United States Patent

Daily et al.

[15] **3,641,735**

[45] **Feb. 15, 1972**

[54] BAG PACKER WITH HORIZONTAL TRANSFER

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[73] Assignee: **R. A. Jones & Company, Inc.,** Covington, Ky.

[22] Filed: **Jan. 20, 1970**

[21] Appl. No.: **4,378**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 808,831, Mar. 20, 1969, abandoned.

[52] **U.S. Cl.** ..... **53/159,** 53/164, 214/6 DK

[51] **Int. Cl.** **B65b 35/50,** B65b 5/06

[58] **Field of Search** ..... 53/159, 164, 244, 247; 214/6 D, 6 DK, 6 M; 198/25, 34, 35, 69, 76, 103

[56] **References Cited**

UNITED STATES PATENTS

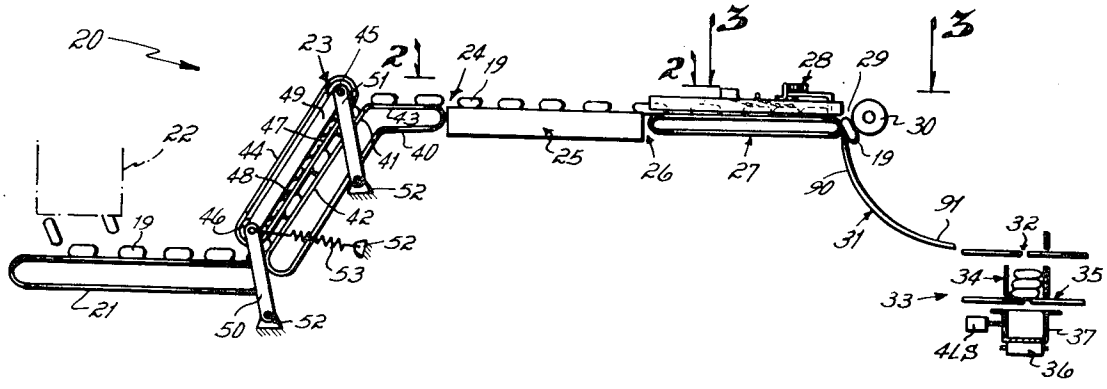
3,205,794	9/1965	Califano et al.	214/6 K
3,512,336	5/1970	Rosecrans	53/164
2,404,882	7/1946	Monaco	198/34
1,299,198	4/1919	Low et al.	198/103 X
2,961,086	11/1960	Edis	214/6 D X
3,126,105	3/1964	Marguet	214/6 K

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Attorney—Wood, Herron & Evans

[57] **ABSTRACT**

Apparatus for packing flexible bags into cases, the apparatus elevating the bags, dividing them into a plurality of channels, delivering them to a hopper having an accumulator chamber, the bags being dropped into the accumulator chamber one layer at a time, and when a case load is accumulated all bags being transferred into the case.

13 Claims, 17 Drawing Figures



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SHEET 1 OF 7

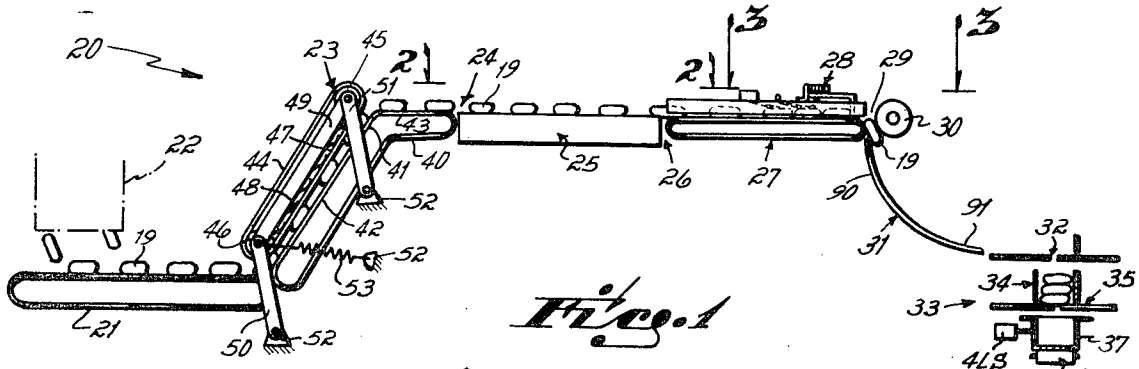


Fig. 1

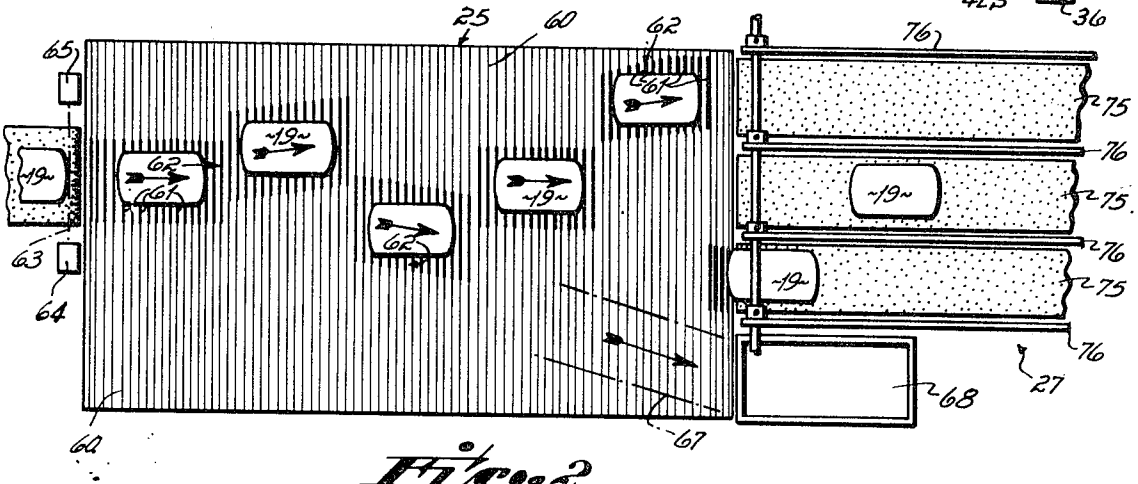


Fig. 2

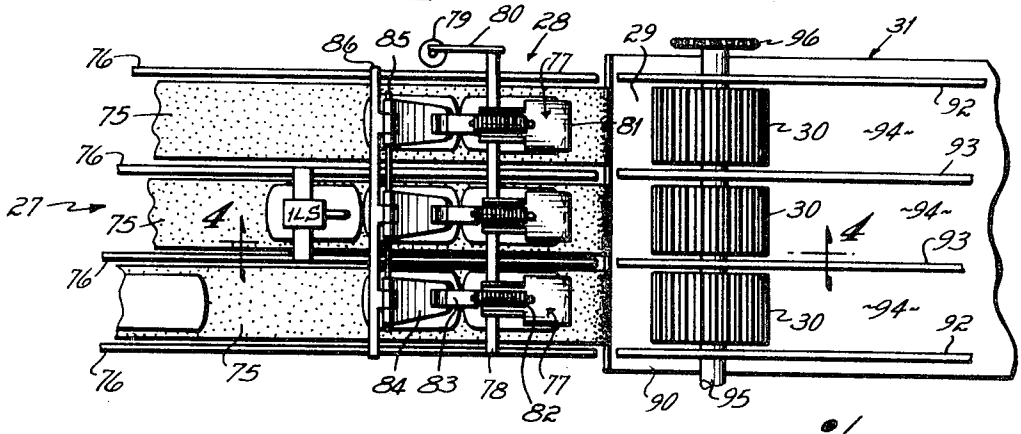


Fig. 3

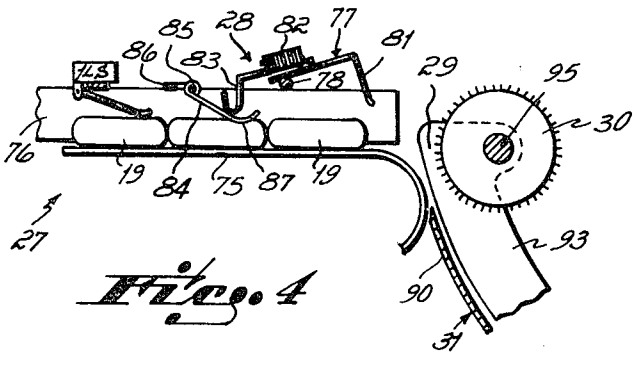


Fig. 4

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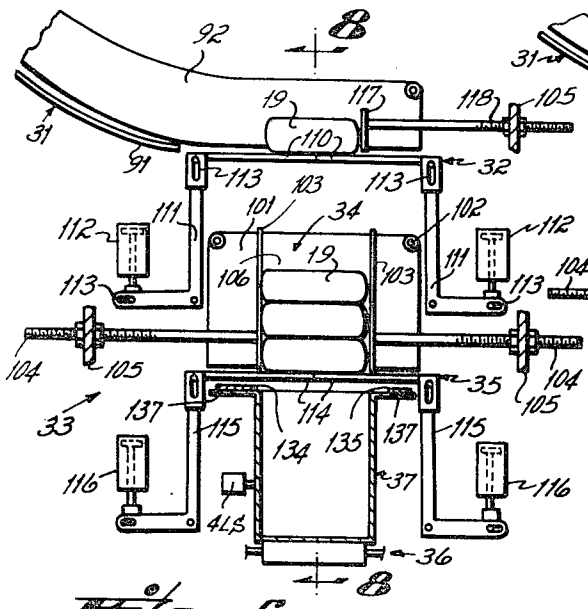


