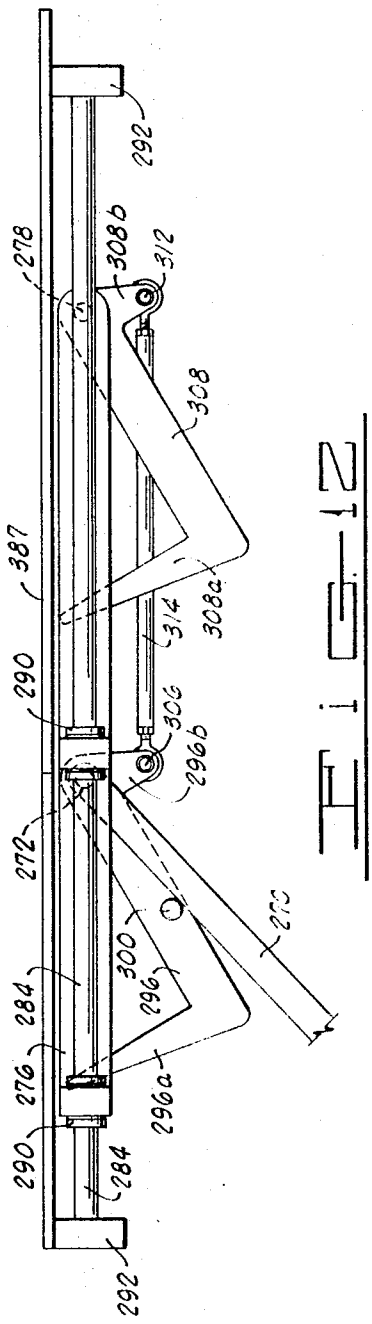
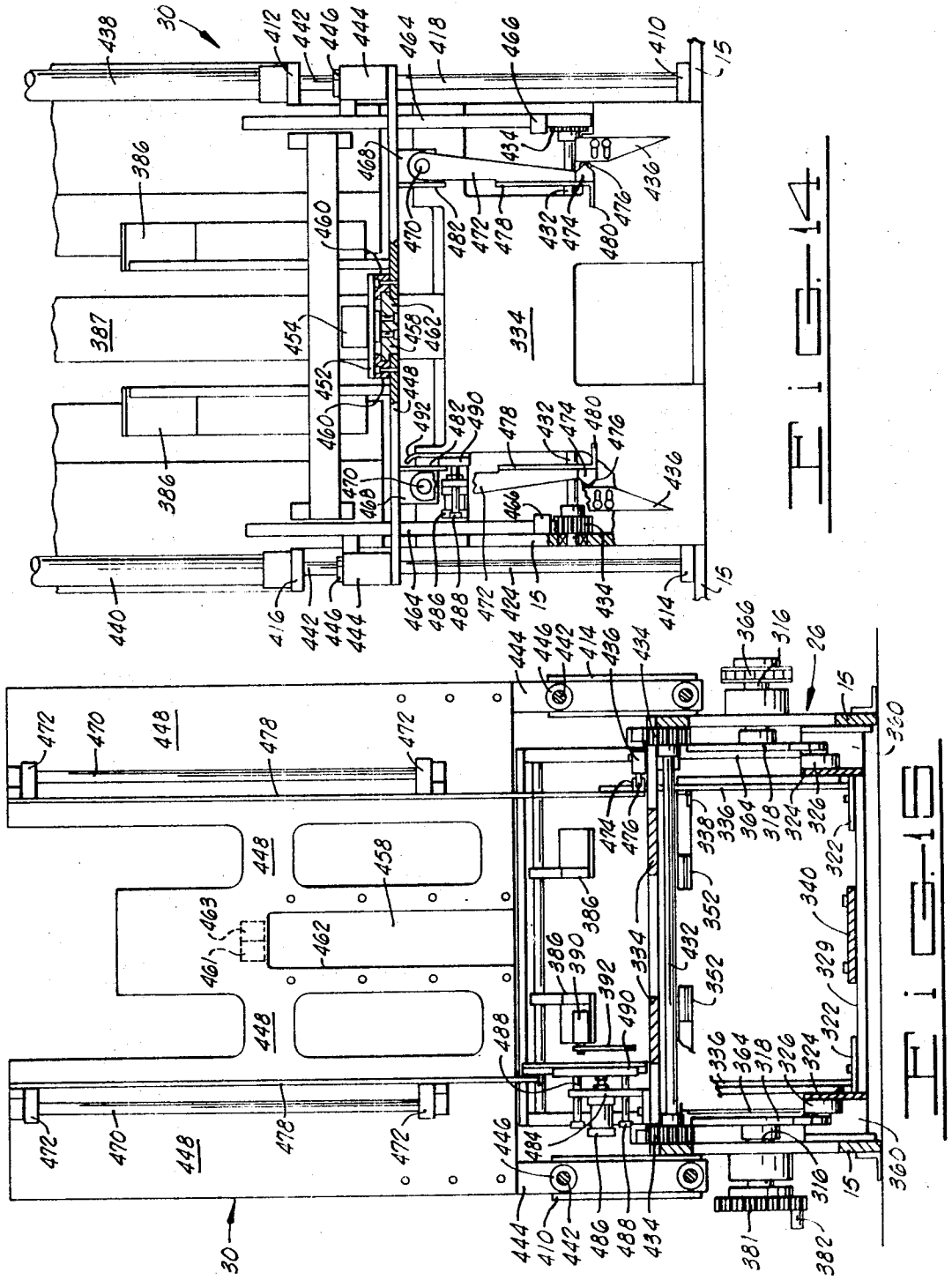


Fig. 12

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BAG COLLATING AND STACKING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to apparatus for collating and stacking paper bags, and more specifically, the invention relates to an apparatus for grouping paper bags in hands containing a predetermined number of bags, and then stacking these hands in a stack containing a predetermined number of hands, with the bags in each hand facing in an opposite direction from the bags in adjacent hands within the stack.

2. Brief Description of the Prior Art

A number of machines have been developed for collating, stacking and baling predetermined quantities of large paper bags of the type used in grocery stores for purposes of shipment and storage. Frequently, the apparatus will include a machine which is positioned adjacent a bag-forming machine to receive from the bag-forming machine, bags which are produced therefrom and for sorting and grouping these bags into a plurality of groups, each of which contain a predetermined number of bags. These groups, called hands, are then stacked on top of each other and are moved into a bag press which is integrally connected and operated with the grouping or collating apparatus. In the bag press, the stack of bags is compressed and is then packaged by wrapping a sheet of paper around the compressed bags and securing the wrapper in this position. Apparatus of the type described is, for example, made by the Potdevin Company of Teterborough, N.J., and is in commercial use.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

The present invention is an apparatus or system for automatically receiving bags from a bag-forming machine and collating or grouping these bags into hands which contain a preselected number of bags. The hands are then oriented in a particular relative position with respect to each other and moved in consecutive sequence into a stacking device where the bags are stacked by adding each successive hand to the bottom side of the stack in a unique manner. The particular mode of collating and stacking the bags permits additional hands to be inserted in the stack, if this should be desired, or, alternately, permits a hand containing defective bags to be removed from the stack without the necessity of ultimately producing a short bale by such procedure. The collating and stacking apparatus can be operated entirely separately from a bag press, and can be quickly and easily secured to a bag forming machine to automatically receive the bags therefrom without slowing down or interrupting the operation of the bag forming machine.

Broadly described, the apparatus of the present invention comprises conveyor means for receiving bags from a bag-forming machine and moving them in consecutive sequence to a point where they are picked up by a pair of cooperating spiral augers. The spiral augers cooperate with the conveyor means to periodically pick off or remove from the conveyor means a preselected number of aligned bags so as to form a hand of bags containing this number of individual bags. The thus removed hand of bags is then conveyed by the spiral augers into a turntable assembly. The turntable assembly is periodically actuated by appropriate synchronizing mechanism driving it in synchronism with the conveyor means and the spiral auger so that the hands of bags placed therein are, in alternating sequence, turned first to a position in which the bottoms of the bags face in one direction, and then, as a succeeding hand is placed in the turntable assembly, to a position in which the bottoms of the bags in this hand face in the opposite direction to the direction toward which the bottoms of the bags in the preceding hand were faced by the turntable. Upon each movement of the turntable to the two alternate positions described, a mechanism then forces the bags from the turntable assembly onto a tilting box assembly. The bags, which are in a flattened, vertically extending status as they move onto the tilting box assembly, are then tilted by this assembly through an angle so as to move them from this vertical status to a horizontal status. Pushing mechanism then pushes each successive hand of bags from the tilting box assembly into a rotating unit assembly which, upon timed actuation in synchronism with other assemblies of the apparatus, delivers the bags to a transfer unit which then conveys each successive hand of bags into a bag lifter assembly. The bag lifter assembly periodically lifts a stack of vertically superimposed hands of bags upwardly to permit a new hand to be delivered beneath the stack by the transfer unit. Then the lifter assembly lowers the lifted stack onto the new hand. Finally, after the stack of bags within the bag lifter assembly has come to contain a desired number of hands, a banding press loader assembly is automatically actuated to load the stack of bags from the lifter assembly into a banding press.

The various assemblies which have been described in the preceding paragraph are operated in the described sequence, and such operation is brought about, by synchronizing mechanism which includes a common mechanical drive system and appropriate camming, switching and pneumatic cylinder actuation elements.

From the foregoing description of the invention, it will have become apparent that it is an important object of the present invention to provide an improved bag-collating and -stacking apparatus.

Another object of the invention is to provide a bag stacking and collating apparatus which can be set to automatically collate a number of bags into hands each containing a preselected number of bags, and then place a preselected number of these hands in a stack.

A further object of the invention is to provide a bag-handling machine for receiving preformed bags from a bag-forming machine and automatically preparing these for baling under compression.

Another object of the invention is to provide a bag-collating and -stacking machine which can be altered in its function during its operation to change the number of hands to bags placed in a bale preparatory to compression and wrapping.

An additional object of the invention is to provide a bag-collating and -stacking machine which is mechanically strong, is reliable in operation, and is characterized in having a long and trouble free operating life.

Additional objects and advantages will become apparent as the following detailed description of the invention is read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of the bag-collating and -stacking apparatus of the invention as it appears when viewed from one side thereof.

FIG. 2 is a side elevation of the bag-collating and -stacking apparatus of the invention as it appears when viewed from the opposite side thereof from the side seen in FIG. 1.

FIG. 3 is a plan view of the bag-collating and -stacking machine of the invention.

FIG. 4 is a sectional view taken along line 4–4 of FIG. 3.

FIG. 5 is an enlarged detail sectional view of a portion of the spiral auger assembly forming a portion of the present invention.

FIG. 6 is a sectional view taken along line 6–6 of FIG. 3 and illustrating the turntable assembly forming a part of the present invention.

FIG. 7 is a side elevation view of the turntable assembly.

FIG. 8 is a front elevation view of a tilting box assembly forming a portion of the present invention.

FIG. 9 is a sectional view taken along line 9–9 of FIG. 3.

FIG. 10 is a plan view of the chain drive portion of the transfer unit assembly forming a portion of the invention.

FIG. 11 is a plan view of the transfer hook portion of the transfer unit assembly forming a portion of the invention.

FIG. 12 is a side elevation view of the apparatus shown in FIG. 11.

FIG. 13 is a sectional view taken on line 13–13 of FIG. 1.

FIG. 14 is a plan view with parts broken away illustrating the press transfer assembly forming a part of the invention.

FIG. 15 is a sectional view taken along line 15–15 of FIG. 1.

FIG. 16 is a circuit diagram illustrating electrical circuitry utilized in the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

In referring to the drawings and the following detailed description of a preferred embodiment of the invention, major machines, assemblies or subassemblies have been designated by reference numerals associated with lead lines having arrowheads. Individual elements are indicated by reference numerals which carry plain lead lines not having arrowheads.

