# United States Patent

**Vieson et al.**

[15] **3,670,474**

[45] **June 20, 1972**


## [54] BAG PACKER


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



[22] Filed: **March 3, 1971**

[21] Appl. No.: **120,518**

**Related U.S. Application Data**

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

[52] **U.S. Cl.** ..... **53/55,** 53/62, 53/159

[51] **Int. Cl.** ..... **B65b 57/02,** B65b 57/10

[58] **Field of Search** ..... 53/55, 59 R, 62



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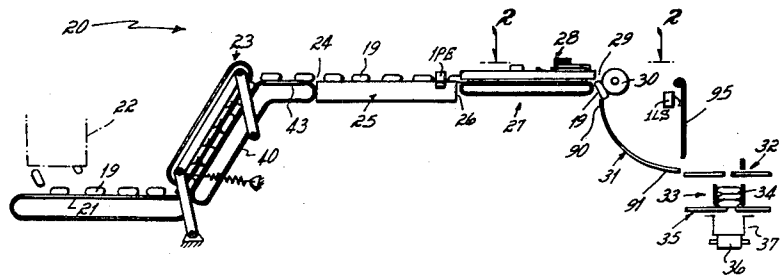
[57] **ABSTRACT**

A bag packing apparatus is capable of varying the number and configuration of bags packed into a case. The packer is three-dimensionally variable so that it can be s et up to pack combinations of a variable number of layers of bags, a variable number of rows of bags in each layer or a variable number of bags in each row. A control circuit is variably switched to a desired condition to select the number of layers and the number of rows in each layer and a channelizer, movable guides and check and release units are adjusted to accommodate a desired number of bags in each row. Electronic variable timers are provided in the control circuit to time the operation of the various movable elements of the apparatus and may be adjusted to attain optimum performance. Detecting devices are utilized to sense the presence of the bags and the cases in their various positions and are connected so as to prevent malfunctions in the event that bags or cases are not in their predetermined positions at the proper time or in the event that the bags back-up beyond a predetermined point.


**9 Claims, 16 Drawing Figures**



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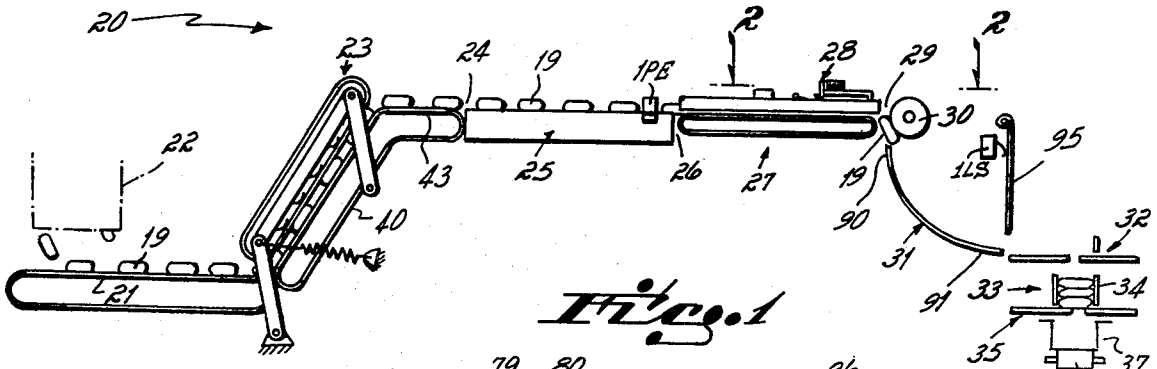