Fig. 5

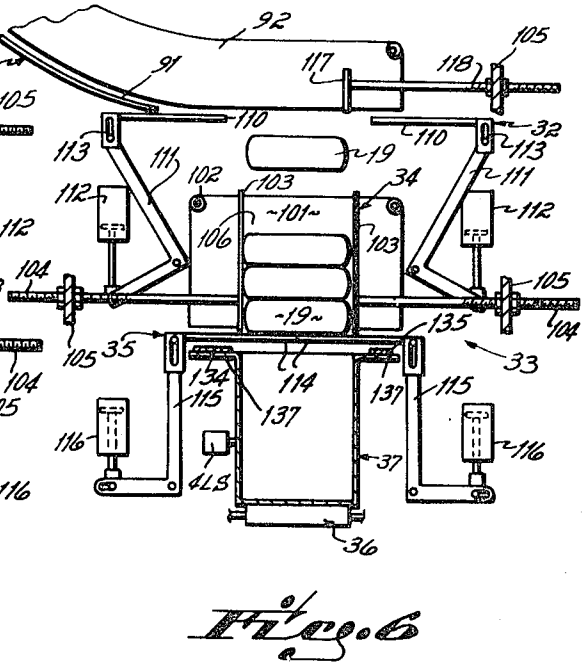


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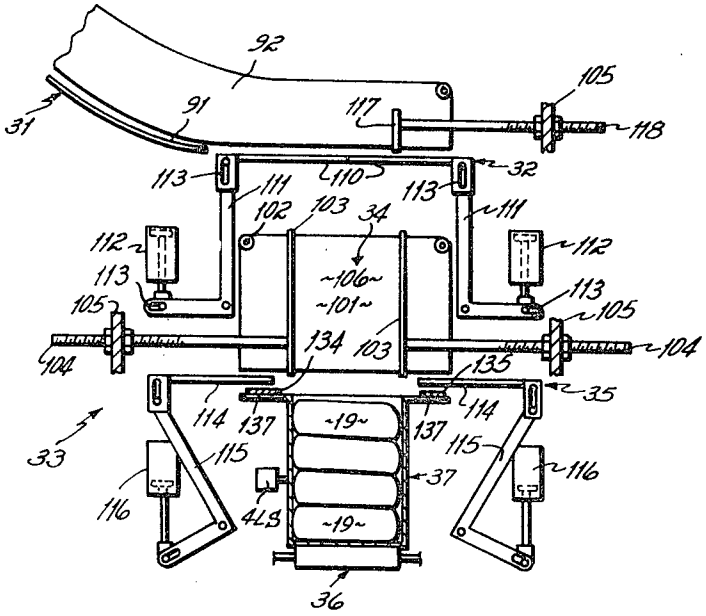


Fig. 7

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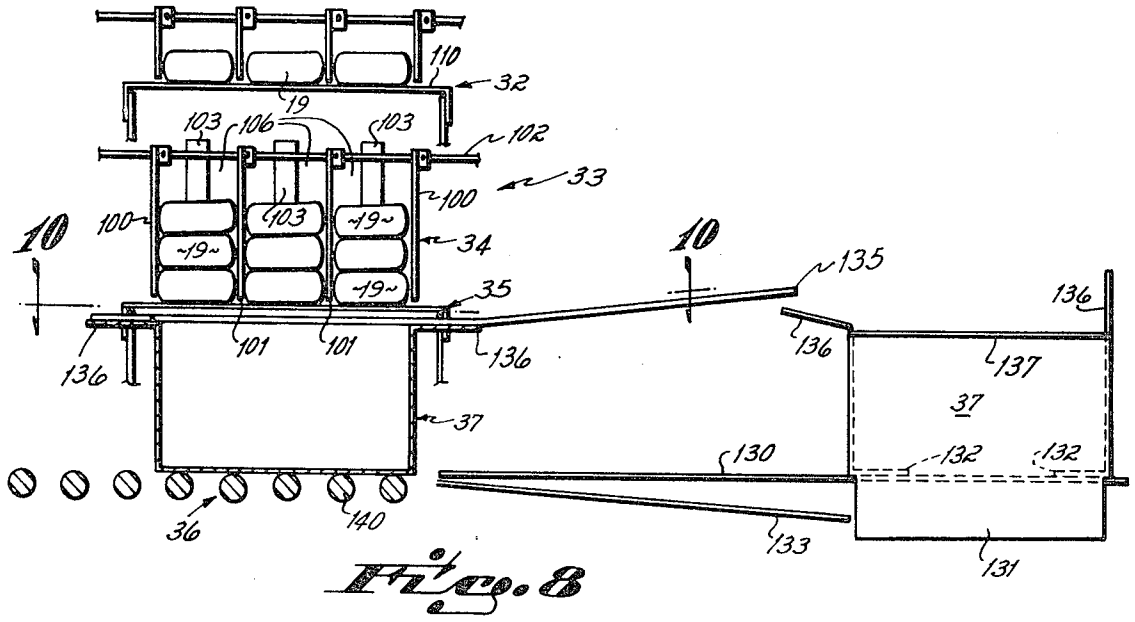