The bag collating and stacking apparatus of the present invention is designated generally by reference numeral **10** and is shown in a normal mode of use in which it is located adjacent a bag-forming machine designated generally by reference numeral **12**. The bag-forming machine **12** may be many different types of bag-forming machines currently in use for making large, self-opening grocery bags, but the one illustrated merely for purposes of description in the present application is a machine of the type shown in U.S. Pat. No. 3,180,237 assigned to the assignee of the present application. Extending from the bag-forming machine **12** is a drive shaft **14** which is driven in synchronism with the bag-forming machine and furnishes the primary power source for the moving mechanical elements of the bag-collating and -stacking apparatus **10** of the present invention. The various functional assemblies of the bag-collating and -stacking apparatus **10** of the present invention may be preliminarily identified to advantage in order to aid in the subsequent, more detailed description of the invention. These assemblies are generally mounted on a machine framework **15** and include a conveyor means **16** for receiving bags formed by the bag-forming machine **12**, and a spiral auger assembly **18** which periodically removes hands of bags containing a preselected number of bags from the conveyor means **16** and transfers them to a turntable assembly **20**. The turntable assembly **20** transfers the hands of bags to a tilting box assembly **22**. From the tilting box assembly **22**, the bags move into a rotating unit assembly **24**. The hands of bags are then transferred in successive order from the rotating unit assembly **24** to a bag lifter assembly **26** by a transfer unit assembly **28**. Finally, the bag lifter assembly **26** stacks the hands of bags on a support plate from which the bags may be moved into a banding press (not forming a portion of the present invention) by a banding press loader assembly **30**.

Referring now in greater detail to the drawings, the bag-collating and -stacking apparatus **10** of the present invention includes, as has been indicated, a conveyor means **16** which functions to pick up formed bags as they are discharged from the bag-forming machine **12** and transfer or move these to a remote location where they are then picked up in preselected numbers or groups by the spiral auger assembly **18**. The conveyor means **16** utilized in the invention comprises a shaft **32** which has formed around the outer periphery thereof a helical thread or fin **34** which has succeeding convolutions longitudinally spaced or separated from each other by a distance approximately equal to the thickness of a folded bag which has been formed on the bag-forming machine **12**. The pitch of the fins **34** is such that as a bag is fed from the bag-forming machine **12** downwardly with the bottom of the bag at the lowermost side thereof, the bag comes to rest between a pair of adjacent convolutions of the fin **34** on the conveyor means **16**, and is then effectively moved by a screw action away from the bag-forming machine **12** and toward the spiral auger assembly **18**.

It should be pointed out that the speed of rotation of the shaft **32** which carries the helical fin **34** is correlated to the output speed of the bag-forming machine **12** so that a newly formed bag is discharged from the bag-forming machine onto the conveyor means **16** as each new space of reception between adjacent convolutions of the helical fin **34** appears below the discharge location of the bags from the bag-forming machine. Thus, each successive bag as formed enters each successive adjacent slot between adjacent convolutions of the fin **34**. For the purpose of holding the bags in alignment with each other and centered on top of the conveyor means **16**, a horizontally extending run **36***a* of a belt **36** is vertically positioned above the conveyor means **16** by a distance approximately equivalent to the height of a bag. The belt **36** is supported on a plurality of idler rollers **38**.

Lateral support for the bags is provided by a vibrator assembly **40** which is positioned on the side of the conveyor means **16** towards which the shaft **32** is rotated so that the bags cannot be carried sideways off of the rotating fin **34**. The vibrator assembly **40** includes a vibrator bar **41** connected by suitable vertical rods **42** to a crossmember **43**. The crossmember **43** is connected to a shaft **45** by rods **47**, and the shaft **45** is secured to a cam arm **49** which has a cam roller **51** at the upper end thereof. The cam roller **51** rollingly engages a cam sleeve **53** mounted eccentrically on the drive shaft **14** so that periodically the vibrator bar **41** is rocked inwardly towards the bags, and a periodic tapping motion is imparted to the vibrator bar to tap the bags on their side edges, and keep them in alignment with each other as they move along the conveyor means **16**.

For the purpose of driving the shaft **32** of the conveyor means **16** in rotation about its longitudinal axis, a timing belt **46** is passed over a timing belt pulley **48** carried on the drive shaft **14**, and over a timing belt pulley **50** keyed to one end of an input shaft extending into a gearbox **52** supported on the framework **15** beneath the conveyor means **16**. An output shaft **54** from the gearbox **52** carries a timing belt pulley **55** which drives a timing belt **56**. The timing belt **56** is extended around a timing belt pulley **57** keyed to a small coaxial extension **58** of the shaft **32**. The gearing in the gearbox **52** provides for the desired synchronization of the speed of rotation of the shaft **32** with respect to the speed at which bags are formed on the bag-forming machine **12**. It will be noted in referring to FIG. **4** that at the downstream end of the conveyor means **16**, the helical fin **34** undergoes a substantial increase in its pitch so that greater spacing is caused to occur between adjacent bags carried on the conveyor means. The purpose of this is to permit the conveyor means **16** to cooperate with the spiral auger assembly **18**.

As will be seen in referring to FIG. **3**, the spiral auger assembly **18** includes a pair of large, oppositely disposed spiral auger subassemblies **60** which each include a helically turned blade **62** which terminates at its forward or upstream end in a point **63**. Each helically turned blade **62** is sufficiently thin at its forward and central portions that the point **63** thereof can pass between the widely spaced convolutions of the fin **34** at the downstream end of the conveyor means **16**. A support table **65** is positioned between the lower portions of each of the spiral auger blades **62** for supporting bags moved thereby as hereinafter described.

As best illustrated in FIG. **5**, the blade **62** of each of the spiral auger subassemblies **60** is mounted on a drum **64** which is keyed to, and rotates with, a hollow shaft **66**. The hollow shaft **66** extends through a gearbox **68** which contains a worm gear **70** keyed to the hollow shaft. The worm gear **70** meshes with a worm **72** carried on a shaft **74** which projects into, and is journaled in, the gearbox **68**. At its outer end, the shift **74** carries a sprocket **76** which engages a chain **78**. The chain **78** passes over a second sprocket **80** keyed to the outer end of a cross-shaft **82** which extends through the gearbox **52** from one side of the machine to the other. Within the gearbox **52**, the cross-shaft **82** is drivingly engaged by gearing which permits it to be driven from the drive shaft **14** by means of the belt **46**. The gearing and sprockets utilized in driving the spiral auger subassemblies **60** in rotation about the axes of the shifts **66** is such that the spiral augers are driven at a preselected speed ratio with respect to the speed of rotation of the shaft **32** forming a portion of the conveyor means **16**. In a preferred em-

bodiment of the invention, the conveyor means **16** is driven at a rate of rotation which is 25 times the rate of rotation of the spiral auger subassemblies **60** for a purpose which will hereinafter be described.

It will be noted in referred to FIGS. **1**, **3** and **5** that at the downstream end of each blade **62**, the blade is terminated in a substantially vertical plane (that is, the pitch is removed therefrom) and the blade is thickened so as to provide a substantially vertically extending, relatively thick heel plate portion **83** of the blade. It will also be noted in referring to FIG. **5** that the hollow shaft **66** upon which each spiral auger blade **62** is mounted concentrically surrounds an air cylinder **84** which projects to a location near the downstream end of the drum **64**, and which contains a piston secured to one end of a piston rod **86** which carries at its other end a pusher plate **88**. The pusher plate **88** can be projected from the drum **64** when the air cylinder **84** is actuated to accomplish a bag moving function hereinafter described in greater detail.

Immediately downstream from the spiral auger assembly **18** is the turntable assembly **20** which is illustrated in greater detail in FIGS. **6** and **7**. The turntable assembly **20** includes a vertically extending front support plate **94** and vertically extending rear support plate **96** disposed upstream, and horizontally spaced from, the front support plate. The support plates **94** and **96** each have a large circular opening **98** formed therein with these openings in the plates being in horizontal registration. A pair of suitable horizontally extending connecting girts **100** space the front and rear support plates from each other.

Mounted between the front and rear support plates **94** and **96** is a turntable **102** of circular configuration. The turntable **102** is supported between the front and rear support plates **94** and **96** by a plurality of bearings **104** which are mounted on spacer sleeves **106** extending between the support plates. The central portion of the turntable **102** is cut away so that an opening **107** is formed therethrough resembling in configuration a pair of crossed rectangles of substantially equal size, with each of the rectangles having pairs of opposed protuberant cutaways or reliefs **107***a* extending outwardly therefrom. The reliefs **107***a* are in a position such that each relief is aligned with one of the pusher plates **88** of the spiral auger assembly **18** for purposes hereinafter described. Extending transversely across the upper portion of the front plate **94** to at least partially close the circular opening **98** therethrough, and to obstruct or close a portion of the opening **107** through the turntable **102** is a bag stop plate **112**.

For the purpose of rotating the turntable **102** upon the bearings **104** and between the front and rear support plates **94** and **96**, respectively, a Geneva drive assembly, designated generally by reference numeral **114**, is connected to the turntable **102** by means of an output shaft **115** secured to a crank arm **116** which is connected through a bracket **118** to a pushrod **120**. The pushrod **120** has its end opposite the end connected to the bracket **118** secured to a bracket **122** which is pivotally secured by a suitable pin to the turntable **102**. The power input to the Geneva drive assembly **114** is delivered via a sprocket **124** keyed to an input shaft **126** which enters the opposite side of the Geneva drive housing **128** from that side from which the output shaft **115** projects. The sprocket **124** is driven in rotation by a chain **132** which drivingly engages a sprocket **134** carried on the output shaft **54** extending from the gearbox **52** (see FIGS. **2** and **4**). The Geneva drive assembly **114** is constructed so that during each actuation of the Geneva wheel contained therein by the input shaft **126** to move this wheel through a 90° increment of rotation, the output gearing connected to the Geneva wheel drives the output shaft **130** through 180° and the turntable, through the interconnecting linkage, is rotated through an angle of 90°.

A subassembly which forms a part of the turntable assembly **20** is the bag flap subassembly designated generally by reference numeral **136**. The bag flap subassembly **136** includes a mounting pedestal **138** which is secured to the upper side of a bag support plate **140** and which has pivotally connected thereto, a vertically extending air cylinder **142**. The vertically extending air cylinder **142** encloses a piston which is connected to a piston rod **144** secured at its outer end to a bracket **146**. The piston rod **144** actuates a bag flap plate **148** through an intervening crank arm **150** and shaft **151** supported by suitable brackets **152** which are cantilevered from the exposed side of the bag stop plate **112**. It may be seen that the bag flap plate **148** extends opposite a major portion of the opening **107** through the turntable **102**, and is secured at its upper edge to the shaft **151** which is journaled in the brackets **152** and secured to the crank arm **150**.

The tilting box assembly **22** is best illustrated in detail in FIGS. **4** and **8**. As here shown, the tilting box assembly **22** is positioned adjacent the bag support plate **140** and receives bags moving downstream from the turntable assembly **20** as hereinafter described. The tilting box assembly **22** includes a tilting table subassembly, designated generally by reference numeral **160**, which comprises a large plate **162** having a circular opening **163** formed in the center thereof, and which is secured to a pair of L-shaped, horizontally spaced brackets **164**. The L-shaped brackets **164** carry an outwardly projecting hook or toe **166** at the ends of the aligned legs **164***a* thereof which are not secured to the plate **162**. Extending between these legs **164***a* is an air cylinder mounting bracket **170** which is used for mounting an air cylinder **172** between the legs **164***a* of the L-shaped brackets **164**. The air cylinder **172** contains a piston secured to one end of a piston rod **173** which has its other end connected to a pusher plate **174** which is illustrated in FIG. **4** in its retracted position.

Extending between the legs **164***b* of the L-shaped brackets **164** which are secured to the plate **162** and positioned to extend across the circular opening **163** in this plate is an air cylinder-mounting bracket **176**. The air cylinder-mounting bracket **176** supports an air cylinder **178** which contains a piston secured to one end of the piston rod **179** which carries a pusher plate **180** at its opposite end. The pusher plate **180** is of circular configuration and is of slightly lesser diameter than the diameter of the circular opening **163** in the plate **162**. A switch **182** is mounted on the plate **162** adjacent the pusher plate **180** so that extension of piston rod **179** and this plate opens the switch, and full retraction of the plate into the opening **163** trips the switch.

For the purpose of tilting the tilting box assembly **22** through a 90° angle to achieve a function hereinafter described, an air cylinder **184** is provided and has its base secured to the framework through a suitable bracket **186**. The air cylinder **184** contains a piston which is connected to one end of a piston rod **188** which is secured at its other end to a lever arm **190**. The lever arm **190** is keyed to a shaft **192** at its end opposite that end which is connected to the piston rod **188** so that as the piston rod is extended and retracted, the lever arm causes the shaft to rotate about its longitudinal axis. The shaft **192** can be journaled to the framework of the machine in any suitable manner, and has keyed to a central portion thereof for rotation therewith, spaced hubs **194** which are carried by the L-shaped brackets **164** at the intersection of the legs **164***a* and **164***b*. It will thus be apparent that as the air cylinder **184** is actuated so as to extend or retract the piston rod **188**, the L-shaped brackets **164** will pivot with the shaft **192**, and the effect obtained will be a tilting of the tilting box assembly **22** through an angle of 90° at preselected times during the operation of the apparatus as hereinafter described. Secured to the main framework of the machine, and projecting upwardly on opposite sides of the tilting box assembly **22**, are a pair of parallel guide plates **198** (see FIGS. **1**, **2** and **3**).