Fig. 1

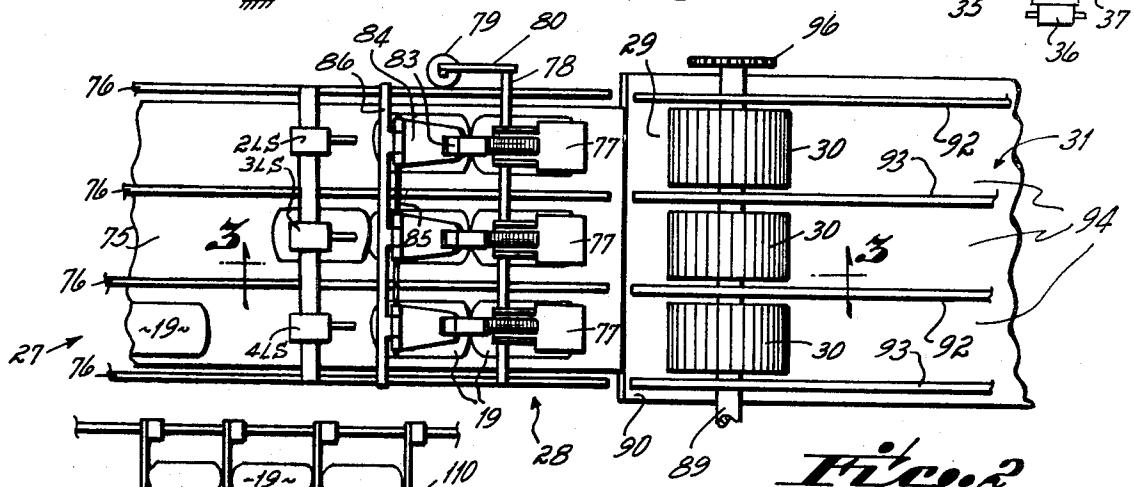

Fig. 2

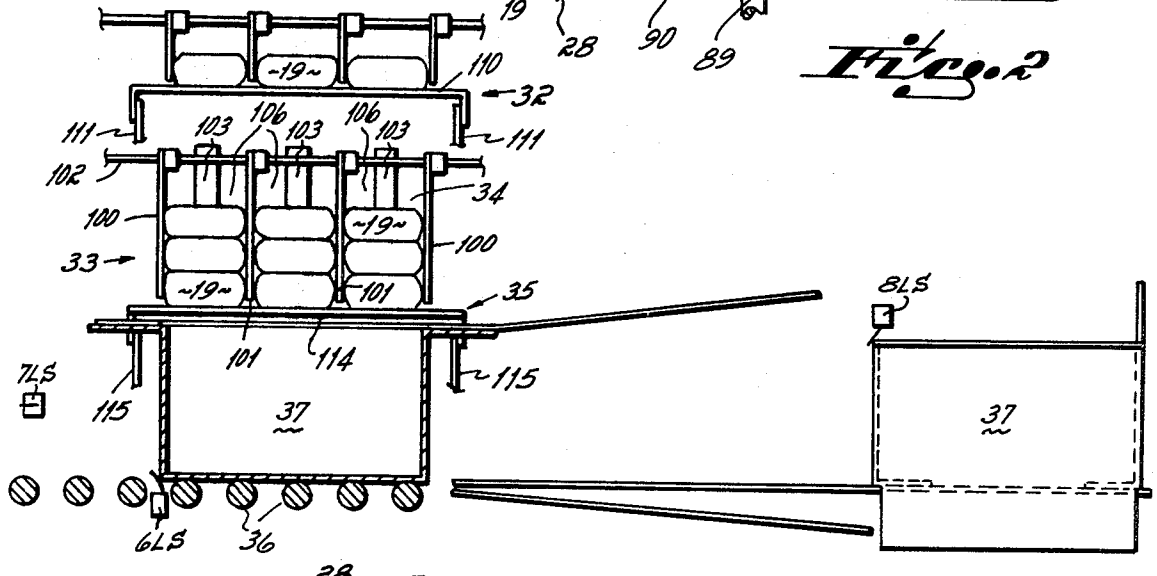

Fig. 7

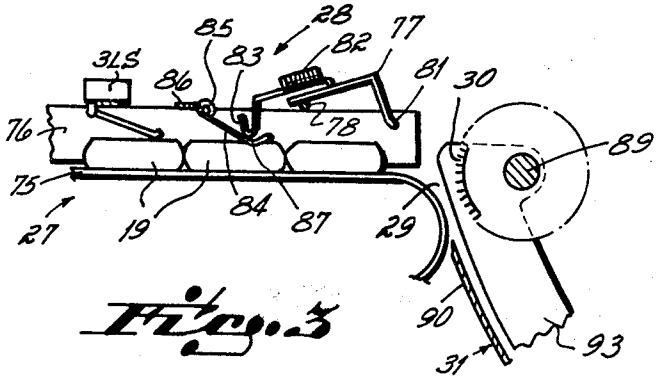

Fig. 3

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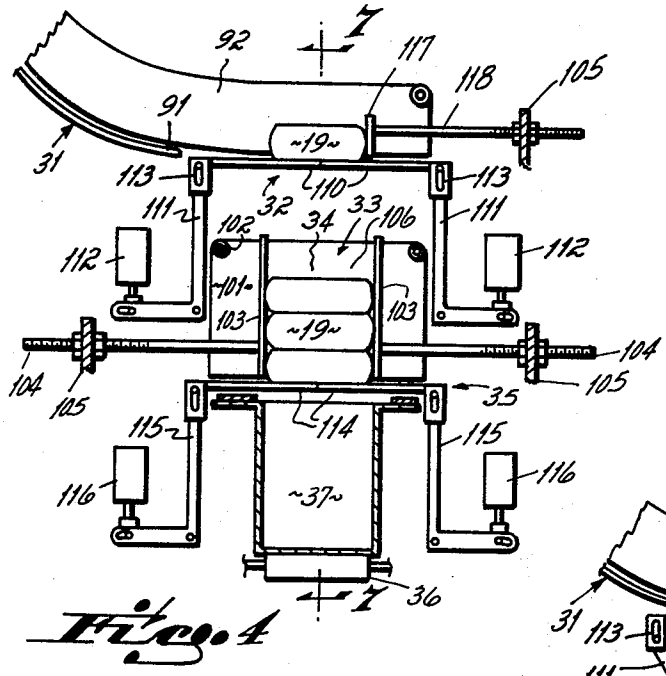