Fig. 8

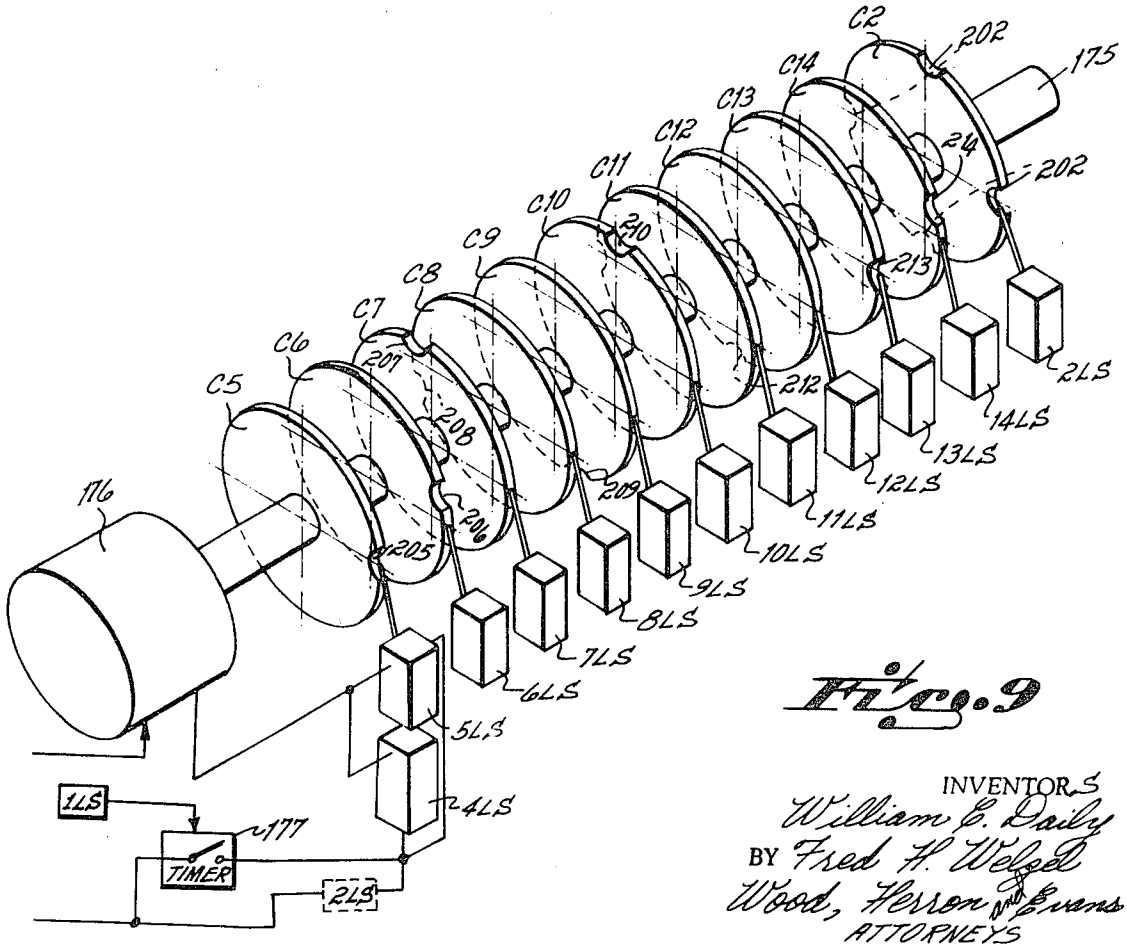


Fig. 9

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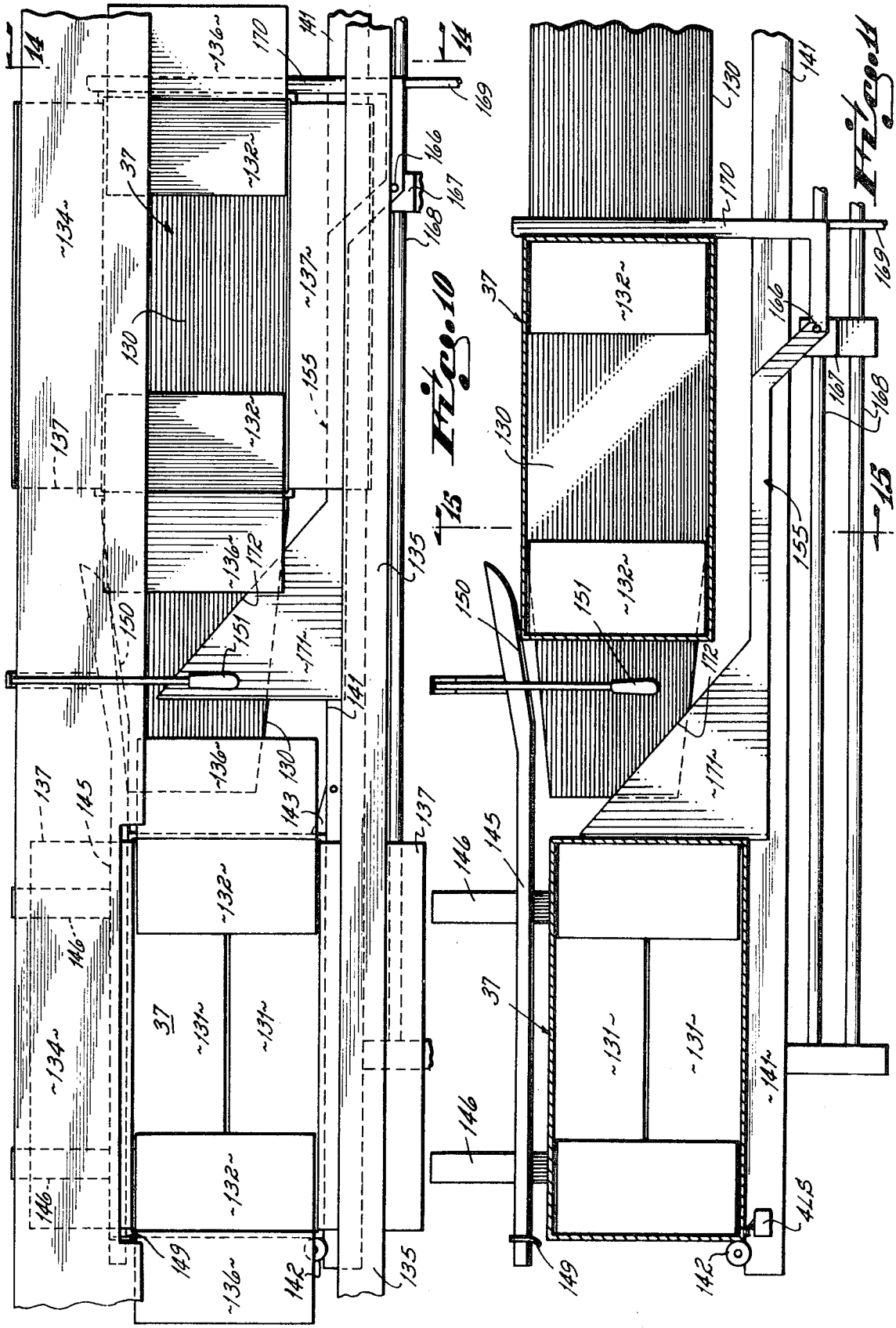