Immediately downstream from the tilting box assembly **22** and disposed between the guide plates **198** is the rotating unit assembly **24**. This assembly is illustrated in detail in FIGS. **4** and **9**. It includes a transversely extending, longitudinal shaft **200** which is journaled in the framework of the apparatus, and which projects from one side of the framework into a Geneva drive subassembly designated generally by reference numeral **202** and mounted on suitable supporting brackets **204**. Keyed

to the central portion of the shaft 200 for rotation therewith is an index wheel subassembly designated generally by reference numeral 206. The index wheel subassembly 206, as shown in FIGS. 4 and 9, includes a pair of parallel sideplates 208 which are identical in configuration and have the shape best shown in FIGS. 4 and 9. Thus, each of the sideplates 208 is generally circular in configuration with four, substantially rectangular slots 210 cut therein with the sides of each slot extending along chords of the respective circular plate. These slots 210 are cut in each of the sideplates 208 with the four slots being disposed at 90° from each other around each sideplate.

Secured across the longest side of each pair of aligned rectangular slots 210 in the two sideplates is an H-shaped bag support plate 212. There is further provided adjacent the bottom edge of each of the slots 210 an angle plate 214. It will be noted in referring to FIGS. 4 and 9 that, in the illustrated position of the indexing wheel subassembly 206, the sideplates 208 are positioned so that one pair of their aligned rectangular slots 210 faces toward the turntable assembly 22, and has the longest edge of each of the slots (which carries the bag support plate 212) positioned in alignment with the bag support plate 140 hereinbefore described. As will be subsequently described, each incremental fractional rotation of the index wheel subassembly 206 with the shaft 200 rotates this subassembly through an angle of 90° so that at the end of each incremental fractional rotation, a new pair of aligned rectangular slots 210 in the two sideplates 208 is brought into the forwardly facing position described so that the index wheel subassembly 206 is ready to receive a hand of bags from the tilting box assembly 22.

Rotation of the index wheel subassembly 206 is effected by the Geneva drive subassembly 202. The Geneva drive subassembly 202 is driven by a chain 218 which is passed over the sprocket 220 connected to an input shaft 222 of the Geneva drive subassembly. At its opposite end, the chain 218 is passed over a drive sprocket 224 which is carried by a shaft mounted in the framework of the machine in a manner hereinafter described. The operation of the Geneva drive subassembly 202 is such that each actuation of the Geneva wheel contained therein will rotate this wheel through 90° and the wheel in turn will drive the output shaft 200 through a corresponding amount. It will be noted that the shaft 200 extends through the Geneva drive housing and carries a plurality of cams 225*a*, 225*b*, and 225*c* which function to periodically activate a plurality of switches located in a switch box 227 adjacent the cams in a manner hereinafter described.

Secured to the framework on opposite sides of the index wheel subassembly 206 are a pair of upwardly extending brackets 226. Secured between the upper ends of the brackets 226 and above the index wheel subassembly 206 is a shaft 228. A pair of downwardly extending, horizontally spaced guide rods 230 are secured at their upper ends to the shaft 228 at horizontally spaced intervals therealong by means of set collars 232. The guide rods 230 are to some extent resilient, and their angular relationship with respect to the vertical can be adjusted by adjustment of set screws in the set collars 232. It will be noted that in the illustrated position of the guide rods 230, they extend downwardly in a plane which is spaced horizontally downstream from the shaft 200 to which the index wheel subassembly 206 is keyed. The function of the guide rods 230 will be hereinafter explained.

The transfer unit assembly 28 is located immediately downstream in the bag-collating and -stacking apparatus from the rotating unit assembly 24. The details of construction of the transfer unit assembly 28 are best illustrated in FIGS. 4, 10, 11 and 12. In referring to FIG. 4, it will be noted that the outer end of the shaft 54 which projects rearwardly from the gearbox 52 carries a sprocket 232 which drivingly engages a chain 234. The chain 234 drives a sprocket 236 which is carried on the outer end of a shaft projecting from a speed reducer 238. A shaft 240 projects from one side of the speed reducer 238 and carries a sprocket 242 which engages a drive chain 244. The drive chain 244 extends rearwardly or downstream in the bag-collating and -stacking apparatus 10, and is passed around a sprocket 246 which is keyed to a central portion of the shaft 248 hereinbefore described. The shaft 248 extends transversely across the machine and is journaled in the framework thereof and, as has previously been described, carries a Geneva drive sprocket 224 on one end thereof (see FIG. 3).

The shaft 248 also has keyed thereto at a position intermediate its ends, a gear 250 which rotates with the shaft and drivingly engages a gear 262 which is rotatably mounted on a stub shaft 254 secured to, and projecting laterally from a portion 256 of the frame 15 (see FIG. 10). Drivingly secured to the gear 252 for concurrent rotation about the stub shaft 254 is a chain sprocket 260 illustrated in FIG. 4. The chain sprocket 260 engages a chain 262 which passes over a sprocket 264 corresponding in size to the sprocket 260 and rotatably mounted on a stub shaft 266 which is secured to the frame portion 256 hereinbefore described.

In referring to FIGS. 4 and 10, and to the foregoing description, it will be perceived that the drive is transferred from the gearbox 52 via the chain and sprocket connections and the speed reducer 238 ultimately to the shaft 248. The shaft 248 is utilized for driving the Geneva drive subassembly 202 hereinbefore described, for driving the sprockets 260 and 264 and for driving certain other portions of the apparatus hereinafter described. The sprockets 260 and 264 are thus driven in synchronism with the conveyor means 16, the spiral auger assembly 18, the first mentioned Geneva drive assembly 114 and the rotating unit assembly 24 by this mechanical interconnection.

In referring to FIGS. 4 and 11, it will be noted that a connecting rod 270 has one of its ends pivotally connected to the chain 262 and extends upwardly from the chain. The upper end of the connecting rod 270 is journaled on a shaft 272 which has its opposite ends secured in carrier plates 274 and 276. Horizontally spaced along the carrier plates 274 and 276 in a downstream direction from the shaft 272, a second shaft 278 extends parallel to the shaft 272 and has its opposite ends secured in the end portions of the carrier plates 274 and 276. At about the central portion of the length of each of the carrier plates 274 and 276, each carrier plate has secured thereto a bracket 280 which projects outwardly therefrom and supports a ball bushing 282. Each ball bushing 282 concentrically surrounds, and is slidable on, an elongated slide shaft 284, which slide shafts extend parallel to the carrier plates 274 and 276 and to each other. At the upstream ends of each of the carrier plates 274 and 276, a second bracket 286 is secured to each of the carrier plates and projects outwardly therefrom. The brackets 286 each carry a ball bushing 290 which surrounds and slidingly engages one of the elongated slide shafts 284. The slide shafts 284 are rigidly supported in suitable brackets 292 which are mounted on the framework 15 of the bag collating and stacking apparatus. It will be perceived from the foregoing description that the carrier plates 274 and 276, the shafts 272 and 278 which extend therebetween, the brackets 280 and 286, and the ball bushings 282 and 290 carried by these brackets, collectively form a reciprocating carriage which can undergo reciprocating movement on the two parallel, horizontally spaced slide shafts 284.

Mounted inwardly on the shaft 272 from the position at which the connecting rod 270 is journaled thereon is a first trailing transfer hook 296, the configuration of which is best illustrated in FIG. 13. In referring to FIG. 13, it will be noted that the transfer hook 296 has one of its ends journaled around the shaft 272 by means of a suitable bushing 298, and that its other end is free and carries an upwardly projecting toe 296*a*. The transfer hook 296 also has secured to the side thereof adjacent the connecting rod 270, a cam roll bearing 300 which rollingly engages the flat upper surface of this connecting rod. Near the opposite end of the shaft 272 from that upon which the connecting rod 270 and the transfer hook 296 are journaled is pivotally mounted a second trailing transfer hook 302. The second transfer hook 302 is parallel, and is

shaped similarly, to the transfer hook **296**, thus having a toe **302***a*. The transfer hook **302**, like the transfer hook **296**, is journaled on the shaft **272** by means of a suitable bearing **304**. Opposite the ends of the trailing transfer hooks **296** and **302** at which the toes **296***a* and **302***a* are located, each of these transfer hooks carries a downwardly projecting lug **296***b* and **302***b*, respectively. A crossbar spacer **306** extends between, and is secured to, the lower ends of the downwardly projecting lugs **296***b* and **302***b*.

A first leading transfer hook **308** is journaled on the shaft **278** adjacent the forward end of the carrier plate **274** and is of a configuration which is substantially identical to the configuration of the trailing transfer hooks **296** and **302**. A second leading transfer hook **310** is journaled on the shaft **278** at its opposite end just inside the carrier plate **276**. The downwardly depending lugs **308***b* and **310***b* of the leading transfer hooks **308** and **310** are interconnected by a crossbar spacer **312**. Extending between the crossbar spacers **306** and **312** is a connecting rod **314** which is journaled at its opposite ends around each of these spacer bars.

The bag lifter assembly **26** is positioned downstream from the transfer unit assembly **28** for receiving hands of bags from the transfer unit assembly in a manner and for a purpose hereinafter described. The details of construction of the bag lifter assembly **26** are best illustrated in FIGS. **1**, **4**, **13** and **15**. In referring to FIGS. **1** and **13**, it will be noted that a pair of stub shafts **316** are extended inwardly from opposite sides of the framework **15** and are journaled in the framework for rotation about horizontal axes. The stub shafts **316** each have keyed to their inner ends, a circular crank disc **318** which extends in a substantially vertical plane. Each of the crank discs **318** carries a cam roller bearing **320** adjacent the outer periphery thereof so that the cam roller bearing **320** on each of the crank discs **318** moves through a circle during the rotation of the respective crank disc with its stub shaft **316**.

A vertically reciprocating bag lifter carriage subassembly designated generally by reference numeral **322** is positioned between the opposed sidewalls of the frame **15** and between the crank discs **318**. The bag lifter carriage subassembly **322** includes a pair of horizontally spaced, horizontally extending, parallel slide carrier plates **324** which extend parallel to the sidewalls of the frame **15**, and have secured to their sides adjacent the respective crank discs **318**, an oval cam member **326** which defines an elongated, horizontally extending slot **328**. The slot **328** is dimensioned to receive the cam roller bearing **320** on the adjacent crank disc **318** so that the respective cam roller bearing may roll along the slot in the cam member **326**. It will thus be perceived that as the stub shafts **316** are rotated about their axes, the crank discs **318** are also rotated so that the cam roller bearings **320** move in circular paths, and the cam members **326**, in following the cam roller bearings, move upwardly and downwardly in a reciprocating motion which is transmitted to the entire bag lifter carriage subassembly **322**.

The bag lifter carriage subassembly **322** further includes a transverse girt **329** which is secured between the lower edges of the plates **324**, and which supports a pair of vertically extending lifter arms **330**. The vertically extending lifter arms **330** are secured to the transverse girt **329** by a pair of adjusting brackets **322** which can be adjusted in their points of securement to the girt to permit the horizontal spacing between the lifter arms **330** to be adjusted for reasons hereinafter described. Secured to an upper portion of each vertically extending lifter arm **330** at a lever below that at which a horizontally extending bag-supporting plate **334** is located is a bracket **336** which has hingedly secured thereto for pivotation about a horizontal axis, a bag lifter flap **338**. Each of the bag lifter flaps **338** is spring biased to an upwardly and outwardly extending position at which it extends at an angle of about 45° with respect to the vertical. Each of the bag lifting flaps **338** can be pivoted downwardly to a horizontal position, however, at which position it strikes a positive stop which limits further downward movement.

Secured to the upper side of the transverse girt **329** is a baseplate **340** which is adjustably secured to the transverse girt **329** so that it may be moved in a direction which is normal to the longitudinal axis of the girt. The baseplate **340** has secured to the outer edges thereof a pair of vertically extending lifter arms **342**. The lifter arms **342** have a hinge plate **344** secured therebetween at their upper end portions and the hinge plate **344** supports a hinge element which carries a bag lifting flap **346** movable within the limits hereinbefore described as characteristic of the bag lifting flaps **338**.