Fig. 4

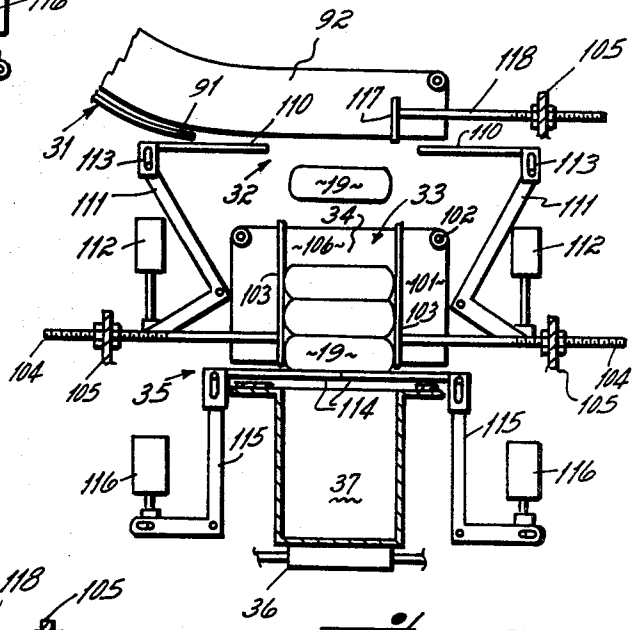


Fig. 5

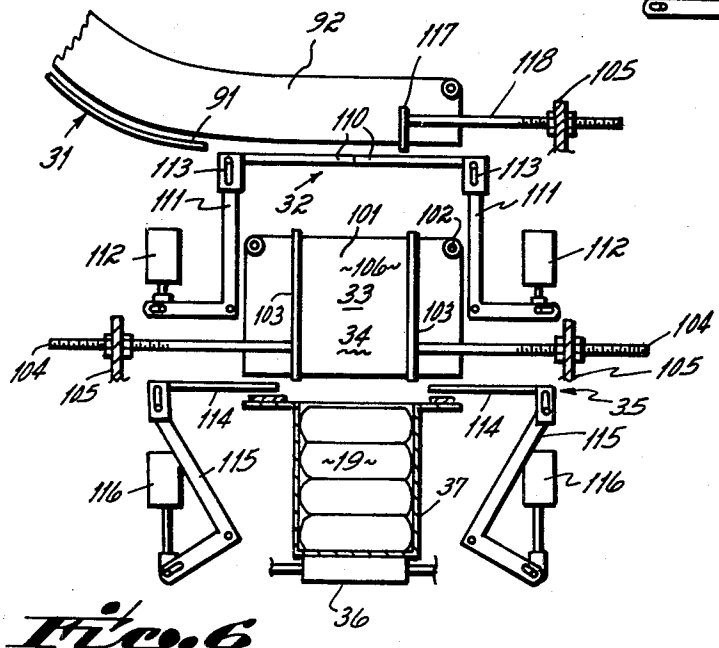


Fig. 6

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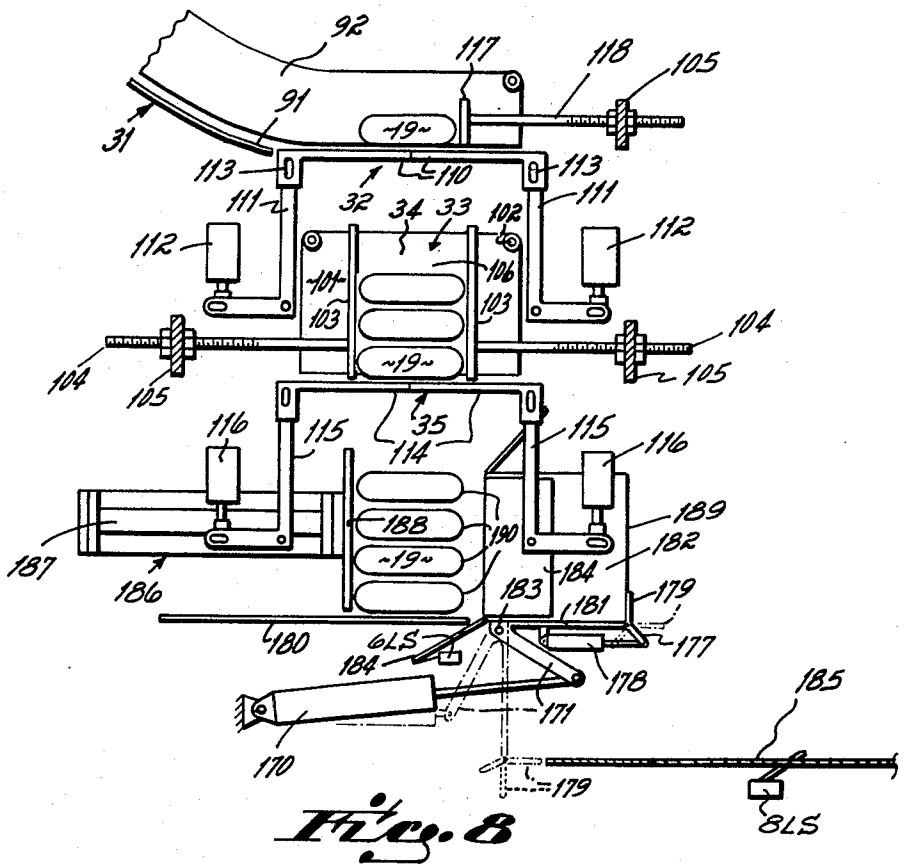