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Fig. 10

Fig. 11

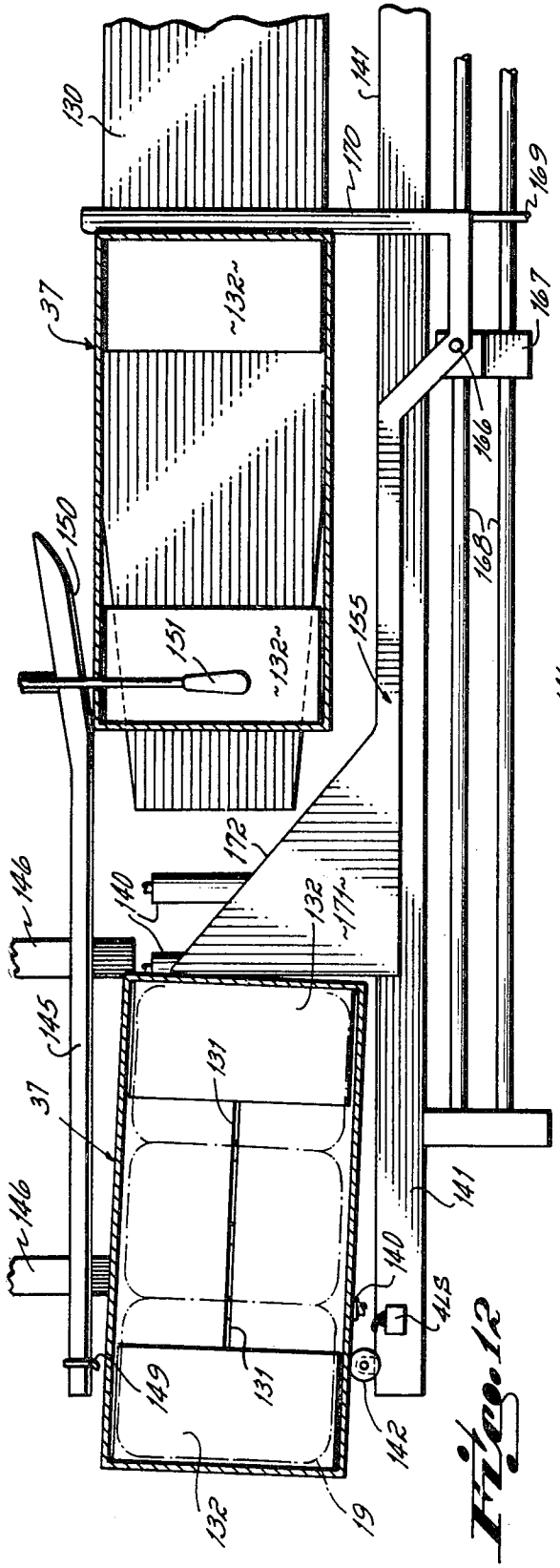


Fig. 12

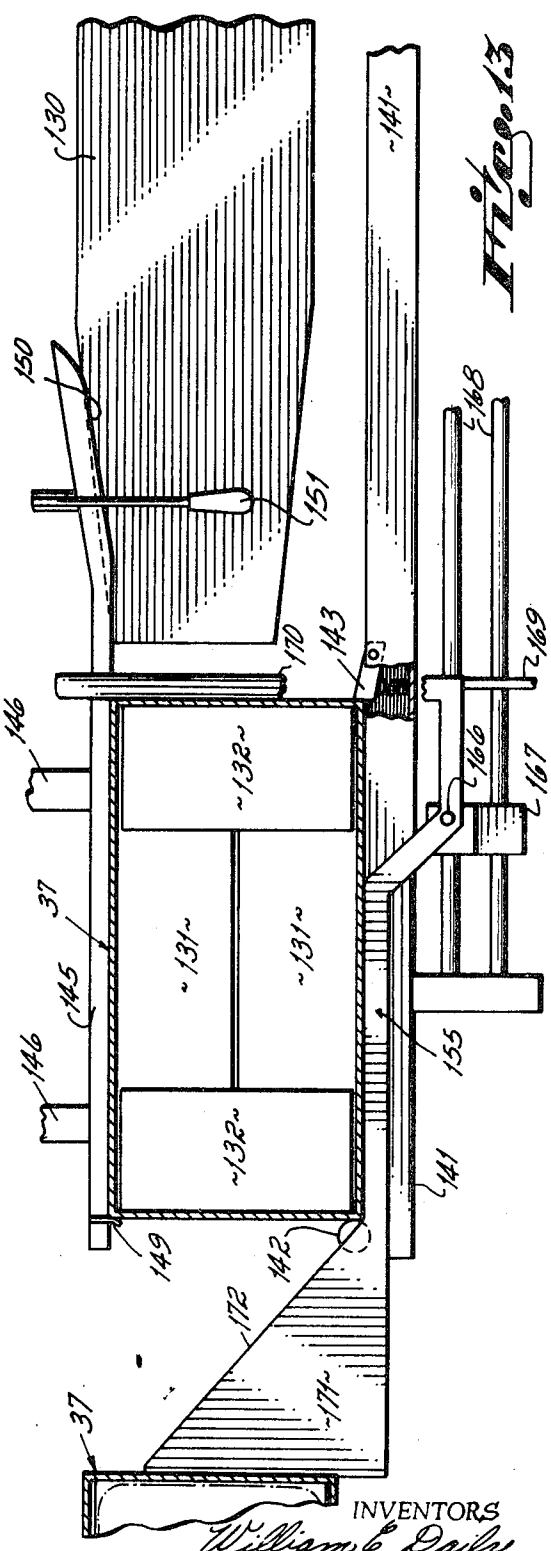


Fig. 13

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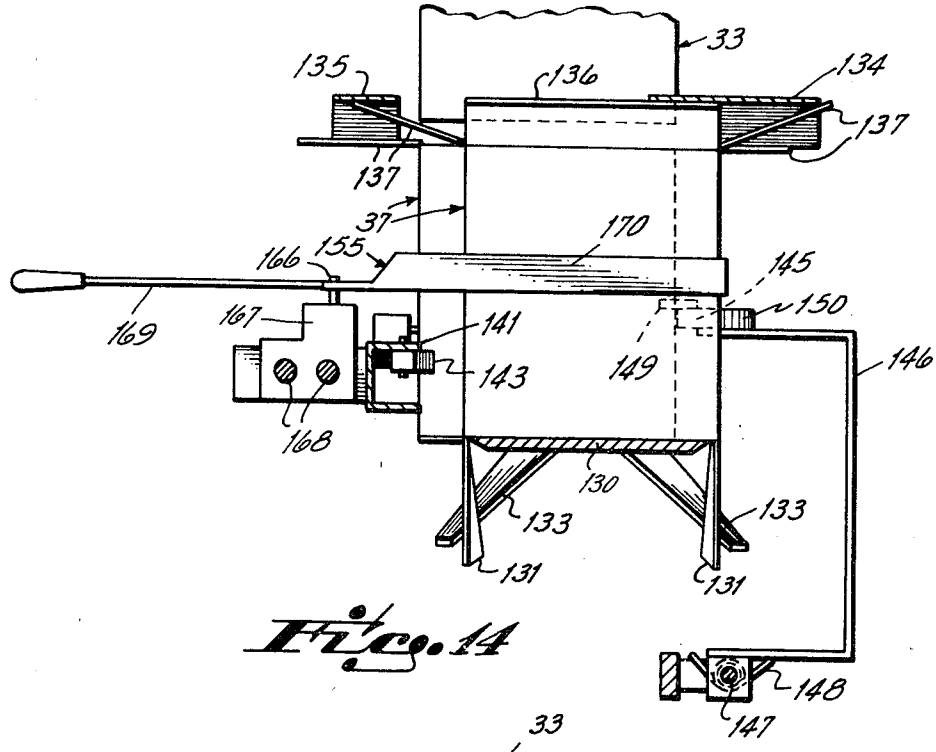


Fig. 14

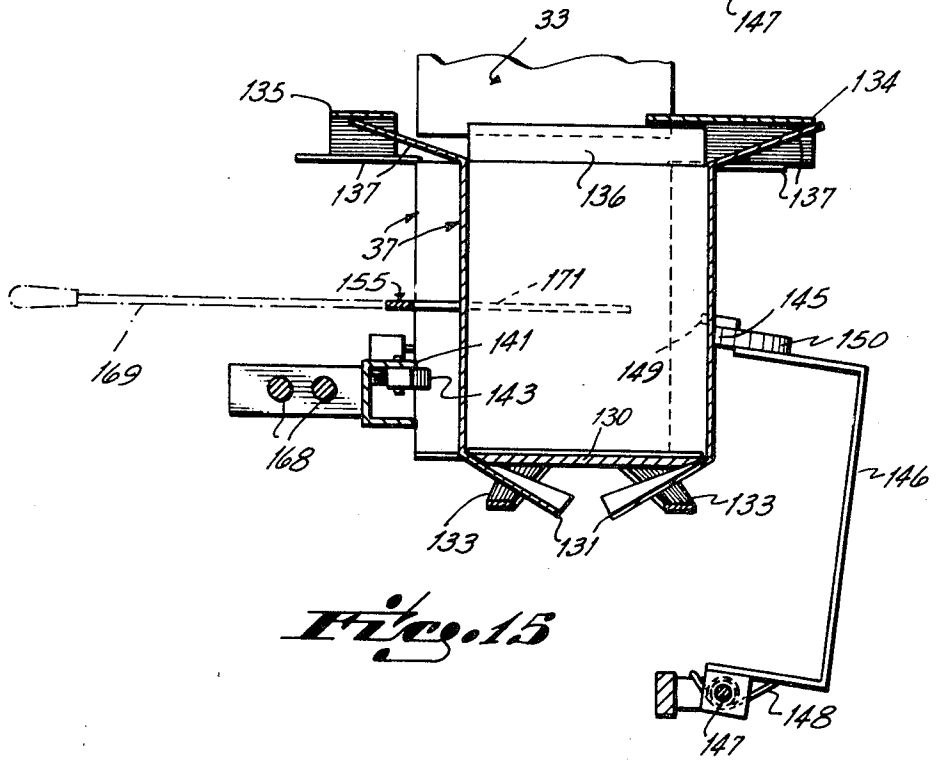


Fig. 15

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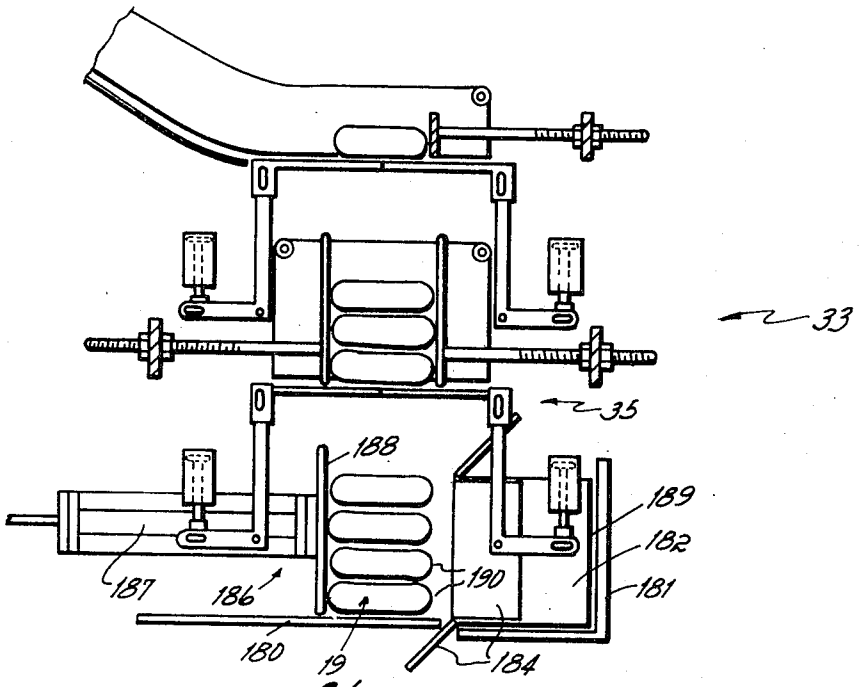