Secured to the forward or upstream portion of each of the slide carrier plates **324** is a vertically extending lifter arm **350**. The lifter arms **350** are horizontally spaced from each other, and carry at locations adjacent their upper ends, a pair of hinge structures which include bag lifter flaps **352** having the movement characteristics hereinbefore described in referring to the bag lifter flaps **338** and **346**.

In referring to FIG. **13**, it will be noted that the bag lifter flaps **352**, **338** and **346** are positioned around the edges of, and project into, a generally rectangular space. This rectangular space is of an area which corresponds to the area of a flattened bag. Thus, when the hands of bags are pushed downstream on the bag support plate **334** by the transfer unit assembly **28**, they ultimately come to rest on the bag support plate **334** with their edges positioned over the bag lifter flaps **338**, **346** and **352**. At this time, the bag lifter carriage subassembly **322** commences to move vertically upwardly as a result of the rotational movement of the crank discs **318** carried on the stub shafts **316**. The bag lifter carriage subassembly **322** further includes four bearing blocks **360** secured at the opposed corners of the slide carrier plates **324**. Each bearing block **360** slidably surrounds a vertically extending shaft **364**, which has its upper end secured to the underside of the bag support plate **334** and its lower end secured in the framework **15**.

For the purpose of driving the stub shaft **316** at one side of the framework **15** in rotation, a chain sprocket **366** is keyed to this stub shaft, and a chain **368** extends from this sprocket to a sprocket **370** carried on the outer end of the shaft **248** hereinbefore described. At the other end of the shaft **248**, a sprocket **372** is keyed to this shaft adjacent the sprocket **224** from which the Geneva drive subassembly **202** is driven, and a chain **374** extends from this sprocket to a sprocket **376** rotatably journaled on a stub shaft **378** secured on the opposite side of the frame **15** from the side on which the sprocket **366** is located. The sprocket **376** is keyed to a gear **380** which is also rotatably journaled on the stub shaft **378**, and which drivingly engages a gear **381** keyed to the stub shift **316**. It will be perceived that since the drive for both the sprockets **376** and **366** has a common origination in the rotation of the shaft **248**, with proper ratios used in the several sprockets and in the gearing **380** and **382**, the crank discs **318** located just inside the opposite sides of the framework **15** can be caused to rotate in rotational synchronism, yet in opposite directions, so that any canting or skewing of the bag lifter carriage subassembly **322** during its vertical reciprocating movement is avoided, and binding upon the vertically extending shafts **364** by the bearing blocks **360** is avoided.

It will also be noted that the gear **381** carries an outwardly projecting protuberance **382** mounted near its outer periphery, and that the protuberance **382** can strike and close the actuator arm of a microswitch **383** once during each revolution of gear **381**. The microswitch **383** is mounted on the framework **15** adjacent the gear **381**.

Positioned just upstream from the bag lifter assembly **28** is a hand guiding subassembly **384**. This subassembly **384** includes a pair of overhead skids **386** under which the hands of bags are moved by the transfer hooks **296**, **302**, **308** and **310** as they pass on an elongated bag support plate **387** toward the bag lifter assembly **28**. The overhead skids **386** carry a switch-supporting bracket **388** upon which a microswitch **390** is mounted. An elongated switch finger **392** is pivotally mounted on the switch bracket **388** and projects downwardly into the

path of the hands of bags passing under the overhead skids **386**. Each time a hand of bags strikes the finger **392**, the microswitch **390** is closed to transmit a signal to an electric counter **394** mounted in an accessible location on the framework **15**.

In FIGS. **14** and **15** are illustrated details of construction of the banding press loader assembly **30** which is utilized to horizontally displace the stack of superimposed hands of bags which is formed by the bag lifter assembly **26**. As here shown, and as will appear in FIGS. **1** and **4**, the press loader assembly **30** includes four brackets **410**, **412**, **414** and **416** which are mounted in two pairs disposed on opposite sides of the framework **15** and project vertically therefrom. It will be noted in referring to FIGS. **1**, **3** and **4** that the vertically extending brackets **410**, **412**, **414** and **416** define the corners of a rectangle and are located in horizontally spaced relation around the outside of the bag lifter assembly **26**. Extending between the brackets **410** and **412** are a pair of vertically spaced, horizontally extending slide rods **418** and **420**. In like manner, a pair of vertically spaced, horizontally extending slide rods **422** and **424** extend between, and have their ends secured to, the vertically extending brackets **414** and **416** on the opposite side of the framework **15** from the brackets **410** and **412**.

Positioned between the vertically extending brackets **410**, **412**, **414** and **416** is the horizontally extending bag-supporting plate **334** which has been hereinbefore described. The bag-supporting plate **334** is supported on the upper edges of opposed side portions of the framework **15**. A transversely extending shaft **432** has its opposite ends journaled in the framework **15** and has keyed thereto adjacent the opposed side portions of the framework **15** a pair of gears **434**. Supported on the bag support plate **334** and spaced inwardly from the gears **434** are a pair of cam plates **436** which are adjustably secured to the bag support plate **434** for adjustment toward or away from each other (see FIG. **18**).

Secured to the brackets **412** and **416** on opposite sides of the framework **15** are a pair of air cylinders **438** and **440** (see FIGS. **3** and **14**). The air cylinders **438** and **440** each have piston rods **442** projecting therefrom and extending through suitable apertures in the brackets **412** and **416**. Each of the piston rods **442** is secured at its outer end to a vertically extending bracket **444** which carries a pair of vertically spaced bushings **446**. The bushings **446** of one bracket **444** slidingly surround the slide rods **418** and **420** on one side of the machine, and the bushings **446** of the other bracket **444** surround the slide rods **424** and **426** on the opposite side of the machine. The brackets **444** are thus journaled on the slide rods **318**, **320**, **324** and **326** for sliding reciprocating movement therealong.

The upper end portions of the vertically extending brackets **444** are secured to the outer edges of a vertically extending pusher plate **448** which extends transversely across the machine at the leading or upstream edge of the bag support plate **334**. Mounted on the side of the pusher plate **448** which faces the air cylinders **438** and **440** is an air cylinder mounting bracket **452** which is secured to, and supports, a vertically extending air cylinder **454**. The vertically extending air cylinder **454** has a piston rod **456** extending downwardly therefrom and secured at its lower end to a slide plate **458**. The slide plate **458** is slidably mounted in a pair of elongated slide guides **460** which are disposed on opposite sides of a slide receiving slot **462** formed in the pusher plate **448**.

Secured to the inside of each of the vertically extending brackets **444** are a pair of horizontally projecting racks **464** which extend parallel to each other and to the slide rods **418**—**424**. The racks **464** are supported in suitable rack guide elements **466** which are secured to the opposite sides of the framework **15**. The position of the racks **464** is such that, as they are reciprocated along their longitudinal axes, the teeth of the racks engage the teeth of the gears **434** which are keyed to the shaft **432**. Intermediate their length, the racks **464** are supported on the bag support plate **334**.

Mounted on the back or downstream side of the pusher plate **448** at horizontally spaced positions are two vertically aligned pairs of bearing blocks **468**. Each vertically aligned pair of bearing blocks **468** journals a pivot pin **470** which is secured at its opposite ends to elongated bag guide arms **472**. The bag guide arms **472** on each pivot pin **470** are free to pivot on the pivot pin about a vertical axis coincident with the longitudinal axis of the pivot pin. Each of the two lower bag guide arms **472** carries a roller bracket **472** which carries a roller **476**. The roller **476** mounted in this way at the outer end of each of the lower bag guide arms **472** bears against the inwardly facing surface of the adjacent cam plate **436**. This surface has the configuration best illustrated in FIG. **14**.

It will be perceived that as the pusher plate **448** is reciprocated across the bag support **334** by the air cylinders **438** and **440**, the bag guide arms **472** will, under the resilient bias of suitable springs associated with these arms and their respective pivot pins **470**, swing outwardly at their outer ends as the rollers **476** follow the cam surfaces of the cam plates **436**. In other words, the bag guide arms **472** will undergo a divergent motion at their outer ends during the pushing motion of the pusher plate **448** as hereinafter described.

Connected between the inner sides of the upper and lower bag guide arms **472** in each vertically aligned pair of these guide arms is a bag guide plate **478**. Each of the bag guide plates **478** has an inwardly angled bag retaining flange **480** which projects normal to the edge of the respective bag guide plate which is nearest the outer end of the bag guide arms to which the guide plate is secured. There are also provided additional vertically extending bag guide plates **482** which are horizontally spaced from each other, and which are secured between the inner surfaces of the vertically aligned pairs of bearing blocks **468** which support each of the pivot pins **470**. It will be noted that the bag guide plate **482** extended between each vertically aligned pair of bearing blocks **468** is in coplanar alignment with the corresponding bag guide plate **478** secured between the vertically aligned bar guide arms **472** which are mounted on the respective pivot pin **470** at the time when these bag guide arms are in the positions illustrated in FIG. **14**.

Mounted on the bag-supporting plate **334** at a position immediately below the bag guide plate **482** secured to one pair of the vertically aligned bag guide arms **472** is an air cylinder bracket **484** which supports an air cylinder **486**. The air cylinder bracket **484** is also apertured to accommodate a pair of slide rods **488** which extend through the air cylinder bracket **484** and are secured to one side of a guide plate base **490**. The guide plate base **490** has secured to the opposite side thereof from that secured to the slide rods **48**, a vertically extending guide plate **492**. The vertically extending guide plate **492**, under actuation by the air cylinder **486** functions to periodically tap the sides of the vertically stacked hands of bags to maintain the vertical alignment of the stack.

There is further provided for use in association with the press loader assembly **30**, a guide flap subassembly designated generally by reference numeral **494**. The guide flap subassembly includes a pair of horizontally spaced bearing boxes **498** adapted for mounting on opposite sides of a banding press, or other machine into which it may be desired to discharge the stack of bags which has been built up within the press loader assembly of the bag-collating and -stacking apparatus of the invention. Journaled in bearing boxes **498** are the ends of an elongated, transversely extending, horizontal shaft **500** which, it will be noticed in referring to FIG. **15**, extends transversely across the upper, downstream portion of the press loader assembly **30**. Keyed to the central portion of the shaft **500** are a pair of brackets **502** which are secured to a guide plate **504**.

For the purpose of rotating the shaft **500** about its horizontal axis so as to swing the guide plate **504** through an arc about this axis for a purpose hereinafter described, an air cylinder **506** is mounted by means of a suitable bracket **508** on the press or other structure which supports the bearing boxes **498**.

The air cylinder **506** extends upwardly and contains a piston secured to one end of a piston rod **510** which is pivotally connected at its other end to a lever arm **512**. The lever arm is in turn secured to the horizontal shaft **500** so that, as the piston rod **510** is extended, the shaft will be rotated about its longitudinal axis to bring the guide plate **504** to a horizontally extending position above the stack of bags within the press loader assembly **30**.

FIG. **16** is a wiring circuit diagram illustrating the electrical circuitry used in the operation of the counter **394** and the several switches and solenoid valves used in the bag-collating and -stacking apparatus. As will be subsequently explained, valves **516**, **518** and **520** are mechanically actuated valves which are contained in the valve housing **227** and which are actuated by the cam wheels **225***a*, **225***b*, and **225***c* and are therefore not illustrated in the circuit diagram.

The switch **182** is actuated by pusher plate **180** to close a solenoid valve **522** as hereinbefore described. The switch **390** is a normally open switch which is closed each time a hand of bags is pushed into the bag lifter assembly **26**. Each closure of the switch **390** sends an electrical signal to the counter **394**, which may suitably be a Veeder-Root Digi-Flex predetermining counter upon which a predetermined hand count may be set to govern the number of hands of bags to be placed in each stack. When a predetermined number of signals is transmitted to the counter **394** by the switch **390**, the counter generates an output signal which operates relay **R-1** to make a circuit through normally closed switch **530**. The switch **530** acts as an interlock to hold the relay in until this switch is opened. When the relay **R-1** is thus energized a circuit is made to a solenoid valve **532** to operate this valve to permit air to extend the piston rod **456** of the air cylinder **454**. This lowers the slide plate **458**.

Lowering of the slide plate **458** closes the switches **461** and **463**. Switch **461** is in series with the switch **383** which is periodically closed by contact of the protuberance **382** therewith (once during each revolution of the gear **381**). Closure of switch **383** while switch **461** is closed (while the slide plate **458** is down) energizes relay **R-2**. Switch **463** then acts as an interlock to hold this relay in even after switch **383** opens following its momentary closure. The circuit is made through relay **R-2** to the solenoid valve **536** which causes air to be introduced to air cylinders **438** and **440** to extend the piston rods **442** which project therefrom.