Fig. 8

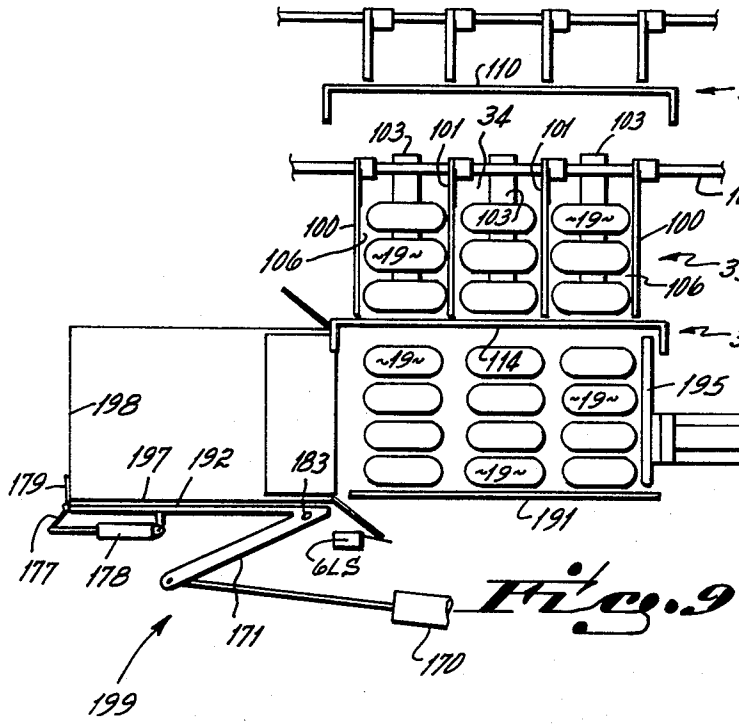


Fig. 9

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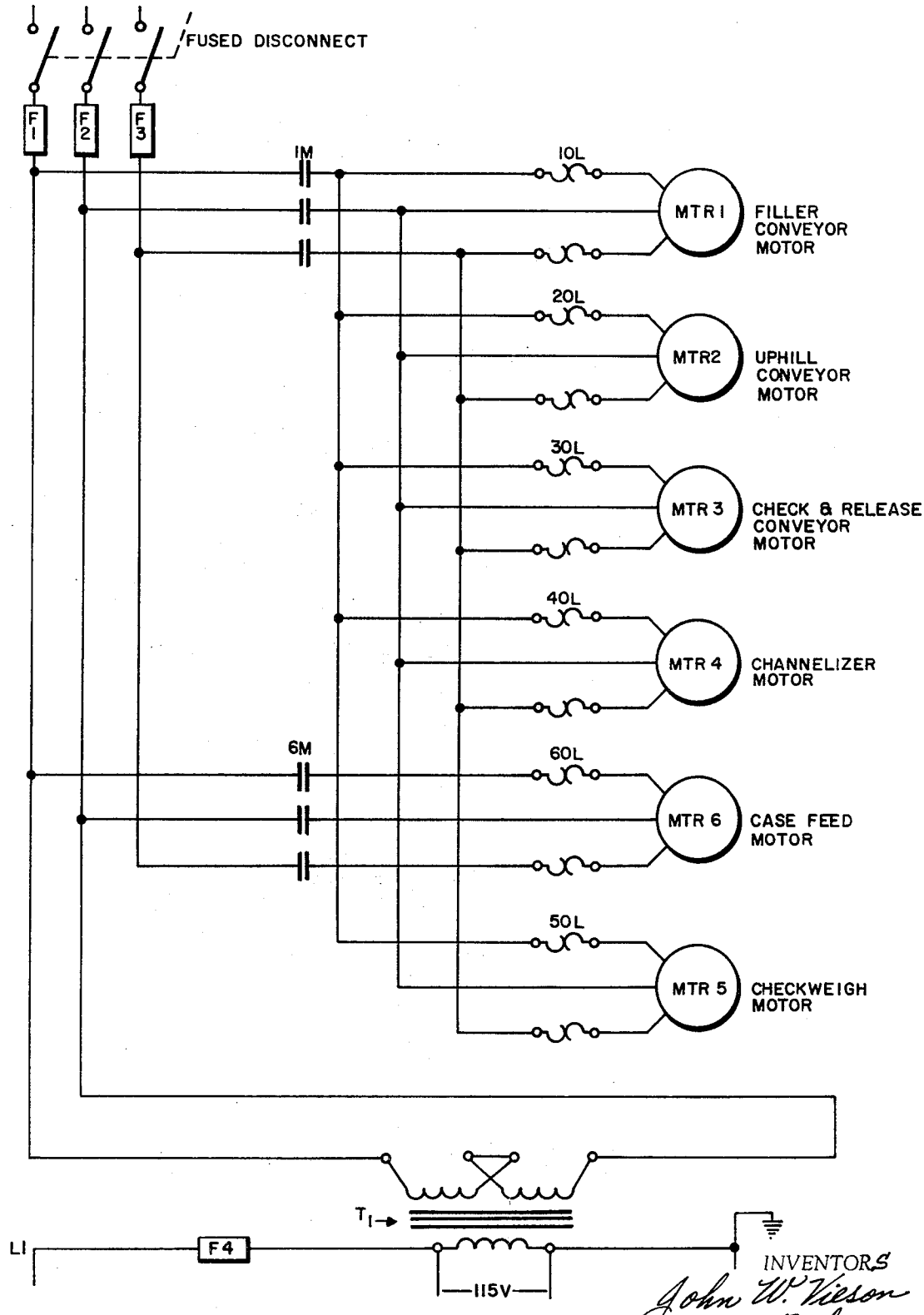


Fig. 10A

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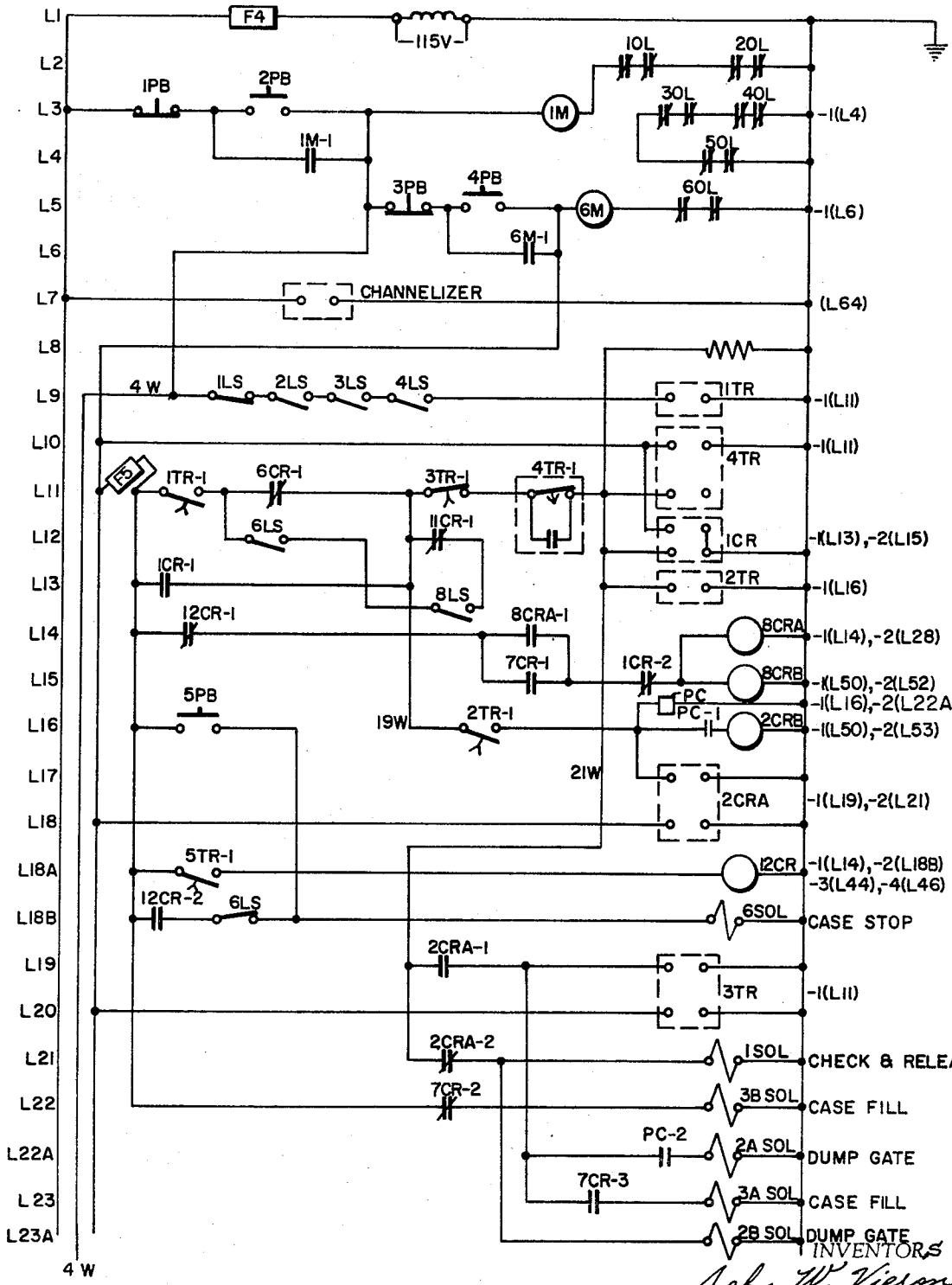