Fig. 16

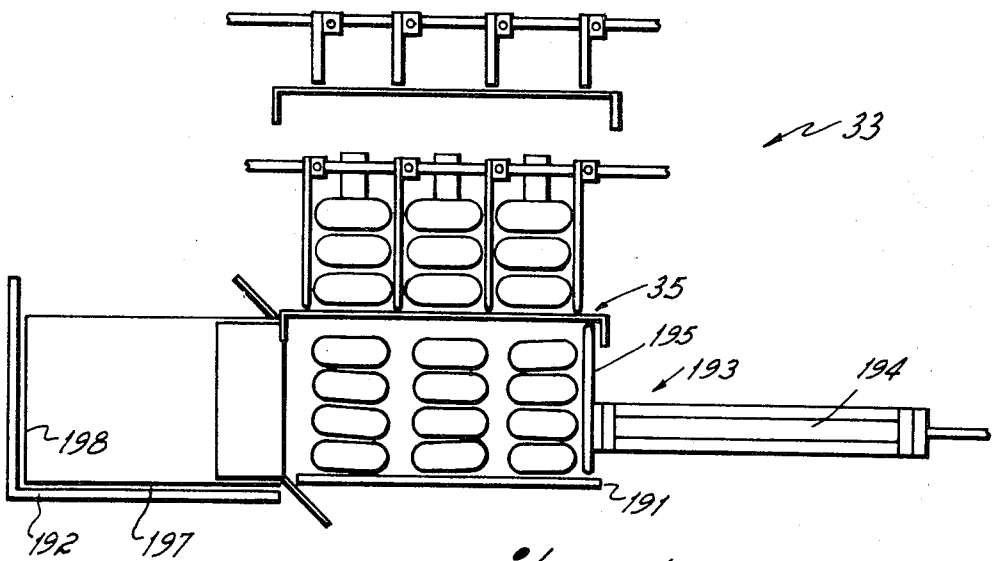


Fig. 17

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BAG PACKER WITH HORIZONTAL TRANSFER

This is a continuation-in-part of our copending application Ser. No. 808,831, filed Mar. 20, 1969, now abandoned.

This invention relates to a bag-casing machine, and more particularly the invention is directed to a machine for automatically packing small flexible bags which are filled with particulate goods or goods of irregular shapes.

In the past, filled flexible bags have been packed into cases by hand. The flexible nature of the bags as contrasted to cartons, cans and the like has prevented the bags from being susceptible to handling by apparatus which is in common use for packing more rigid articles. Specifically, the problem has been one of maintaining control over the flexible bag as it is conveyed from the filling station to the casing station and continuing the control over the bag as it is deposited into a case so as to assure its assuming the desired orientation.

Rosecrans in U.S. Pat. application Ser. No. 663,573 filed Aug. 28, 1967 has described a bag packer which is addressed to the same problem of controlling a flexible bag from filling to casing as is the present invention. The Rosecrans apparatus includes, serially, a conveyor for the filled bags, an elevator, a channelizer for diverting a single file of bags into two or more files of bags, a conveyor for removing the bags from the channelizer, a gravity chute for conveying the bags from the conveyor to loading pockets, the bags being discharged from the loading pockets into a case.

The objective of the present invention is to improve upon the Rosecrans structure in several areas, thereby providing a greater control over the bags, particularly including the control of the bags as they are deposited into a case.

A particularly important area of control involves a hopper mechanism from which bags are deposited into cases for it is in the deposit of the bags into cases that the greatest problems arise. Assume, for example, that a case requires four layers of bags. The lowermost bag must be dropped a distance greater than the combined thickness of the four layers of bags. In dropping this distance, it has been found that the most difficult-to-handle bags will not drop completely flat, but will first hit the bottom of the case and thereafter crumple. The difficult-to-handle bags are those which are filled with particulate material, such as peanuts and frozen peas, and handle like a bean bag.

Further, if the bags are dropped one layer at a time into a case, after a case has been filled, the flow of bags must be stopped until the filled case is removed and an empty case brought into place.

The control of the deposit of the bags into the case is attained in the present invention by providing a hopper having an upper set of trap doors for receiving a single layer of bags and a lower set of trap doors upon which a full case load of bags can be accumulated. It has been found that whereas a single bag dropping the depth of a case may become disoriented, the cooperating action of a stack of bags dropping the depth of a case will maintain all bags of the stack in a flat orientation. Further, the time interval during which bags are accumulated in the hopper permits an operator to remove a filled case and bring an empty case into position below the hopper.

When the bags are dropped directly into a case from the lower set of trap doors, the bags will lie flat in the case. Some products, however, are most efficiently or effectively packed by placing the bags in the case on their side edges or on their ends. It is an objective of the present invention to accommodate this type of packing by providing apparatus below the lower set of trap doors for receiving an accumulated case load of bags in flat condition and thrusting that case load of bags transversely into a case which is supported on its side. When the case is turned so as to rest on its bottom wall, the bags will be supported in the case on their edges. If the apparatus is oriented to move the bags laterally with respect to their long dimension, then the bags when packed, will rest upon their side edges. On the other hand, if the bags are thrust into the case in a longitudinal direction, the bags will rest upon their end edges when the case is turned with its open side facing upwardly.

Another objective of the invention has been to provide means for delivering bags in a flat orientation to the upper trap doors of the hopper. The means include an arcuate chute having a vertical portion which receives the bags and a horizontal portion which discharges the bags onto the upper trap, and a friction wheel which engages the bags and drives them at an appropriate speed down the chute. The positive driving action of the friction wheel provides assurance that the bags will develop the speed required to slide to a proper position on the trap regardless of variations in the frictional characteristics of the bag surface as might be created by varying bag materials, printing inks, temperature conditions and the like.

Another objective of the invention has been to provide a check and release mechanism by which a row of two or more bags is captured above the chute. The mechanism provides for the release of the bags at a preselected time while checking the next adjacent row of incoming bags so that only one row of bags is released at a time. Associated with the check and release mechanism is a low friction conveyor belt which runs continuously to urge the bags toward the chute. In the preferred form of the invention, the belt has been impregnated with a low friction material, such as Teflon, and is particularly useful in the handling of especially floppy bags to avoid their bunching up in the check and release mechanism.

A further objective of the invention has been to provide, as an elevator, a double belt endless conveyor wherein the pulleys for one of the belts are mounted on a parallelogram linkage which can be pivoted with respect to the other belt to vary the spacing between the belts. Preferably, the parallelogram linkage is spring urged to close the spacing so that automatic compensation for bags of varying sizes is achieved.

Still another objective of the invention has been to provide case shifting mechanism associated with the hopper. The case-shifting mechanism is particularly adapted for use with cases which have been shipped flat from a converter. When opened and placed on the mechanism, the cases can be thrust under the hopper where they are releasably locked in alignment with the hopper while driving a filled case out from under the hopper. During this movement, the case bottom flaps are plowed to a closed condition and the case top flaps are held by guides in an open position as required for depositing the bags into the case.

These and other objectives of the invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagrammatic side elevational view of the bag packing apparatus of the invention;

FIG. 2 is a top plan view taken in the direction of lines 2—2 of FIG. 1 and showing the channelizer mechanism;

FIG. 3 is a top plan view taken along lines 3—3 of FIG. 1 and showing the check release mechanism;

FIG. 4 is a cross-sectional view taken along lines 4—4 of FIG. 3;

FIG. 5 is a diagrammatic side elevational view, partly in section, of the hopper mechanism;

FIGS. 6 and 7 are views similar to FIG. 5 illustrating succeeding stages of operation;

FIG. 8 is a diagrammatic front elevational view of the hopper and case-loading mechanism, taken along lines 8—8 of FIG. 5;

FIG. 9 is a perspective view of the cam timer which programs the sequence of bag-loading operations;

FIG. 10 is a top plan view of the case-loading apparatus, taken along lines 10—10 of FIG. 8;

FIG. 11 is a top plan view, partly in section, of the case-loading mechanism illustrating an early stage of the loading operation;

FIGS. 12 and 13 are views similar to that of FIG. 11 illustrating succeeding stages in the case-loading operation;

FIG. 14 is a cross-sectional view taken along lines 14—14 of FIG. 10;

FIG. 15 is a cross-sectional view taken along lines 15—15 of FIG. 11;

FIG. 16 is a diagrammatic side elevational view illustrating the transverse packing of bags in a longitudinal direction; and

FIG. 17 is a diagrammatic front elevational view illustrating the transverse packing of bags in a lateral direction.

GENERAL ORGANIZATION AND OPERATION

Referring to FIG. 1 of the drawings, the bag-packing apparatus indicated at **20** includes a horizontal endless conveyor **21** which receives bags **19** from a bag filler indicated generally at **22**. The bags **19** are conveyed by the belt **21**, single file, to an elevator **23**. The bags are discharged at **24** from the elevator to a channelizer **25** wherein the bags are diverted, single file, to two or more files. In the illustrated embodiment of the invention, three files are shown.