Normally closed switch **530** is momentarily opened at the end of the extension stroke of the air cylinders **438** and **440** to release relay **R-1**. This breaks the circuit to valve **532**, causing this valve to shift and thereby effecting the retraction of the piston rod **456** into the air cylinder **454**. This movement lifts the slide plate **458** which opens the switches **461** and **463**. This releases relay **R-2**, interrupting the circuit to valve **536** and causing the piston rods **422** of air cylinders **438** and **440** to be retracted.

OPERATION

Large paper bags are formed on the bag-forming machine **12** and are discharged therefrom in a direction which is substantially tangential with respect to the large drum forming a portion of the bag-forming machine, and appearing at the right-hand edge of FIG. **4**. The bags leaving the bag-forming machine **12** come to rest upon the conveyor means **16** of the bag-collating and -stacking apparatus **10** with the creased bottom edges of the flattened bags disposed between adjacent convolutions of the helical fin **34**. As the conveyor means **16** rotates, the threading or screwing action of the helical fin **34** moves the bags outwardly along the helical fin and away from the bag-forming machine **12**. As each successive newly formed bag is discharged from the bag-forming machine **12**, it enters one of the spaces between two adjacent convolutions of the helical fin **34**. Thus, a plurality of bags are caused to move downstream on the conveyor means **16** at all times during operation of the bag-collating and -stacking apparatus **10** of the invention. The bags are retained on the upper side of the helical fin **34** by means of the vibrator assembly **40** as the vibrator bar **41** periodically taps the side edges of the bags to keep them from being frictionally moved toward that side of the machine as a result of the screw action of the conveyor means **16**. The top edges of the bags are maintained in alignment during their movement by the horizontally extending run **36***a* of the belt **36**.

When the bags move downstream on the conveyor means **16** to the end thereof at which the convolutions of the helical fin **34** become widely spaced, the horizontally spaced, helically turned blades **62** of the two spiral auger subassemblies **60** segregate a predetermined number of bags, and move them off of the conveyor means **16** and onto the support table **65**. This is accomplished by the relatively thin points **63** of the helically turned blades **62** passing simultaneously between the widely spaced convolutions of the helical fin **34** and thus between adjacent bags carried by the helical fin at this point.

As has been pointed out, the speeds of rotation of the spiral auger subassemblies **60** are controlled so that the blades **62** will rotate relatively slowly in comparison to the rate of rotation of the helical fin **34** carried on the shaft **32** of the conveyor means **16**. Thus, for example, in a typical embodiment of the invention, the drive connections between the drive shaft **14** and the shaft **32** of the conveyor means **16**, on the one hand, and the drive connections between the drive shaft **14** and the hollow shafts **66** of the auger subassemblies **60**, on the other hand, are such that the helically turned blades **62** of the auger subassemblies will make only one revolution for each 25 revolutions of the shaft **32** and the helical fin **34** carried thereon in the conveyor means **16**. Therefore, 25 bags will have passed beyond the end of the conveyor means **16** and onto the support table **65** each time that the thin points **63** of the helically turned blades **62** pass between the widely spaced convolutions of the helical fin **34**. In this manner, the auger subassemblies **60** function to periodically separate or isolate one hand of bags (containing 25 bags) from the following or succeeding bags moving on the conveyor means **16**.

After being picked off or removed from the conveyor means **16** by the spiral auger assembly **18**, the hands of bags containing the preselected number of bags arranged with their bottom edges, side edges and top edges aligned, are moved into the turntable assembly **20**. Movement of each hand of aligned bags into the turntable assembly **20** is accomplished by the screwing action of the helically turned blades **62**. When the hand of bags is moved to the rear of these blades, the bags are forced by the heel plate portions **83** of the blades **62** into the rectangular shaped, vertically extending portion of the cross shaped opening **107** in the rotating turntable **102** mounted between the front and rear support plates, **94** and **96**, respectively. The bags are, of course, at this time, positioned with their folded bottom edges downwardly and their tops facing upwardly. The opening **107** in the turntable **102** is dimensioned in correspondence to the size of the bags to be received therein so that a hand of aligned bags will fit fairly snugly in the vertically extending, rectangularly shaped portion of the opening **107** without excessive clearance. Stated differently, the opening **107** has been previously described as resembling in configuration a pair of crossed rectangles of substantially equal size. Moreover, it may now be noted conveniently that these crossed rectangles, in the operative positions of the turntable **102**, extend horizontally and vertically, respectively. Thus, as the hand of bags initially enters the opening **107** in the turntable **102**, the hand always enters the rectangular portion of the opening **107** which extends vertically with the opposite ends of the horizontally extending rectangular portion left open. The hands of bags are prevented from passing through the opening **107** in the turntable **102** by the bag stop plate **112** which is secured across the front support plate **94**, and by the pusher plate **180** which is extended at this time in a manner hereinafter described.

The turntable **102** remains in the described position in which the vertically aligned bags pass into the vertically ex-

tending rectangular portion of the opening **107** until the preselected number of bags collated in each hand has been positioned in the opening. When this has been accomplished, the turntable **102** is caused to rotate on the bearings **104** carried by the spacer sleeves **106** due to actuation originating with the Geneva drive assembly **114**. The actuation of the Geneva drive assembly **114** is synchronized with the rotational speeds of the conveyor means **16** and the spiral auger assembly **18** by the chain drive which connects the output shaft **54** with the drive sprocket **124** of the Geneva drive assembly. It is through this drive that the periodic actuations of the turntable **102** by the Geneva drive assembly **114** are caused to occur in synchronism with the removal of the predetermined number of bags from the conveyor means **16** by the spiral auger assembly **60**, and with the movement of the bags by the latter, assembly into the turntable assembly **20**.

When the predetermined number of bags to constitute a hand has been positioned within the vertically extending rectangular portion of the cross-shaped opening **107** in the turntable **102**, the Geneva drive assembly **114** is actuated so that the output shaft **115** therefrom is rotated through an angle of 180°. Through the intervening linkage of the crank arm **116**, bracket **118**, pushrod **120** and bracket **122**, the turntable **102** is caused to rotate through an angle of 90°. This will be in a counterclockwise direction as the turntable **102** is viewed in FIG. **6**. The rotation of the turntable **102** reorients the cross-shaped opening **107** so that the rectangular portion of this opening which carries the hand of bags is moved from a vertically extending position to a horizontally extending position and the bottom edges of the bags extend toward the right as they would appear in FIG. **6**. Simultaneously, that portion of the cross-shaped opening **107** which had previously been in the form of a horizontally extending rectangle is moved into a vertically extending position preparatory to receiving the next hand of bags to be formed by the spiral auger assembly **60**.

During the time that the foregoing movements of the described machinery are occurring, driving power is being delivered from the output shaft **54** through the chain **234** and the speed reducer **238** to the chain **244**. The chain **244** drives the shaft **248** which extends across the apparatus and carries at one of its ends, the sprocket **249**. This sprocket in turn drives the input shaft **203** to the Geneva drive subassembly **202** which has keyed thereto the cam plates **225***a*, **225***b*, and **225***c*. As the cam plate **225***a* is rotated with the shaft **203**, it will actuate valve **516** to permit air to be transmitted to the air cylinders **84** forming a portion of each of the spiral auger subassemblies **60**. This occurs at a point in time which is immediately after the turntable **102** has been turned through an angle of 90° to orient the hand of bags in a horizontally extending position. Upon the delivery of air to the air cylinders **84** by the throwing of the valve **516**, the piston rods **86** associated with the air cylinders **84** are extended so that the pusher plates **88** carried at the outer end of these rods are extended from their respective drums **64** and pass through the reliefs **107***a* in the turntable **102**. The pusher plates **88** are dimensioned so that a portion of each one of these extends into the main portion of the opening **107** in which the hand of bags is located. The pusher plates **88** will therefore effectively force the hand of bags out of the horizontally extending rectangular portion of the slot **107**. The hand of bags is thus pushed out of the turntable **102** and through the front support plate **94**.

Prior to the time that the ejection of the hand of bags from the turntable **102** by means of the pusher plates **88** commences, the pusher plate **180** forming a portion of the tilting box assembly **22** is extended from its position illustrated in FIG. **4** of the drawings to a position in juxtaposition to the hand of bags in the turntable assembly. The pusher plate **180** thus provides lateral support for the hand of bags at this time. As the pusher plates **88** are extended to force the bags out of the turntable **102**, the pusher plate **180** is retracted by the withdrawal of the piston rod **179** into the air cylinder **178**. This is accomplished by the throwing of a valve **518** in the air system by contact with the cam plate **225***b* carried on the shaft **203**. Stated differently, valves **516** and **518** in the air system are concurrently thrown to effect the extension of the piston rods **86** which carry the pusher plates **88** and the simultaneous retraction of the piston rod **179** which carries the pusher plate **180**.

It will be perceived that the simultaneous actions of pusher plates **88** and **180** result in the hand of bags being moved out of the turntable assembly **20** onto the bag support plate **140** at a location immediately above the legs **164***b* of the L-shaped brackets **164** forming a portion of the tilting table subassembly **160**. In this position of the tilting table subassembly **160**, of course, the legs **164***a* are extending vertically as depicted in FIG. **4**. It should be further pointed out that in this status of the apparatus, the piston rod **144** is extended from the air cylinder **142** so that the bag flap plate **148** is in its elevated, substantially horizontally extending position in which it extends toward the turntable assembly **20**.

When the pusher plate **180** is fully retracted to a position within the circular opening **163** in the plate **162**, it strikes the microswitch **182** which throws a solenoid valve **522** in the air system. The actuation of the valve **522** introduces air to the air cylinders **184** and **142** in a manner such that the piston rod **188** is retracted into the cylinder **184** and the piston rod **144** is retracted into the cylinder **142**. These concurrent actions result in the tilting table subassembly **160** being pivoted about the shaft **192**, and the bag flap plate **148** being pivoted downwardly about the shaft **151**.

As the tilting table subassembly **160** is pivoted (in a counterclockwise direction as viewed in FIG. **4**), the plate **162** and pusher plate **180** are brought to a horizontally extending position in alignment with the longest edges of an aligned pair of the rectangular slots **210** formed in the parallel sideplates **208** of the index wheel subassembly **206**. At the same time that the tilting table subassembly **160** is undergoing this tilting movement through an angle of about 90°, the bag flap plate **178** sweeps downwardly, and in a downstream direction, to move the side edges of the bags (which have now been laid on their sides by reason of the 90° rotation of the turntable assembly **20** hereinbefore described) downwardly, and to cause the hand to lie flat upon the plate **162** and pusher plate **180**.

With the hand of bags lying flat on the pusher plate **180** and the plate **162** with which it is in coplanar alignment, the bags may be pushed from these plates into the aligned pair of rectangular slots **210** in the parallel sideplates **208** of the index wheel subassembly **206** by extension of the piston rod **173** from the air cylinder **172**. The extension of the piston rod **173** is effected by cam wheel **225***c* contacting and throwing, a switch **524** in the air system which permits air to be delivered to the cylinder **172**. As the piston rod **173** is extended, the pusher plate **174** sweeps across the horizontally aligned, horizontally extending pusher plates **180** and plate **162** to move the bags off of these plates into the rectangular slots **210** carried in the parallel sideplates **208** of the index wheel subassembly **206**. When the bags are in the rectangular slots **210**, they are supported on the H-shaped bag support plate **212** which is secured to the longest sides of the slots **210** and extends between the side plates **208**. Support for the bags is also afforded by the angle plate **214** extending along the bottom edges of the rectangular slots **210**.

After the cam wheel **225***a* is rotated through a particular increment of rotation, the valve **516** is released so that air may be exhausted from the air cylinders **84** of the spiral auger subassemblies **60**, and the pusher plates **88** may thus be retracted. Also, when the cam wheel **225***b* rotates through a predetermined increment of rotation, the valve **518** is opened, thus causing the piston rod **179** to be extended from the air cylinder **178** so that the pusher plate **180** moves outwardly from the plate **162**. With this movement of the pusher plate **180**, the microswitch **182** is released to reverse the valve **522** and introduce air to the air cylinder **184** in a manner to extend the piston rod **188**. This will cause the tilting table subassembly **160** to tilt back to the receiving position shown in FIG.

4, in which position it is ready to receive another hand of bags from the turntable assembly 20.