Fig. 10B

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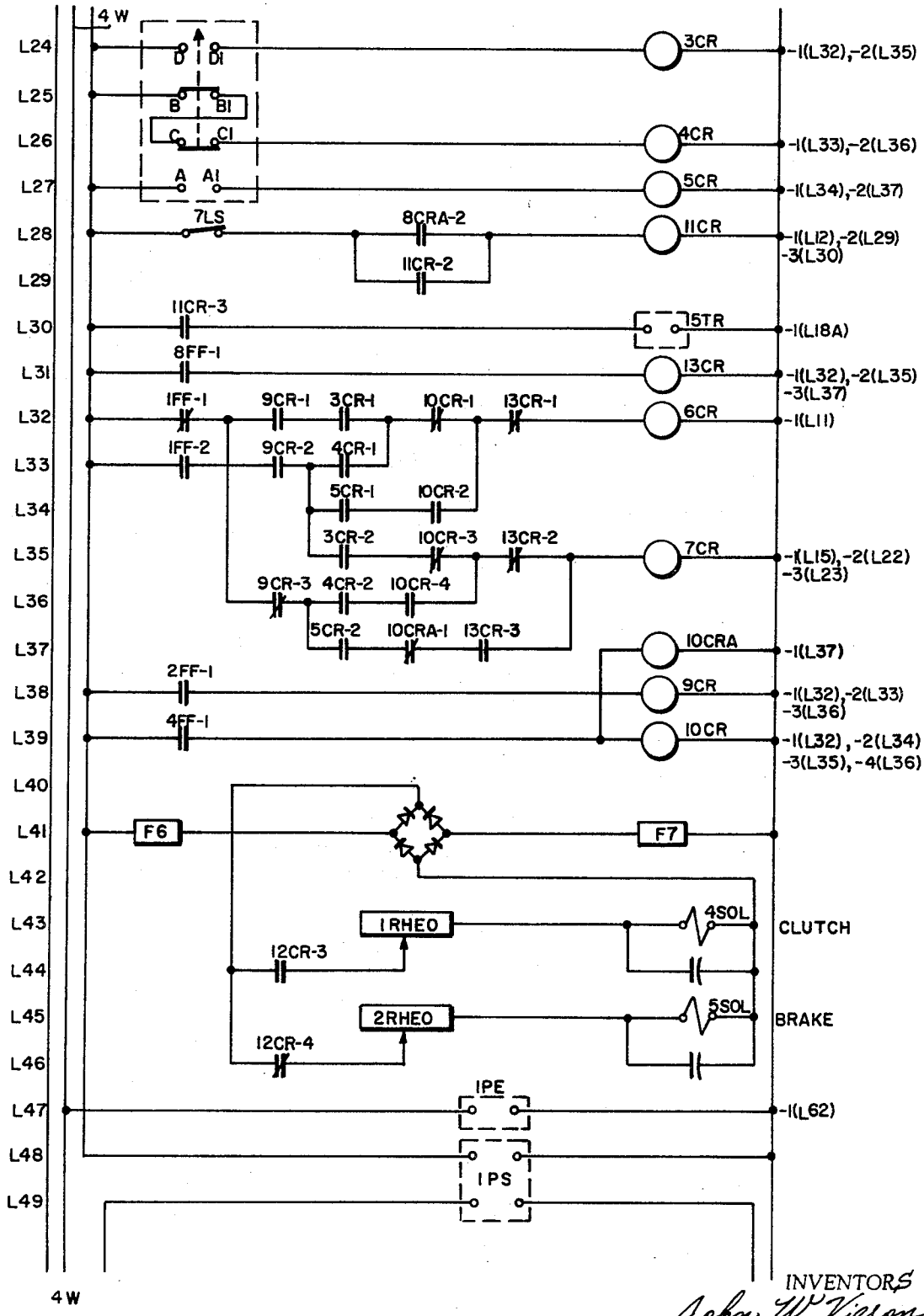


Fig. 10C

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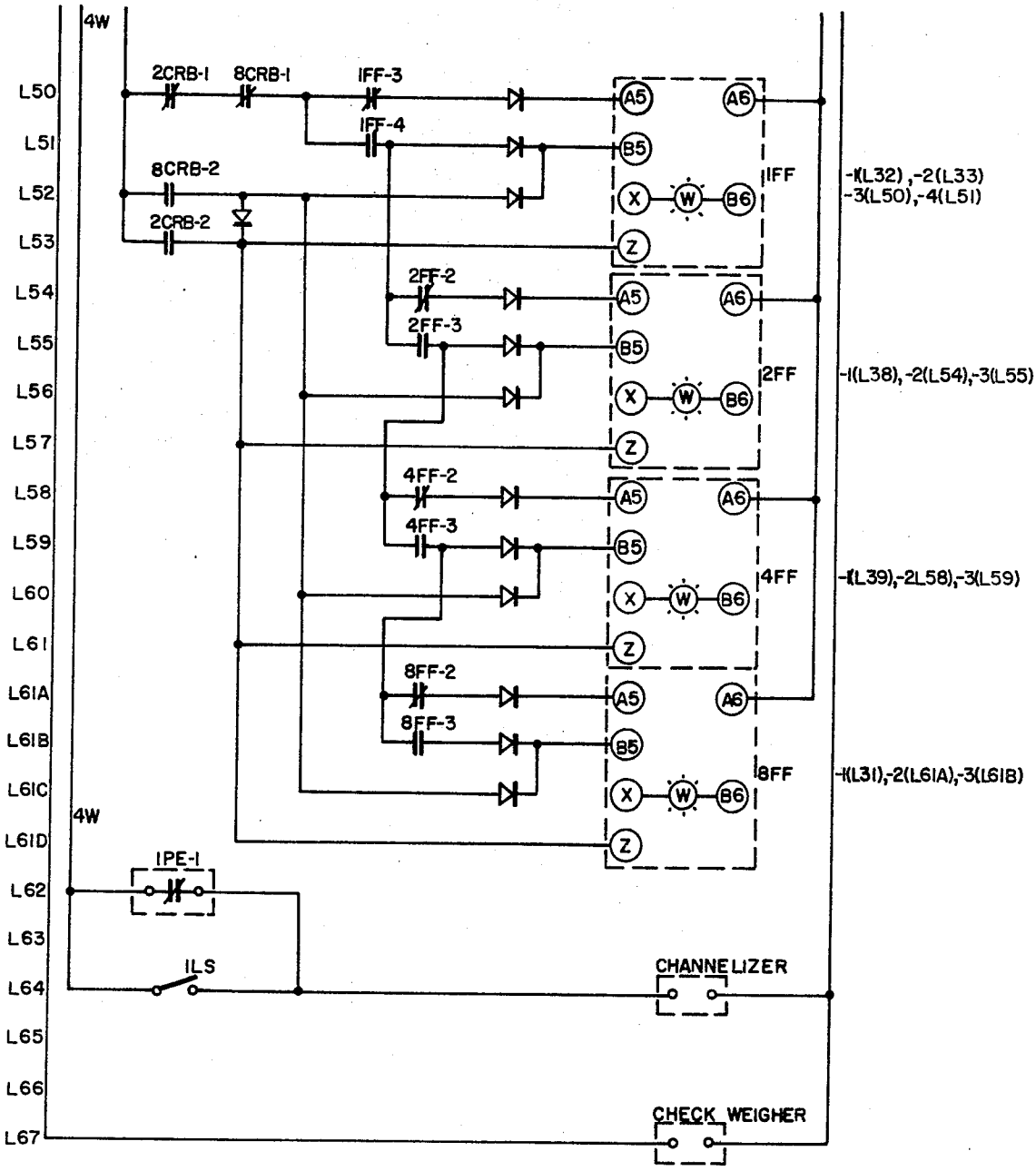