The bags are delivered at **26** from the channelizer to a three-belt conveyor **27**. Overlying the three-belt conveyor **27** is a check and release mechanism **28** which receives and holds two aligned rows of incoming bags as shown in FIG. **3**. At a preselected time, the check and release mechanism releases the leading row of bags while holding the next adjacent row of bags momentarily. The conveyor **27** conveys the row of three bags to a nip **29** formed between a friction wheel **30** associated with each belt **27**, the nip **29** and wheel **30** overlying an arcuate chute **31**. The bags are driven by the friction wheel downwardly onto the chute **31** from which they slide freely to an upper trap **32** associated with a hopper **33**. Immediately below the upper trap **32** is an accumulator chamber **34** having a bottom wall formed by a lower trap **35**. A horizontal support **36** for a case **37** is located immediately below the hopper **33**.

The single layer of bags delivered to the upper trap **32** is released to fall into the accumulator chamber **34**. When the desired number of layers (for example four) is reached, the lower trap **35** is opened to release all of the bags into the case **37**. Thereafter the filled case is removed and an empty case brought into its place.

Elevator Mechanism

The elevating mechanism includes a lower endless belt **40** having an upper reach **41**, one portion **42** of which extends in an upper direction and another portion **43** of which extends horizontally. A second belt **44** passes about upper and lower pulleys **45** and **46** respectively. The belt has a lower reach **47** which lies parallel to and spaced from the portion **42** of the upper reach of belt **40**. An elevator is provided between the upper reach of the lower belt and the lower reach of the upper belt between which bags **19** pass. Preferably, longitudinally spaced leaf springs **48** are associated with one or both of the belts to urge the belts toward each other. The leaf springs **48** are particularly useful where bags of indeterminate sizes are conveyed up the elevator in that they prevent the possibility of a large bag separating the two opposed reaches to such an extent that succeeding bags cannot be frictionally engaged between the reaches and carried up the elevator.

The pulleys **45** are rotatably mounted on a bar **49** which is supported on links **50** and **51**. The links are pivotally mounted at their upper ends to the bar **49**, and their lower ends are pivotally mounted to the frame of the machine indicated diagrammatically at **52**. A spring **53**, connected at one end to the frame **52** and at the other end to link **50**, is under tension and urges the upper belt toward the lower belt. Through the parallelogram linkage and the spring **53**, space between the two belts is automatically variable to accommodate bags of varying sizes.

The Channelizer

The horizontal portion **43** of the lower elevator belt **40** discharges bags in single file onto the channelizer **25**. The channelizer is a known device for diverting articles from a single file to plural files. A channelizer useful with the present invention is manufactured by Illumitronic Engineering, Sunnyvale, California, Model No. CH4. It includes an endless conveyor of transverse rods **60** which carry elongated block **61** slidable on the rods. A diverting mechanism located underneath the upper flight of the conveyor formed by the rods guides a preselected group of blocks **61** in a predetermined direction so as to form a pad **62** suitable for carrying an individual bag **19** in the predetermined direction. The diverter mechanism shifts the blocks **61** to form pads moveable selectively in one of three primary directions at intervals determined by the appearance of a bag **19** on the discharge end of the elevator **23** passing through a beam **63** from a lamp **64** which interrupts its impingement on a photoelectric cell **65**. In the event of a malfunction of the apparatus, the channelizer can be adjusted to convey all bags on a fourth path indicated at **67** which drops the bags into a container **68** until the fault is cleared or the apparatus is shut down. The channelizer discharges at its downstream end **69** onto the three belt conveyor **27**.

Conveyor Apparatus Between Channelizer and Hopper

The conveyor **27** has three belts **75**, each of which is preferably impregnated with an antifriction material such as Teflon. The belts convey the bags **19** through the check and release structure to the chute **31**. During this conveyance, the bags are confined to their respective belts by longitudinal guides **76** forming outer walls for the conveyor **17** as well as two dividers between the three belts. As illustrated in FIGS. **3** and **4**, each check and release mechanism **28** overlying each respective belt includes an elongated arm **77** which is mounted on a bar **78**, the bar being rotatably mounted on the guides **76** to be able to pivot the arm **77** between its two operative positions described below. The bar **78** is rotated by a double acting piston cylinder **79** attached to an arm **80** fixed to the bar **78**. The actuation of the piston cylinder is determined by the timer shown in FIG. **9** to be described below.

The check and release arm **77** has a stop **81** fixed to its downstream end, the stop **81** being adapted to move into the path of a leading bag **19** to block it momentarily from passing on to the chute **31**. The upstream end of the arm **77** provides means for checking momentarily the movement of the next adjacent bag **19** when the leading bag is released. The upstream end of the arm is formed by a spring **82** and a foot **83** attached to the end of the spring. The foot **83** engages a secondary arm **84** pivoted at one end to a rod **85** which is mounted on a bar **86**, the bar being secured to the guides **76**. The secondary arm **84** preferably has a curved undersurface, as indicated at **87**, for it provides direct contact with the bags, and the curved undersurface avoids inflicting damage on the thin bag walls.

As viewed in FIG. **4**, clockwise rotation of the arm **77** brings the stop into the path of incoming bags while raising the foot **83** to release the flow of incoming bags. The spacing between the stop on the one hand and the check means formed by the foot **83** and the arm **84** on the other hand is sufficient to allow the passage of one bag. Counterclockwise movement of the arm **77** brings the foot **83** into engagement with the secondary arm **84**, thereby holding or checking the bag underneath it while releasing the leading bag for movement toward the chute **31**, it being understood that the belts **75** run continuously. It should be noted further that a variation in the length of the bags with which the check and release will cooperate is permitted simply by adjusting the spacing between the bar **78** which carries the arm **77** and the rod **85** which carries the secondary arm **84**.

Upstream of the check and release is a limit switch **1LS** which is closed by the presence of a bag **19** underneath it. In the absence of a bag underneath it, the operation of a cycle motor which programs the discharge of bags to the hopper will cease, thereby providing assurance that there will be a sufficient supply of bags for full loading of the cases before the check and release operates. Only one limit switch is shown, but it should be understood that three limit switches, one for each belt, can be provided.

The bags are discharged by the check and release mechanism **28** from the conveyor **27** onto the chute **31**. The chute, as shown in FIG. **1**, is arcuate, the upper portion **90** projecting generally vertically and the lower portion **91** projecting generally horizontally. The chute has side walls **92** and

dividers 93 which form three channels 94 to guide the bags in proper alignment onto the upper trap 32 overlying the hopper. The upper surface of the chute is preferably lined with nylon or like low friction material.

Immediately above the chute are the wheels 30, one wheel corresponding to each chute channel 94. The wheels are fixed to a shaft 95 journaled in the walls and dividers 92 and 93 and being driven by a chain passing over a sprocket 96. Each wheel 30 forms the nip 29 with respect to its respective conveyor belt 75 as the conveyor belt passes around its pulley. The function of each wheel is to frictionally engage a bag released from the end of belt 75 and to drive that bag through the nip downwardly onto the upper portion 90 of the chute 31. To provide proper engagement of the wheel 30 with the bag, the surface of the wheel is preferably formed of rubber or like resilient material and has a series of transverse teeth forming its periphery. The wheel 30 is preferably driven at about twice the speed of the belt 75, although the speed of the wheel will be dependent upon the particular conditions and specific structural relationships involved. The importance of the high speed of the wheel is that it imparts to the bag a sufficient force to cause it to make a full traverse of the chute 31 and to arrive in a flat condition on the upper trap 32. Too great a speed might cause the bag to bunch up at a stop associated with the trap (to be described below), and insufficient speed would prevent the bag from covering the full distance.

The Hopper

The hopper 33 is best shown in FIGS. 5–8 and includes longitudinally extending vertical outside walls 100 and parallel divider walls 101, all adjustably mounted on transverse rods 102. The hopper also includes narrow front and rear transverse walls 103 whose edges are normally spaced from the walls 100 and dividers 101 to permit adjustment of the latter without interference from the transverse walls. The transverse walls are mounted on threaded rods 104 which are in turn adjustably secured to frame structure indicated at 105 to permit their adjustment. The longitudinal walls and dividers together with the transverse walls provide adjustable compartments 106 adapted to receive a stack of bags, and, as indicated, the size of the individual compartments can be varied to accommodate bags of varying sizes. The individual compartments 106 collectively form the accumulator chamber 34 in which a full case load of bags is accumulated before being dropped into the case 37. The upper trap 32 is located immediately above the accumulator chamber 34. (The trap is shown spaced somewhat from the accumulator chamber, but it is to be understood that it should be as close as is structurally possible in order to minimize the distance of the bag drop into the bottom of the accumulator chamber.) The trap includes a pair of guillotine doors 110 which are mounted for horizontal sliding movement and which are connected through a bellcrank lever 111 to a piston and cylinder 112. Operation of the piston and cylinder causes the bellcrank lever to pivot and, through slotted connections 113 to the guillotine doors, to open the guillotine doors 110 permitting a bag to fall through (FIG. 6). This action is preferably quite rapid so that the bag does not begin to sag as the doors are opened.