It should here be pointed out that the mechanical interconnection between the turntable 102 and the Geneva drive assembly 114 is such that alternate incremental rotations through 90° of the turntable occur in opposite directions. Thus, after one hand of bags has entered one vertically extending portion of the opening 107 in the turntable, and has then been rotated from an upstanding to a lying-on-its-side position with the bottom edges extending in one direction (toward one side of the machine), this hand of bags will be ejected into the tilting box assembly 22 in this orientation, and another hand will commence moving into the new vertically extending portion of the opening 107. When this second hand is in position in this portion of the opening 107, the turntable 102 is then turned through 90° in the opposite direction from that in which it was initially turned. This results in the next hand of bags being laid sideways in the opposite direction from the first hand of bags, that is, with the bottom edges of the bags facing toward the opposite side of the machine from the side toward which the bottom edges of the bags in the first hand faced.

In properly timed sequence with the movements of the tilting box assembly 22, the index wheel subassembly 206 of the rotating unit assembly 24 undergoes a 90° increment of rotation. This 90° rotational movement of the index wheel subassembly 206 is caused to occur by the Geneva drive subassembly 202. Thus, as the input shaft 203 of the Geneva drive subassembly 202 is driven in rotation by the chain 218 passed around the sprocket 220 keyed thereto, the output shaft 200 from the Geneva drive subassembly 202 upon which the index wheel subassembly 206 is mounted is caused by the Geneva works within the Geneva drive subassembly to periodically undergo the 90° increment of rotation. The driving connections between the shaft 248 and the other moving parts of the apparatus assure that the indexing of the index wheel subassembly 206 through 90° will occur at the proper time; that is, after a hand of bags has been delivered to an aligned pair of the rectangular slots from the tilting box assembly 22, and the tilting table subassembly 160 has been rotated back to its hand-receiving position illustrated in FIG. 4. It will be seen in referring to FIG. 4 that each time the index wheel subassembly 206 is rotated through 90°, followed by tilting of the tilting table subassembly 160 through 90° from the position shown in FIG. 4, a new aligned pair of the rectangular slots 210 is ready to receive a hand of bags, and the rectangular slots which were previously aligned with the tilting table subassembly 160 has been moved 90° in a counterclockwise direction (as the tilting table subassembly 160 is viewed in FIG. 4). After two incremental rotations of 90° following the reception of a hand of bags in one pair of the slots 210, this hand of bags is brought to a horizontally extending, relatively lower position in which the hand is positioned over the transfer unit assembly 28 upon the bag-supporting plate 387. During the time that the index wheel subassembly 206 is undergoing rotation, the bags are retained in their respective rectangular slots 210 and against the H-shaped bag support plate 212 by the horizontally spaced guide rods 230 which bear against the hand of bags and force them back against the bag support plates as the index wheel subassembly moves.

With the bags having been moved to a position in which they rest flatly upon the bag support plate 387 and are still within one of the aligned pairs of slots 210 of the index wheel subassembly 206, each hand of bags is engaged by the trailing transfer hooks 296 and 302 of the transfer unit assembly. The upwardly projecting toes 296*a* and 302*a* of the transfer hooks 296 and 302, respectively, are swung upwardly behind, or upstream from, each hand of bags located in the lowermost pair of slots 210 of the index wheel subassembly 206, and are then moved horizontally toward the mouth of these slots to carry the hand of bags out of the rectangular slots while it is supported on the supporting plate 387. The ejection of the hand of bags from the slots 210 by the trailing transfer hooks 296 and 302 occurs, of course, at a time when the index wheel subassembly 206 is not undergoing rotation, but during one of its periods of arrest. This timing is effected by the positive interconnection of the drive portion of the transfer unit assembly 28 with the drive shaft 14 from which the other moving components of the apparatus are driven. Thus, the transfer hooks 296 and 302 are driven in an oscillating movement by means of the connecting rod 270 and the connecting rod 314 through which both of the hooks are effectively connected to the drive chain 262. The drive chain 262 is passed over the sprockets 260 and 264, and the sprocket 260 rotates with the stub shaft 254 which is in turn driven in rotation by the gear 252 which is keyed thereto and meshes with the gear 250. The gear 250 is keyed to the shaft 248 which carries the sprocket 246 driven by the chain 244 as hereinbefore described.

During the operation of the transfer unit assembly 28, the connecting rod 270 remains at approximately the same angular position as that shown in FIG. 4 until the location at which the chain 262 passes around the sprocket 260 is reached. At this location, the connecting rod 270 will undergo a change in its angulation by having its end connected to the chain 262 dip downwardly sharply. The transfer hook 296 will then also pivot so that its upwardly projecting toe 296*a* falls downwardly as a result of the cam roll bearing 300 carried by this transfer hook following the upper surface of the connecting rod 270. As the transfer hook 296 pivots to move the projecting toe 296*a* downwardly, the downwardly projecting lug 296*b* pivots in a direction to move the connecting rod 314 toward the bag lifter assembly 26. This motion of the connecting rod 314, which is connected through the crossbar spacer 306 to the downwardly projecting lugs 302*b* and 310*b* of the transfer hooks 302 and 310, causes the pivotation of the latter transfer hooks so as to retract the upwardly projecting toes 302*a* and 310*a* downwardly below the horizontal level of the bag support plate 387. With the upwardly projecting toes 296*a* through 310*a* of the transfer hooks 296 through 310, respectively, retracted below the bag-supporting plate 387, all the transfer hooks remain in substantially the same lowered position while the point of connection of the connecting rod 270 to the chain 262 traverses the lower run of the chain as it passes from the sprocket 260 to the sprocket 264. Thus, during this interval, the upwardly projecting toes 296*a* through 310*a* of the transfer hooks 296 through 310 are retracted, and the transfer hooks are reciprocated in an upstream direction. The transfer hooks 296, 302, 308 and 310 finally return to a position such that the upwardly projecting toes 296*a* and 302*a* of the trailing transfer hooks 296 and 302 are raised upwardly to stand behind the hand of bags contained within one of the aligned pairs of slots 210 in the index wheel subassembly 206 preparatory to moving the hand downstream toward the bag lifter assembly 26.

It should be pointed out that after the hand of bags has been moved out of one of the aligned pairs of slots 210 in the index wheel subassembly 206, the second increment of downstream movement of this hand of bags toward the bag lifter assembly 26 is effected by the set of leading transfer hooks 308 and 310. Thus, as both sets of transfer hooks (leading and trailing) are lifted to an operative position in which their upwardly projecting toes extend above the level of the bag support plate 387, the trailing transfer hooks 296 and 302 function to engage the trailing hand of bags located in the slots 210, while the leading transfer hooks 308 and 310 function to engage the leading hand of bags which has previously been moved out of the slots 210 by the trailing transfer hooks 296 and 302.

The hands of bags are passed in consecutive sequence by the transfer unit assembly 28 into the bag lifter assembly 26. As the hands of bags are moved by the transfer hooks 296, 302, 308 and 310 toward the bag lifter assembly 26, the hands pass under the overhead skids 386 which function to keep the bags in vertically superimposed alignment, and also to slightly compress the bags to remove excessive air therefrom. As each hand of bags moves under the overhead skids 386 and into the bag lifter assembly 26, the switch 390 is closed as the bags

strike the elongated switch finger 392. In this manner, an electrical signal is transmitted to the counter 394 to register the number of hands of bags passing into the bag lifter assembly. In moving into the bag lifter assembly 26, the hands of bags move from the bag supporting plate 387 onto the bag-supporting plate 334. It should be pointed out that at the time the hands of bags move onto the bag-supporting plate 334, slide plate 458, which is slidably mounted on the pusher plate 448 and actuated by the air cylinder 454, is elevated by the cylinder so that the hands of bags are free to pass under the slide plate and into the bag lifter assembly 26.

With the bags at rest on the bag-supporting plate 334, they are then subjected to the periodic lifting action of the bag lifter assembly 26. It will be noted in referring to FIG. 13 that the bag-supporting plate 334 is cut away at certain locations around its edges to permit the lifter arms 342, 330 and 350 to be extended vertically through the slots in the bag-supporting plate, and also that the slots are sufficiently large to allow the bag lifter flaps 338, 346, and 352 to pass through the slots in the supporting plate. The edges of the lowermost bag in the hand of bags resting upon the supporting plate 334, however, extend over the edges of slots so that contact will occur between the lowermost bag in the hand resting on the supporting plate and the several bag lifter flaps 338, 346 and 352 as the bag lifter carriage subassembly 322 moves upward.

The stub shafts 316 which carry the circular crank discs 318 are driven in rotation in synchronism with the other moving elements of the bag-collating and -stacking apparatus so that after each hand of bags has been moved onto the bag-supporting plate 334, and before another hand has moved into the bag lifter assembly 26, the cam roller bearings 320 carried by the circular crank discs 318 have moved to a relatively high position with respect to the aligned axes of the stub shafts 316, thus causing the bag lifter carriage subassembly 322 to be reciprocated upwardly by engagement of these cam roller bearings with the oval cam members 326 carried on the slide carrier plates 324. As the bag lifter carriage subassembly 322 is moved upwardly, its four bearing blocks 360 slide on the vertically extending shafts 364.

As the several vertically extending lifter arms 330, 342 and 350 move upwardly through the slots in the bag-supporting plate 334, the bag lifter flaps 338, 346 and 352 which are carried thereby are also moved upwardly. As the lifting flaps 338, 346 and 352 engage the lower side of the hand of bags resting on the bag-supporting plate 334, the lifting flaps are forced downwardly against the spring bias previously described until they reach the horizontal status in which positive stops prevent further downward movement of these flaps. In this position, the flaps then lift the hand of bags upwardly from the bag-supporting plate 334, and the hand of bags continues to move upwardly with the bag lifter carriage subassembly 322 during the remaining portion of its upward travel. This movement of the hand of bags upwardly clears the bag-supporting plate 334 so that another hand of bags can be moved onto this plate by the transfer unit assembly 28.

After a new hand of bags has been positioned on the bag-supporting plate 334, the continuing rotational movement of the circular crank discs 318 (in synchronism with the linear transfer speed of the transfer unit assembly 28) causes the bag lifter carriage subassembly 322 to commence its downward movement. As the several bag lifter flaps 338, 346 and 352 are moved downwardly with the bag lifter carriage subassembly of which they form a part, they come in contact with the upper side of the new hand of bags which is now resting upon the bag-supporting plate 334. This contact biases the bag lifting flaps 338, 346 and 352 upwardly so that they can pass by the hand of bags resting on the bag supporting plate. Continued downward movement of the vertically extending lifter arms 330, 342 and 350 carries the lifting flaps 338, 346 and 352 past the lowermost hand of bags to the original position in which the lifting flaps are located below this hand of bags. The lifting cycle is then ready for repetition.

It will be noted that the one or more hands of bags which have been initially moved upwardly by the vertically reciprocating bag-lifting carriage subassembly 322 have been, at this stage of the cycle, lowered until they rest upon the bottom hand of bags which has been most recently moved onto, and is supported at this time by, the bag-supporting plate 334. Thus, it is to be noted that the bag lifter assembly 26 included in the apparatus of the invention functions by adding each successive hand of bags which is transferred into the assembly by the transfer unit assembly 28 to the lower side of the stack of hands of bags, rather than adding the incoming hands to the upper side of the stack of hands of bags.

As has been previously pointed out, as each hand of bags passes under the overhead skids 386, the microswitch 390 is tripped to send a signal to the electrical counter 394 so that a count is subtracted from that which has been set on the counter. During this time, the vertically extending air cylinder 454 is in a status in which its piston rod 456 is retracted so that the slide plate 458 is raised to permit the passage of hands of bags into the bag lifter assembly 26. This status of the air cylinder 454 and its piston rod 456 continues until the counter 394 has counted out due to a predetermined number of hands of bags having been moved into the bag lifter assembly 26, and stacked in a vertically superimposed position by the alternating lifting and lowering actions hereinbefore described. When the counter 394 has registered the predetermined number of hands of bags which it is desired to stack in vertical superimposition, the counter transmits a signal functioning to energize the relay R-1 and thereby making a circuit through the relay and the switch 530 which is a holding or interlock switch, mounted on the vertically extending bracket 414. With the relay R-1 energized, an electrical signal is passed to the solenoid valve 532 located in the air line to the air cylinder 454 so that the piston rod 456 is extended, thus moving the slide plate 458 downwardly until the lower edge of the slide plate is adjacent the upper surface of the bag-supporting plate 334. Described in another way, the slide plate 458 is, at this time, lowered to a position where it can contact the side edges of the bags in the lowermost hand of bags in the stack within the bag lifter assembly 26, which lowermost hand rests upon the bag-supporting plate 334. The band press loader assembly 30 is now positioned to move the stack of superimposed hands of bags out of the bag-collating and -stacking apparatus 10 into a bag press which may be suitably located immediately adjacent the bag press loader assembly.