Fig. 10D

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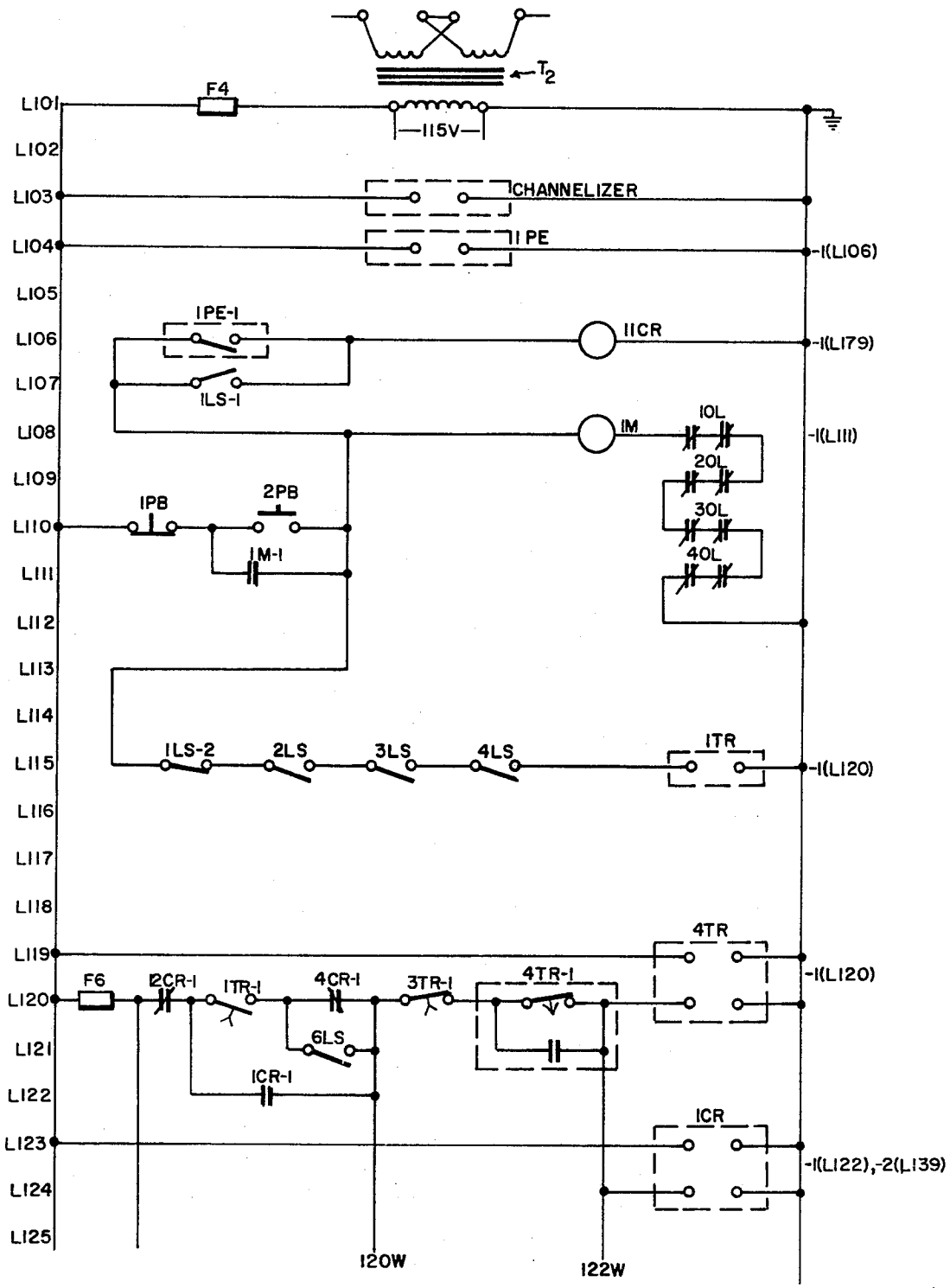