Similarly, at the lower side of the accumulator chamber 34 and forming a bottom therefor is the trap 35 formed by guillotine doors 114 which are actuated similar to guillotine doors 110 through bellcrank lever 115 and piston and cylinder 116. The actuation of the piston and cylinder 116 causes the bellcrank lever 115 to pivot, thereby sliding the guillotine doors 114 horizontally to permit the accumulated stack of bags to drop simultaneously from their respective compartments 106 (FIG. 7).

Immediately above the upper trap 32 is an adjustable stop 117 mounted on a rod 118 which is adjustably secured to the apparatus indicated generally at 105. The stop 117 positions the bags longitudinally with respect to the compartments 106.

Case Transfer Mechanism

The case transfer mechanism is illustrated in FIGS. 10–15, although reference should be made to FIG. 8 to understand the overall orientation of the mechanism with respect to the hopper structure. As shown in FIG. 8, the transfer mechanism includes an elongated flat plate 130 which forms a saddle to support an empty case 37 with bottom side flaps 131 extending downwardly along the sides of the saddle 130 and with bottom end flaps 132 lying flat upon the saddle 130. This structure permits the operator to open and make a preliminary formation of the case from the flat state in which it is received from the converter.

Below the saddle 130 are a pair of angulated plows 133 (FIGS. 14 and 15) which are engaged by the bottom side flaps 131 as the case is thrust toward its loading position under the hopper. As illustrated in FIGS. 14 and 15, the plows fold the side flaps upwardly along the bottom of the case to complete the formation of the bottom of the case.

Overlying the saddle 130 and extending under the hopper 33 are a wide flap guide 134 and a narrow flap guide 135. The narrow flap guide 135 is engaged by the downstream flap 137. The wide flap guide 134 is engaged by the top end flaps 136 and the top upstream side flap 137 of the case 37 to hold those flaps in an open condition until the case is brought fully under the hopper. It will be observed with particular reference to FIGS. 12–15 that the saddle 130 is offset with respect to the center of the hopper 33. This offset relation enables the forward top end flap of the case to underlie the flap guide 134 during its initial movement in a position under the hopper. If the hopper and saddle 130 are aligned, it would not be conveniently possible to use a stationary guide to hold the end flap in open condition, for such a stationary guide would obstruct the path of the bags from the hopper into the case.

The support 36 for the cases underneath the hopper, and adjacent the saddle 130, is formed by rollers 140 which provide convenient antifriction means for rolling a loaded case out from under the hopper.

At the downstream side of the structure, an elongated case side guide 141 is provided against which the case will be lodged to position it underneath the hopper. A roller 142 is mounted on the end of the guide 141 to serve as a detent for the forward end of the case. A spring loaded stop 143 is mounted on the side guide at the rearward end of the case when it is under the hopper to block inadvertent rearward movement of the case when its pusher, to be described below, is returned to its starting position.

A pivoted side guide 145 is at the opposite side of the hopper, the pivoted side guide being mounted on brackets 146 which are pivoted on a rod 147 and urged by a spring 148 in a counterclockwise direction as viewed in FIGS. 14 and 15. The pivoted side guide 145 has an angulated rearward end 150 which provides a flaring entrance for the case as it is thrust into position under the hopper (See FIG. 11), and a stop finger 149 at its forward end which properly positions a case 37 beneath the hopper 33. It will be recalled that the saddle 130, which initially supports the case is offset with respect to the center of the hopper. As the case is thrust into position under the hopper, the case engages the angulated member 150 camming the side guide 145 away from the side guide 141. However, after the case is under the hopper and has passed beyond the saddle 130, the spring 148 returns the pivoted side guide and thrusts the case toward the fixed side guide 141, thus centering the case under the hopper. A lever 151 is attached to the pivoted side guide to permit manual assistance in pivoting the side guide to one side or the other.

A limit switch 4LS is located on the fixed guide 141 adjacent the roller 142 to detect the presence of a case centered under the hopper. The function of the limit switch will become more apparent in connection with the description of the timing operation.

A pusher 155 is pivotally connected at 166 to a block 167 slidably mounted on rods 168 forming ways running parallel to the fixed side guide 141. The pusher has a handle 169 by which the operator pivots the pusher, moving it to-and-fro to effect the transfer of the cases. The pusher has a rearward arm 170 extending transversely across the saddle 130 and a for-

ward arm **171** extending transversely across the saddle **130**. The arm **170** is to engage the rear side of a case to push it into position under the hopper. The arm **171** is to engage the rear side of a filled case and push it out from under the hopper as the empty incoming case is thrust into position. A rearwardly facing edge **172** of the arm **171** is angulated so that as the pusher is moved to the right, as viewed in FIGS. **10–12**, it will be cammed by engagement with the incoming case to pivot counterclockwise to clear it for movement to its starting position. As indicated above, the spring biased stop **143** prevents a return of that case even when a return component of force is imparted to it by the return of the pusher.

In the operation of the case transfer mechanism, let it be assumed that a filled case is in the position shown in FIG. **10**. An empty case in flat condition is opened and placed on the saddle **130** with the bottom side flaps extending downwardly alongside the saddle **130**. The operator begins to thrust the empty case into position under the hopper. During the initial movement, the forward arm **171** of the pusher engages the filled case and thus removes the finger **149** from its blocking position with the filled case. The inward movement of the empty case engages the pivoted side guide and begins to swing it away from the fixed guide. In the meantime, the upper side flaps **137** have moved under the respective flap guides, and the forward end flap **136** moves under the wide guide **134**. Underneath the case, the depending side flaps **131** have engaged the plows **133** to begin the folding of those flaps underneath the case. As the thrust of the pusher continues, the filled case rolls over its roller detent **142** (FIG. **12**) to free it for continued rolling on the support rollers **140** and out of the apparatus. The incoming case continues to move in an offset path, as indicated by FIG. **12**, until it begins to clear the tapered end of the saddle **130**. As it clears the end of the saddle **130**, the spring pressure of the pivoted side guide forces the case into a precise longitudinal alignment underneath the hopper, and the finger **149** stops forward movement of the case so that it is in a proper position for loading. It is held in this position between the fixed and pivoted side guides, the roller and the finger at the forward end, and the spring detent at the rearward end as shown in FIG. **13**. The operator then returns the pusher to the starting position.

It should be understood that the apparatus described above can be replaced by automatic case opening and transfer apparatus without affecting the overall operation of the invention.

The Timing Cams

The loading of the bags into the case is programmed by the timing cams shown in FIG. **9**. Cams **C2**, **C5–C14** are mounted on a shaft **175**, which is driven by a motor **176**, which is connected through a timer **177** and a limit switch **1LS** to a source of voltage. Each cam is associated with a respective limit switch **2LS**, **5LS–14LS**. **2LS** completes a holding circuit to the motor **176**, opening the circuit to the motor only when its switch arm drops into a dip **202** on the cam **C2**. There are four dips **202** on the cam **C2** 90° apart, each dip corresponding generally to the drop of one bag.

The limit switch **5LS** is connected in parallel with the limit switch **4LS** in series with timer **177** contact which is parallel with **2LS** to the timer motor **176** and to a final drop solenoid actuated valve which operates the piston and cylinder **116** through **14LS** associated with the lower trap **35**. The limit switches **6LS–9LS** are connected to the check and release to operate it when one of their switch arms drops into respective dips **206–209**. The limit switches **10LS–14LS** are connected to a solenoid operated valve, not shown, which operates the piston and cylinder **112** to open the upper trap **32** when one of their arms drops into the respective dips **210–214** in their respective cams **C10–C–14**.

In the operation of the timing mechanism, the presence of a full supply of bags at the check and release position operates switch **1LS**.

Operation

In the operation of the invention, the bags are filled and discharged on the conveyor **21** in single file order and carried to the elevator **23**. The elevator carries the bags **19** upwardly and discharges them onto the channelizer **25**. As each bag interrupts the photoelectric cell circuit, the channelizer diverts the bags sequentially to the three conveyors **75**. The conveyors **75** carry the bags into engagement with the stops **81** of the respective check and release mechanisms until there is a backup of bags sufficient to operate the switch **1LS**.