As has previously been mentioned in referring to the circuit diagram illustrated in FIG. 16, lowering of the slide plate 458 closes the switches 461 and 463. The switch 461 is in series with the switch 383 which is a normally open switch that is periodically closed by contact therewith of the protuberance 382 carried on the gear 381. The protuberance 382 is disposed in relation to the cam roller bearing 320 carried on the adjacent circular crank disc 318 so that the protuberance will strike and close the switch 383 at a time when the bag lifter carriage subassembly 322 is being driven downwardly below the bag supporting plate 334 in the lower portion of its travel.

With the closure of the switch 383 while the switch 461 is closed by extension of the slide plate 458, relay R-2 is energized. The relay R-2 is then held in by a circuit which is at this time made through the switch 463 which has been closed by the downward movement of the slide plate 458 as hereinbefore described. The described energization of relay R-2 makes a circuit to the solenoid valve 536. As valve 536 is operated, air cylinders 438 and 440 are actuated so that the piston rods 442 are extended therefrom.

As the piston rods 442 are extended from their respected air cylinders 438 and 440, the vertically extending brackets 444 to which the outer ends of the rods are secured are driven in a sliding movement along the slide rods 418, 420, 422 and 424. Since the vertically extending brackets 444 are secured to the pusher plate 448, their movement along the slide rods 418—422 produces a concurrent translational movement of the

pusher plate 448. It will also be recalled that at this time the slide plate 458 is in its downwardly extending position and, in effect, constitutes a downward extension of the pusher plate 448. Thus, as the pusher plate 448 and slide plate 458 move across the bag-supporting plate 334, they push ahead of them the stack of vertically superimposed hands of bags which has been built up by the bag lifter assembly 26. The stack of bags is retained in the desired stacked formation during this movement by the bag guide plates 478 and 482 which, with the bag retaining flanges 480 carried at the downstream vertical edges of the bag guide plates 478, serve to retain the hands of bags in vertical alignment. Also, the guide plate 504 forming a part of the guide flap subassembly 494 is at this time extended horizontally above the uppermost bag in the stack. Any suitable timing mechanism to effect this positioning of the guide plate 504 at this time can be employed.

At the piston rods 442 are further extended from the air cylinders 438 and 440, the bag guide arms 472 carried on the pivot pins 470 are biased by suitable springs (not shown) in an outwardly or diverging pivoting movement as the rollers 476 carried on the lower of the bag guide arms follow the inside surface of the horizontally spaced cam plates 436 which are mounted on the bag-supporting plate 334. Thus, the bag guide plates 478 and their associated bag-retaining flanges 480 can diverge outwardly from each other to a position in which they do not frictionally contact or retain the stack of bags. This motion occurs as the stack of bags commences to move out of the bag-collating and -stacking apparatus onto a platen or other suitable supporting element of the bag press into which the stack is to be transferred. Movement of the stack of bags onto this platen or other element is completed at the end of the full extension of the piston rods 442 from the air cylinders 438 and 440. It should also be mentioned that in the course of the transfer of the bags out of the bag-collating and -stacking apparatus during the extension of the piston rods 442, the vertically extending guide plate 492 has been pressed against the vertically aligned edges of the bags by the extension of the piston rods from the air cylinder 486.

When the piston rods 442 reach the end of their outward stroke, a suitable mechanical projection carried on the vertically extending bracket 444 aligned with the switch 530 strikes the normally closed switch 530 to momentarily open this switch and thus release the relay R-1. Release of the relay R-1 opens the circuit to the solenoid valve 532 so that this valve is now operated to retract the piston rod 456 of the air cylinder 454. This raises the slide plate 458 preparatory to the retraction portion of the stroke of the piston rods 442. The stack of bags has, of course, by this time been transferred out of the bag-collating and -stacking apparatus 10 to an adjacent location, such as the lower platen of a bag press forming no portion of the present invention. Thus, the stack of bags does not, of course, follow the retracting movement of the bag press loader assembly 30.

When the slide plate 458 is retracted upwardly, it contacts and opens the switches 461 and 463. Opening of these switches deenergizes the relay R-2. The electrical signal to the solenoid valve 536 is thus interrupted so that this valve is operated in the air system so as to effect the retraction of the piston rods 442 within the air cylinders 438 and 440. As the piston rods 442 are retracted, the vertically extending brackets 444 are also retracted, carrying with them the pusher plate 448 and its associated slide plate 458. In this manner, the press loader assembly 30 is returned to its initial status in which it is oriented to permit a new stack of superimposed hands of bags to be built up therein by the bag lifter assembly 26.

From the foregoing description of the invention, it will be appreciated that many structural modifications and changes can be effected at various locations and in various forms within the described apparatus, since the apparatus which has been referred to in the foregoing description and depicted in the drawings represents only a typical, presently preferred embodiment of the invention. Various structural changes and alterations can be effected in the bag-collating and -stacking apparatus of the invention without departure from the basic principles which underlie the invention and which are believed to impart patentability thereto. Changes and innovations of this type are therefore deemed to be circumscribed by the spirit and scope of the invention.

What I claim is:

1. A bag-collating and -stacking machine comprising:
- conveyor means for receiving bags in sequence from another machine and moving said bags;
- a spiral auger assembly including a pair of spiral auger blades cooperating with said conveyor means to pick off a predetermined number of bags from said conveyor means and move them as a hand away from said conveyor means;
- means for orienting said hands of bags in a horizontal, flat position in which the bags in each hand are vertically superimposed, and in which said hands are horizontally spaced from each other;
- a transfer unit assembly for consecutively moving said hands of bags from said orienting means to a location spaced therefrom;
- a bag lifter assembly positioned for consecutively receiving said hands of bags from said transfer unit assembly, and stacking said hands in a stack;
- means for periodically horizontally displacing said stack of hands of bags; and
- means for driving said spiral auger assembly, conveyor means, orienting means, transfer unit, and bag lifter assembly in synchronism.

2. A bag-collating and -stacking machine as defined claim 1 wherein said means for orienting said hands of bags comprises:
- a turntable for receiving from said auger assembly an aligned hand of vertically extending bags in which the bottom edges of the bags face downwardly;
- means for alternately rotating the turntable in one direction through 90° of rotation, then, after a period of dwell, rotating the turntable in an opposite direction through 90° of rotation whereby hands of bags in said turntable are turned to face the side edges of the vertically extending bags downwardly, and to alternately face the bottom edges of the bags in consecutive hands in opposite directions;
- means for ejecting the hands of bags from the turntable while the side edges of the bags are faced downwardly;
- tilting table means for receiving hands of bags ejected from said turntable; and
- means for pivoting said table means to a position in which the bags in said hands extend horizontally.

3. A bag-collating and -stacking machine as defined in claim 1 wherein said conveyor means includes
- a shaft;
- a helical fin around said shaft having its convolutions spaced to receive bags between said convolutions; and
- means for driving said shaft in rotation.

4. A bag-collating and -stacking apparatus as defined in claim 1 wherein said bag lifter assembly comprises:
- a bag lifter carriage subassembly including bag lifter flap means for lifting bag hands from beneath after sliding downwardly past the sides of said bag hands;
- means for vertically reciprocating said bag lifter assembly; and
- means for supporting a hand of bags in the path of the vertically reciprocating movement of said bag lifter assembly.

5. A bag-collating and -stacking machine as defined in claim 1 wherein said transfer unit assembly comprises:
- a set of leading transfer hooks;
- a set of trailing transfer hooks drivingly connected to said leading transfer hooks;
- a continuous driven chain of oval configuration in a substantially vertical plane;
- means driving said chain;

a connecting rod connected between a point on said chain and said transfer hooks for driving said transfer hooks in translational and pivotal movement.

6. A bag-collating and -stacking apparatus as defined in claim 1 wherein said spiral auger assembly includes

a pair of horizontally spaced, helically turned blades, said blades each terminating in a point at one end and in a flat, vertically extending heel plate at the opposite end;

means for turning the helically turned blades in opposite directions of rotation;

a cylinder extending along the axis of rotation of each of said blades;

a piston rod reciprocably mounted in each of said cylinders and extending therefrom toward the respective heel plate of the adjacent blade; and

pusher plates secured to the ends of said piston rods outside said cylinders.

7. A bag-collating and -stacking apparatus as defined in claim 1 wherein said means for displacing said stack of hands comprises:

a vertically extending pusher plate;

means supporting said pusher plate for horizontal reciprocating movement;

cylinder and piston means for horizontally reciprocating said pusher plate;

a slide plate slidably mounted on said pusher plate for vertical reciprocation; and

piston and cylinder means mounted on said pusher plate and connected to said slide plate for periodically vertically reciprocating said slide plate into the path of bags moving from said transfer unit assembly into said bag lifter assembly.

8. A bag-collating and -stacking machine as defined in claim 1 and further characterized to include means for automatically actuating said means for periodically displacing said stack after a predetermined number of hands of bags have been stacked in said stack by said bag lifter assembly.

9. A bag-collating and -stacking machine as defined in claim 1 wherein said spiral auger assembly includes a pair of aligned, horizontally spaced, helically turned blades;

and wherein said driving means includes means for driving said blades in rotation at a speed which is a preselected exact multiple of the speed at which said conveyor means is driven.

10. A bag-collating and -stacking machine as defined in claim 2 wherein said conveyor means includes

an elongated shaft; and

a helical fin surrounding said shaft over a major portion of its length and having a portion of the convolutions thereof spaced axially along said shaft from each other by a greater distance than the remaining convolutions of said fin are spaced axially from each other.

11. A bag-collating and -stacking machine as defined in claim 2 wherein said bag lifter assembly comprises:

a plurality of bag-lifting flaps;

means pivotally supporting said flaps along the perimeter of a rectangular space for pivotation of said flaps from a horizontally extending position to an upwardly extending position; and

means for moving said supporting means upwardly and downwardly in timed response to the movement of hands of bags by said transfer unit assembly to said location spaced from said orienting means.

12. A bag-collating and -stacking machine as defined in claim 3 wherein said transfer unit assembly comprises a plurality of transfer hooks; and

means for moving said transfer hooks in translational movement.

13. A bag-collating and -stacking machine as defined in claim 4 wherein said spiral auger assembly comprises:

a pair of horizontally spaced, helically turned blades;

means for turning the helically turned blades in opposite directions of rotation; and

reciprocating bag ejection means extending along the axis of rotation of each of said blades.

14. A bag-collating and -stacking apparatus as defined in claim 5 wherein said means for displacing said stack of hands comprises:

a pusher plate positioned for horizontally pushing said stack of hands of bags;

means for pneumatically moving said pusher plate; and

slide plate means reciprocably mounted on said pusher plate for extension from one edge of said pusher plate in a direction substantially normal to the path of movement thereof.

15. A bag-collating and -stacking apparatus as defined in claim 7 and further characterized to include means for automatically actuating said periodic displacing means after a predetermined number of hands of bags has been stacked in said stack by said bag lifter assembly.

16. A bag-collating and -stacking machine as defined in claim 9 wherein said spiral auger assembly further comprises:

a pair of drums having said helically turned blades mounted thereon;

a cylinder extending through the hollow interior of each of said drums;

a piston rod reciprocably mounted in each of said cylinders and extending therefrom toward said means for orienting said hands of bags in a horizontal, flat position; and

pusher plates secured to the ends of said piston rods outside said cylinders.

17. A bag-collating and -stacking machine as defined in claim 16 and further characterized to include means for automatically actuating said periodic displacing means after a predetermined number of hands of bags has been stacked in said stack by said bag lifter assembly.

18. A bag-collating and -stacking machine as defined in claim 15 wherein said means for orienting said hands of bags comprises:

a turntable for receiving from said auger assembly an aligned hand of vertically extending bags in which the bottom edges of the bags extend downwardly;

a Geneva drive assembly connected to said turntable for alternately rotating the turntable through 90° in opposite directions; and

tilting table means for receiving a hand of bags from said turntable following each 90° rotation thereof by the Geneva drive assembly.

19. A bag-collating and -stacking assembly as defined in claim 18 and further characterized to include means for contacting the tops and side edges of bags on said conveyor means for maintaining the alignment of said bags.