Fig. 11A

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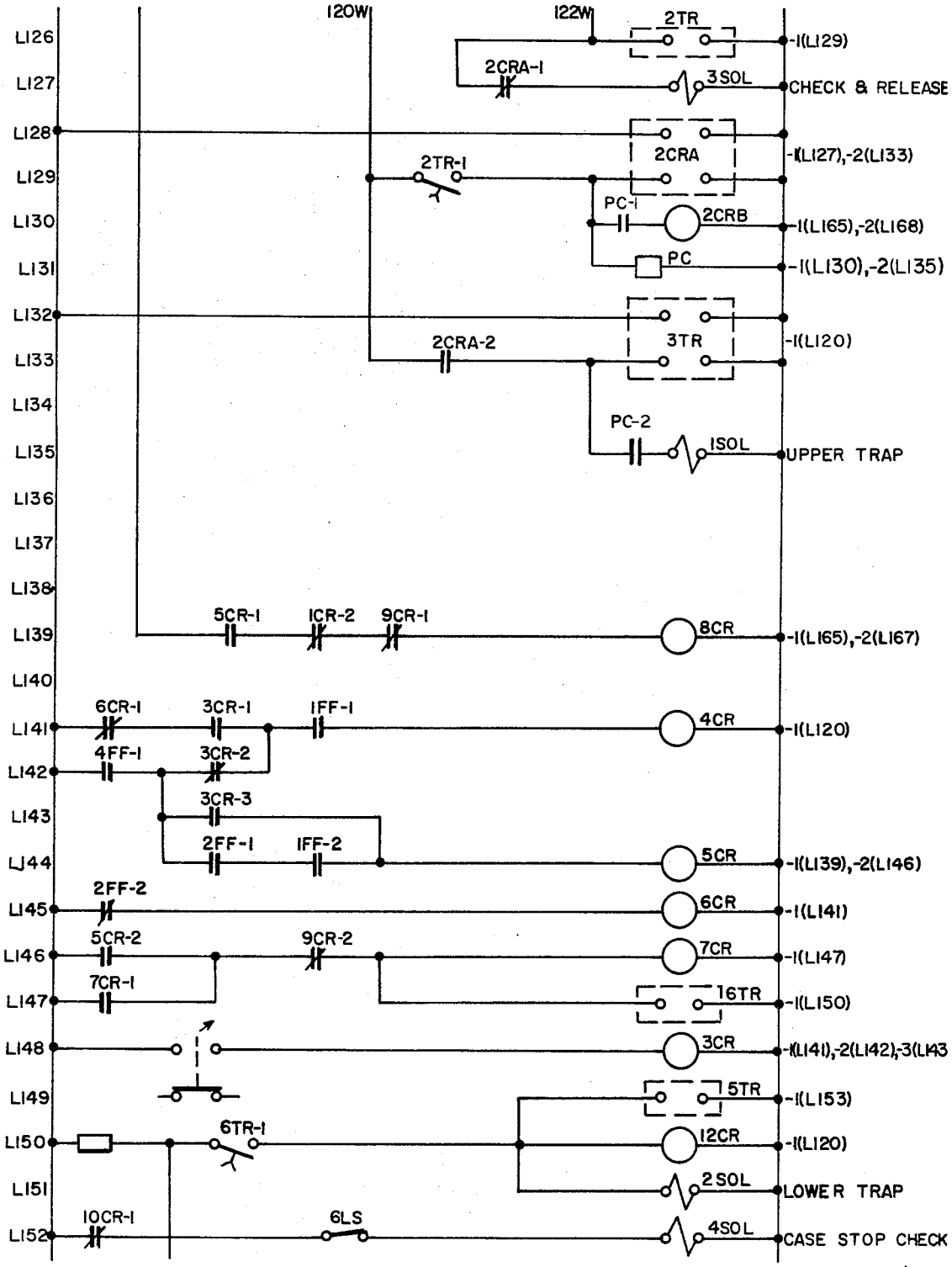


Fig. 11B

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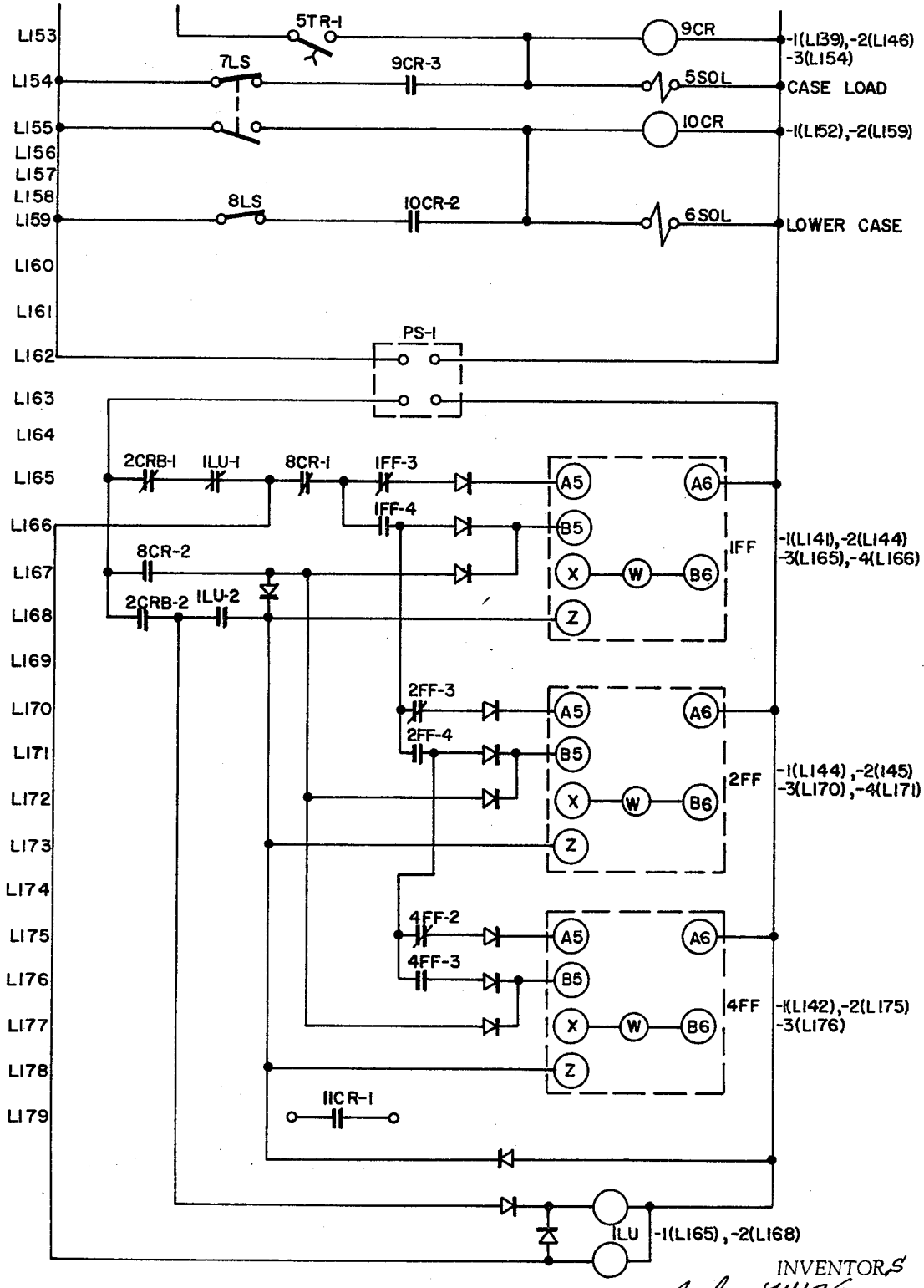


Fig. 11C

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# BAG PACKER

## CROSS-REFERENCE TO RELATED APPLICATION

Reference is made to commonly assigned and related application Ser. No. 4,378 filed on Jan. 20, 1970, by William C. Daily and Fred H. Welzel for a "Bag Packer with Horizontal Transfer," which application is a continuation-in-part of application Ser. No. 808,831, filed Mar. 20, 1969, and now abandoned.