The operation of the switch **1LS** energizes the timer **177**. After a 3-second delay timer **177** energizes timer motor **176**. The timer provides assurance of sufficient bags at the check and release. The energization of motor **176** causes rotation of shaft **175**. The shaft **175** carries the cam **C2** a distance sufficient to permit the arm of limit switch **2LS** to ride out of its dip, thereby completing a holding circuit to the timer motor, which holding circuit assures the continuation of the operation through 90° of rotation, or until the next dip is encountered. Within a few degrees of rotation of shaft **175**, limit switch **6LS** is operated to operate the check and release the first time. That involves closing a circuit which operates the piston and cylinder **79** to rotate the bar **78** counterclockwise, as viewed in FIG. **4**. Thus, the leading bags **19** are permitted to pass through the chute while the next adjacent bags are checked. The three bags thus released by their respective check and release mechanisms are thrust by the wheel **30** downwardly onto the chute, whereafter they slide freely into a position on upper trap **32** overlying the hopper.

Limit switch **10LS** is then closed to operate the piston and cylinder **112** for the upper trap **32** to drop the first layer of three bags into their respective compartments **106** in the accumulator chamber **34**.

The foregoing sequence of operations is continued through the operations of limit switches **7LS** for the check and release and **11LS** for the second stage drop; **8LS** for the check and release and **12LS** for the third stage drop; **9LS** for the check and release and **13LS** for the fourth stage drop.

Meanwhile, a case has been moved under the hopper to operate limit switch **4LS**. If no case is present, limit switch **4LS** will interrupt the circuit to the timer motor **176** to stop it from running and will interrupt a circuit to the solenoid-operated valve which actuates the piston and cylinder **116** to prevent the opening of the lower trap. The normal operation, however, is for limit switch **4LS** to be closed. Limit switch **5LS**, in parallel with limit switch **4LS**, has its dip **205** aligned with that of limit switch **14LS** and will prevent the full drop of the bags into the case unless the limit switch **4LS** is closed.

Immediately following the fourth stage drop which fills the accumulator chamber **34**, **14LS** is operated to close a circuit to the solenoid-operated valve which controls the piston and cylinder **116** to open the lower trap **35**, dropping the accumulated bags into the case. Thus, a case is filled.

The operator, operating the case transfer as described above, thrusts the filled case out and brings the empty case in. While the operator is making this adjustment, the bag packing apparatus continues to run, loading bags into the accumulator chamber. This preliminary loading of bags into the accumulator chamber provides sufficient time for the operator to complete removal of the full case and the introduction of the empty case.

In the foregoing description of the apparatus and its operation, the bags have been dropped from the lower trap doors of the hopper **33**, directly into a case so as to lie flat in the case. In the alternative embodiments of FIGS. **16** and **17**, the accumulated bags are dropped from the hopper onto a platform and are then thrust transversely into a case laying on its side so that the bags in their final orientation will be on their side edges or end edges.

Referring to FIG. **16**, the hopper apparatus above and including the lower trap doors **35** is identical to that previously described. Below the trap doors **35** is a platform **180** onto which an accumulated load of bags **19** will drop. The platform **180** may be a part of a receiving chamber having vertical walls

which will maintain the bags in an orderly arrangement prior to introduction into a case.

A support **181** is located in front of the platform **180** and preferably forms part of automatic case opening and transferring apparatus which brings a case **182** into a position in front of the platform **180** with the case flaps **184** opened so that the case is adapted to receive the bags **19**. On the opposite side of the platform **180** is a ram **186** operated by a piston and cylinder combination **187**. The ram has a plate **188** engageable with a stack of bags **19** to thrust the bags in a longitudinal direction into the case **182**.

In the operation of FIG. **16** bags are loaded into the hopper **33** in the manner described above until a full case load is received. Thereafter, the lower trap doors are opened to permit the accumulated case load of bags to drop onto the platform **180**. During the time that the hopper is being loaded, a case **182** has been brought into position on the support **181**. As soon as the bags are in position on the platform and the case in position on the support, the ram **186** is actuated to thrust the bags into the case.

It will be observed that after the case **182** is loaded and is set on its bottom wall indicated at **189**, the bags will stand on their end edges **190**.

Apparatus similar to that of FIG. **16** is shown in FIG. **17**. The principal difference between the two apparatus is that in FIG. **16** the bags are thrust into a case in a generally longitudinal or machine direction and will stand on their end edges when the case is in upright position. In FIG. **17**, on the other hand, the bags are thrust laterally into a case and will stand on their side edges when the case is in upright position. As shown in FIG. **17**, a bag-receiving platform **191** is located immediately below the trap doors **35** to receive a load of bags from the hopper **33**. Again, it is preferred that the platform have sidewalls to maintain the bags in an orderly arrangement after they have been dropped onto the platform. At one side of the platform is a case support **192** forming part of case opening and transferring mechanism used to bring a case in opened condition alongside the platform **191**. As mentioned above in the description of FIG. **16**, the case is brought in position on its side **197** and its bottom **198** in a vertical attitude. On the opposite side from the case is a ram **193** operated by a piston and cylinder combination **194** and having a plate **195** engageable with the stack of accumulated bags.

In the operation of the apparatus of FIG. **17**, when a case load of bags has accumulated in the hopper **33**, the trap doors **35** open, dropping the accumulated bags onto the platform **191**. When a case is in position and when the bags are in position, the piston and cylinder combination is operated to drive the ram toward the case thereby thrusting the stack of bags from the platform into the case.

When the case has been loaded and is set upright, it will be observed that the bags will be stacked on their side edges.

We claim:

1. A bag-packing machine comprising:
- a hopper,
- an upper trap at the upper portion of said hopper to receive bags in a single layer,
- an accumulator chamber formed by the lower portion of said hopper,
- a lower trap at the lower end of said hopper forming the bottom wall of said accumulator chamber,
- means for delivering bags onto said upper trap,
- means for opening said upper trap at least two times while said lower trap remains closed to drop bags into said accumulator chamber,
- means for opening said lower trap to release accumulated bags for loading into a case,
- a horizontal platform below said lower trap for receiving accumulated bags when released from said hopper,
- means for supporting a case adjacent said platform, and
- a horizontally reciprocable ram mounted adjacent said platform on the side opposite said case supporting means for thrusting bags from said platform into a case.

2. A bag-packing machine according to claim **1** wherein the means for delivering bags onto said upper trap comprise,
- at least one belt conveyor for carrying bags in a horizontal attitude, having a discharge end adjacent said trap,
- means for driving said conveyor,
- a friction wheel located at the downstream end of said conveyor presenting nip between said conveyor and said wheel through which bags pass as they are discharged from said conveyor, and
- means for rotating said wheel to drive bags passing through said nip onto said trap.

3. A bag-cartoning machine according to claim **1** in which each said upper and lower traps comprises:
- a pair of horizontal plates normally in edge abutment, and
- means for sliding said plates rapidly away from each other to open said traps.

4. A bag-packing machine according to claim **1** in which said hopper is formed by longitudinal vertical adjustable walls and divider means, and adjustable transverse walls.

5. A bag-packing machine according to claim **5** in which said transverse walls are disposed between said longitudinal walls and divider means and have side edges spaced therefrom to permit transverse adjustment with respect to said longitudinal walls and divider means.

6. A bag-packing machine according to claim **1** further comprising:
- an arcuate chute having a generally vertical portion and terminating in a generally horizontal portion adjacent said upper trap,
- conveyor means for feeding bags onto the upper portion of said chute, and
- a friction wheel disposed adjacent the upper portion of said chute to engage bags and drive them down said chute.

7. A bag-packing machine comprising:
- a hopper having at least three vertical walls forming at least two vertical compartments,
- an upper trap at the upper end of said hopper to receive bags in a single layer,
- an accumulator chamber formed at the lower portion of said hopper,
- a lower trap at the lower end of said hopper forming the bottom wall of said accumulator chamber,
- means for delivering bags onto said upper trap overlying respective compartments,
- means for opening said upper trap after a single layer of bags is delivered thereto to drop said single layer of bags into said accumulator chamber, said opening means being operable at least two times while said lower trap remains closed, and
- means for opening said lower trap to release accumulated bags for loading into a case.

8. A bag-packing machine according to claim **7** in which said delivering means include channelizing means to divert bags laterally to positions aligned with respective compartments.

9. Apparatus according to claim **2** further comprising:
- a chute between said belt conveyor and said trap doors.

10. Apparatus according to claim **2** in which the peripheral speed of said wheel is substantially greater than the peripheral speed of said belt.

11. Apparatus according to claim **10** in which said belt is impregnated with a low-friction material.

12. Apparatus according to claim **10** in which said belt has a lower coefficient of friction than said wheel.

13. Apparatus according to claim **11** in which said belt is impregnated with Teflon.

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