20. A bag-collating and -stacking machine comprising:

means for receiving consecutively formed bags from a bag-forming machine and arranging said bags in horizontally spaced hands in which a preselected number of bags are aligned alike in vertical piles in each hand, said means for receiving consecutively formed bags comprising:

a screw conveyor having a helical fin thereon formed to sandwich single bags between adjacent convolutions of the fin;

means for retaining bags in alignment on the screw conveyor with the bottom edges aligned, the side edges aligned and the tops aligned;

a spiral auger assembly for periodically screwing off predetermined numbers of bags from the screw conveyor;

means for accepting from said auger assembly successive groups of bags each containing a predetermined number of aligned bags and each constituting a hand of bags; and

means for alternately turning said accepting means first in one direction through 90° of rotation, and then in the opposite direction through 90° of rotation in timed sequence with the receipt of consecutive hands of bags therein from said spiral auger assembly to thereby lay alternate hands of bags on their sides with the bottom edges of the bags in said alternate hands facing in opposite directions;

transfer unit means for conveying said horizontally spaced hands to a common point in succession; and

a bag lifter assembly for stacking said hands in a vertical stack on arrival at said common point, said bag lifter assembly including means for placing each hand to arrive at said point below any bags which have preceded it in arriving at said point.

21. A bag-collating and -stacking apparatus as defined in claim **20** wherein said means for alternately turning said accepting means comprises:

a Geneva drive connected to said accepting means; and

chain drive means drivingly interconnecting said Geneva drive with said screw conveyor and spiral auger assembly.

22. A bag-collating and -stacking machine comprising:

means for receiving consecutively formed bags from a bag-forming machine and arranging said bags in horizontally spaced hands in which a preselected number of bags are aligned alike in vertical piles in each hand, said receiving means comprising:

means for aligning a predetermined number of bags in a hand in which the aligned bottom edges of the bag face downwardly;

means for taking the aligned bags from said aligning means and turning them sideways with the bottom edges of the bags extending vertically; and

means for laying sideways turned bags down flat on their sides with their bottom edges extending horizontally; and

transfer unit means for conveying said horizontally spaced hands to a common point in succession; and

a bag lifter assembly for stacking said hands in a vertical stack upon arrival at said common point, said bag lifter assembly including means for placing each hand to arrive at said point below any bags which have preceded it in arriving at said point.

23. A bag-collating and -stacking machine as defined in claim **22** and further characterized as including a bag indexing assembly for receiving said sideways turned bags laying flat on their sides, and turning them through an angle of 180° to rest on their opposite sides and at a lower level.

24. A bag-collating and -stacking machine comprising:

means for aligning and grouping a predetermined number of bags in hands in which the bags are flat and have their bottom edges, side edges and tops aligned, said aligning means comprising:

a screw conveyor for supporting the bottom edges of bags in horizontal alignment; and

means for maintaining the horizontal alignment of said bottom edges while removing a predetermined number of bags from said screw conveyor;

means for successively receiving said hands and turning them alternately in opposite directions;

means for collecting said oppositely directed hands in a vertical stack with the bags in each stacked hand having their bottom edges aligned with the top edges of the bags in adjacent hands in the stack; and

means for automatically horizontally displacing the vertical stacked hands when the number of hands collected reaches a predetermined number.

25. A bag-collating and -stacking machine comprising:

means for aligning and grouping a predetermined number of bags in hands in which the bags are flat and have their bottom edges, side edges and tops aligned:

means for successively receiving said hands and turning them alternately in opposite directions, said receiving and turning means comprising:

an apertured turntable means having an opening therethrough sized to closely receive a hand of bags in which the bags are aligned; and

means for periodically reorienting said apertured turntable means to turn said opening in the direction it is desired to turn a hand of bags which has been received therein; and

means for collecting said oppositely directed hands in a vertical stack with the bags in each stacked hand having their bottom edges aligned with the top edges of the bags in adjacent hands in the stack; and

means for automatically horizontally displacing the vertically stacked hands when the number of hands collected reaches a predetermined number.

26. A bag-collating and -stacking machine comprising:

means for aligning and grouping a predetermined number of bags in hands in which the bags are flat and have their bottom edges, side edges and tops aligned;

means for successively receiving said hands and turning them alternately in opposite directions;

means for consecutively accepting in a horizontal position from said receiving means, hands of bags which have been turned alternately in opposite directions by receiving means;

means drivingly connected to said hand accepting means to periodically move said hand accepting means to a position in which a hand of bags which has been accepted thereby is turned over through 180°;

means for collecting said oppositely directed hands after the hands have been turned over through 180° and stacking said oppositely directed hands in a vertical stack with the bags in each stacked hand having bottom edges aligned with the top edges of the bags in adjacent hands in the stack; and

means for automatically horizontally displacing the vertically stacked hands when the number of hands collected reaches a predetermined number.

27. A bag-collating and -stacking machine as defined in claim **26** wherein said receiving and turning means comprises:

apertured plate means having an opening therethrough sized to receive a hand of bags in which the bags are aligned; and

means for periodically reorienting said apertured plate means to turn said opening in the direction it is desired to turn a hand of bags which has been received therein.

28. A bag-collating and -stacking machine comprising:

means for aligning and grouping a predetermined number of bags in hands in which the bags are flat and have their bottom edges, side edges and tops aligned;

means for successively receiving said hands and turning them alternately in opposite directions;

means for collecting said oppositely directed hands in a vertical stack with the bags in each stacked hand having their bottom edges aligned with the top edges of the bags in adjacent hands in the stack;

means for automatically horizontally displacing the vertically stacked hands when the number of hands collected reaches a predetermined number, said means for automatically horizontally displacing the vertically stacked hands comprising:

bag guide plate means bearing against the stack of bags on three sides thereof;

a pusher plate bearing against the stack of bags on a fourth side and having said bag guide plate means mounted on one side thereof for concurrent reciprocation therewith

means for pushing the pusher plate and the bag guide plate means mounted thereon toward said stack of bags and in a horizontal direction; and

guide means on a side of said bag guide plate means for guiding said bag guide plate means out of contact with said stacked bags after said pusher plate has commenced to push said stack of bags in a horizontal direction.

29. A bag-collating and -stacking machine as defined in claim **28** wherein said bag guide plate means comprises:

a first pair of vertically aligned bag guide arms on one side of the stack of bags;

a first pivot pin supporting the bag guide arms in said first pair for pivotation about a vertical axis;

a first vertically extending bag guide plate secured between said bag guide arms and adapted to contact the stack of bags on one side thereof;

a flange projecting from said bag guide plate and adapted to contact the stack of bags on a second side thereof;

a second pair of vertically aligned bag guide arms horizontally spaced from said first pair of vertically aligned bag guide arms;

a second pivot pin supporting the bag guide arms in said second pair for pivotation about a vertical axis;

a second vertically extending guide plate secured between the bag guide arms in said second pair and adapted to contact the stack of bags on a third side thereof; and

a flange projecting from said second vertically extending guide plate and adapted to contact the stack of bags on said second side thereof.

30. A bag-collating and -stacking machine comprising:

a screw conveyor including a helical fin thereon having a major portion of its convolutions spaced to receive between each pair of adjacent convolutions, a single bag;

means for retaining bags in alignment on said screw conveyor during movement therealong by the rotation of said helical fin;

a pair of horizontally spaced spiral auger blades on opposite sides of said screw conveyor and each having a larger pitch than said helical fin and oriented to periodically remove a group of bags from said screw conveyor and move them further in the direction of movement imparted thereto by said screw conveyor;

means rotating the spiral auger blades and the screw conveyor in synchronism to achieve the inclusion of a predetermined number of bags in the groups periodically removed from the screw conveyor by said spiral auger blades; and

means for stacking said groups of bags in vertical relation to each other.

31. A bag-collating and -stacking machine as defined in claim **30** and further characterized to include:

a rotatably mounted member having a cross-shaped opening therethrough with said opening configured as a pair of crossed rectangles, each of which is of slightly larger area than a flattened bag, said rotatably mounted member being positioned adjacent said spiral auger blades to receive groups of bags intermittently fed thereto by said spiral auger blades so that each received group is positioned within one of said rectangular portions of said opening;

means for periodically rotating said rotatably mounted member about an axis through the center of said opening, first in one direction of rotation through 90° of arc at a time after a group of bags is received therein, and then in the opposite direction of rotation through 90° of arc at a time after the next succeeding group of bags is received therein; and

means for ejecting each group of bags from said rotatably mounted member after each rotation thereof through 90°.

32. A bag-collating and -stacking apparatus as defined in claim **30** and further characterized to include means for transferring bags in groups from said spiral auger blades to said stacking means, said transferring means including a transfer unit assembly comprising:

a pair of horizontally spaced sprockets;

means for commonly driving at least one of said sprockets and said spiral auger blades in synchronism;

an endless chain extended around said sprockets;

a framework;

carrier means slidably mounted on said frame for reciprocation in a substantially horizontal plane;

a connecting rod drivingly connected between said chain and said carrier means for reciprocating said carrier means as said chain is driven on said sprockets; and

at least one pair of transfer hooks pivotally mounted on said carrier means and engaging said connecting rod for following the movement thereof relative to said carrier means during the movement of said sprockets and chain.

33. A bag-collating and -stacking apparatus as defined in claim **30** wherein said means for stacking said groups of bags in vertical relation to each other comprises:

means continuously undergoing an up and down reciprocating movement; and

flap means pivotally mounted on said up and down reciprocating means for pivoting about a horizontally extending axis from a horizontally extending lifting position to an upwardly folded, bag bypassing down moving position.

34. A bag-collating and -stacking apparatus as defined in claim **31** wherein said means for stacking said groups of bags in vertical relation to each other comprises:

means continuously undergoing an up and down reciprocating movement; and

flap means pivotally mounted on said up and down reciprocating means for pivoting about a horizontally extending axis from a horizontally extending lifting position to an upwardly folded, bag bypassing down moving position.

35. A bag-collating and -stacking apparatus as defined in claim **32** wherein said means for stacking said groups of bags in vertical relation to each other comprises:

means continuously undergoing an up and down reciprocating movement; and

flap means pivotally mounted on said up and down reciprocating means for pivoting about a horizontally extending axis from a horizontally extending lifting position to an upwardly folded, bag bypassing down moving position.

36. A bag-collating and -stacking apparatus as defined in claim **34** and further characterized to include means for transferring bags in groups from said spiral auger blades to said stacking means, said transferring means including a transfer unit assembly comprising:

a pair of horizontally spaced sprockets;

means for commonly driving at least one of said sprockets and said spiral auger blades in synchronism;

an endless chain extended around said sprockets;

a framework;

carrier means slidably mounted on said frame for reciprocation in a substantially horizontal plane;

a connecting rod drivingly connected between said chain and said carrier means for reciprocating said carrier means as said chain is driven on said sprockets; and

at least one pair of transfer hooks pivotally mounted on said carrier means and engaging said connecting rod for following the movement thereof relative to said carrier means during the movement of said sprockets and chain.

37. A bag-collating and -stacking machine comprising:

means for receiving consecutively formed bags from a bag-forming machine and arranging said bags in horizontally spaced hands in which a preselected number of bags are aligned alike in vertical piles in each hand, said receiving means comprising:

means for aligning a predetermined number of bags in a hand in which the aligned bottom edges of the bags face downwardly;

means for taking the aligned bags from said aligning means and turning them sideways with the bottom edges of the bags extending vertically; and

means for laying sideways turned bags down flat on their sides with their bottom edges extending horizontally;

transfer unit means for conveying said horizontally spaced hands to a common point in succession; and

a bag lifter assembly for stacking said hands in a vertical stack upon arrival at said common point.

38. A bag-collating and -stacking machine comprising:

means for aligning and grouping a predetermined number of bags in hands in which the bags are flat and have their bottom edges, side edges and top edges aligned, said aligning and grouping means comprising:

a screw conveyor for supporting bottom edges of the bags in horizontal alignment; and

means for maintaining the horizontal alignment of said bottom edges while removing a predetermined number of bags from the screw conveyor;

means for successively receiving said hands and turning them alternately in opposite direction;

means for collecting said oppositely directed hands in a vertical stack with the bags in each stacked hand having their bottom edges aligned with the top edges of the bags in adjacent hands in the stack, said collecting means comprising:

a hand-supporting plate;

bag lifter flaps for periodically lifting all hands on said hand-supporting plate in a vertical direction by movement of the bag lifter flaps through the horizontal plane of said hand-supporting plate; and

means for automatically moving a hand of bags onto said hand-supporting plate when said lifting means is engaged in its lifting motion;

means for automatically horizontally displacing the vertically stacked hands when the number of hands collected reaches a predetermined number.