## BACKGROUND OF INVENTION

(1) Field of Invention

The invention relates to improvements in packing machines and more particularly to improvements in the versatility of bag packing apparatus, such as the one disclosed in the aforementioned related application.

(2) Description of the Prior Art

The automatic casing of a plurality of flexible bags containing frangible or non-uniformly shaped articles may be accomplished by apparatus as shown in the related application, Ser. No. 4,378. The bag packers disclosed in that application operate to package a plurality of bags into single containers or cases. The efficient operation of such apparatus depends on a multitude of factors and particularly on the control system. The timing of each segment of the operation must be programmed so that the whole system runs smoothly from the moment a bag is fed into the apparatus until a filled case is removed therefrom.

It is known to control the operation of the operative elements of a bag packer with a series of switches actuated in part by a series of cams, all of which are driven by a common shaft and motor. The switches are connected to various solenoids for actuating the movable elements of the packer, for instance a check and release unit, and upper and lower traps. The angular relationships of the dips in the cams which control the switches must be maintained in a predetermined order so that the respective switches are operated at the proper time to in turn control the movement of the various elements of the apparatus. It can be appreciated that a random orientation of the cams could very well cause malfunctions in that the necessary sequence of operation of the check and release unit and the upper and lower trap would be disturbed.

We have found that when an operator desires to change the packed configuration, i.e., the number of layers of bags to be stacked in a case, he must adjust the angular relationships of the cams, thereby varying the timing of the various operations so that he may get, for example, rows of bags stacked in three or eight layers rather than in only four layers as shown. This re-orienting of the various cams is a difficult task since the proper angular relationship must be maintained between all cams. These manipulations have proved to be difficult, impractical and time-consuming and have in that respect limited the versatility of the packer.

Furthermore, it has become desirable to provide bag packing apparatus wherein the number of rows in each layer of bags to be packed is adjustable. Additional cams or limit switches would be necessary to accomplish this in the prior packer.

Another disadvantage of the known control system is that during extended operations the switches involved are operated a great number of times and tend to wear, thus increasing "down time" of the machine for repair and maintenance.

It has also been found difficult for the same reasons to change the effective component of time allowed for the operation of a single segment of the apparatus when it alone needs to be speeded up or slowed down for optimum overall performance.

## SUMMARY OF THE INVENTION

The invention includes improved means for controlling the operation of a bag packer such as the ones shown in the related application. The invention contemplates a bag packer of three dimensional versatility. The packer is adjustable to selectively pack predetermined configurations of bags into a case. For instance, an operator may set up the machine to vary the number of rows in each layer of bags, to vary the number of bags in each row, or to vary the number of layers for each "drop" or accumulation of bags to be packed into a single case.

In general, a circuit is provided for sensing the presence of flexible bags which are to be packed into cases and of the cases themselves in position for loading and for movement into the loading area. A layer selector switch and a binary counter are utilized to control the operation of the apparatus with regard to the number of layers of flexible bags which are to be placed into a single case.

A secondary impulse counter is utilized to control the number of rows in each layer of bags to be packed and apparatus is provided for handling a variable selected number of bags in each row. Actuators such as, for instance, electric motors and air cylinder and piston combinations which are actuated by electric solenoids are controlled by the circuit for operating the various movable elements of the apparatus.

The bag packing apparatus itself generally consists of a horizontal conveyor which receives flexible bags from a filling unit. An elevating conveyor elevates the bags into an area where they are check weighed and then released into a channelizer. The channelizer diverts the bags approaching it in single file into two or more files. A conveyor is provided at the end of the channelizer for accepting the files of bags. This conveyor runs continuously but the bags are held by a check and release mechanism.

When the bags back up behind the check and release mechanism, they actuate prime or limit switches, one of which is provided for each file of bags. Upon actuation of each of these limit switches a circuit is completed and the check and release mechanism operates to allow one row of bags, that is to say one bag from each file or channel, to be conveyed forwardly under a friction wheel and thereafter downwardly on a chute and onto an upper trap. At a particular time as controlled by the circuit of the invention, the upper trap door is opened, allowing a row or rows of bags to fall into an accumulator hopper.

This operation continues until the last row or rows of bags is ready to fall into the accumulator hopper. At this time the circuit completes a check to determine whether or not a case is present under the hopper for loading, and whether or not another case is in its position prior to loading. If the cases are present, the upper trap door is opened and allows the last row or rows of bags to fall into the accumulator hopper. Very shortly thereafter, the lower trap is opened, thus allowing the stack of flexible bags to fall into the case. The lower trap door as well as the upper trap door are then closed and the bags continue to accumulate into the hopper while the filled case is moved away from the loading station and the other case is moved into position under the hopper for filling.

The total number of bags to be packaged into a single case may be easily selected by the mere movement of a switch into a position which controls the casing, for instance, of three, four, or eight layers.

A second embodiment of this invention discloses a controlling means for a bag packer with a horizontal transfer. Such a packer is also shown and disclosed in the related application. The operation of this second bag packer is generally the same as the first with the exception that the case is not placed directly under the hopper for loading, but rather to one side. The bags are dropped from the accumulator hopper onto a platform and are thereafter inserted into the case by a ram which is actuated by an air cylinder.

The circuit for controlling this alternate bag packer is somewhat modified from that of the preferred embodiment. For instance, the check and release mechanism is positively controlled to not begin a new "count", i.e., to release bags after a case has been filled, until the lower trap doors are closed. Also, various circuit elements are provided for controlling the ram and the case positioning elements to insure they function without the possibility of a jam.

As a result of the use of timers in the controlling means of both embodiments, any segment of the operation can be speeded up or slowed down to obtain optimum performance of the whole. For instance, the frequency of the check and release operation at the top of the ramp may be speeded up or slowed down in order to be more consistent with the feed of the bags into the prime area or the rate of accumulation of the bags into the accumulator hopper.

Failsafe switches are provided in the circuit which will stop the operation of the apparatus in the event of any error or malfunction. For instance, prime switches are located between the channelizer and the check and release mechanism. These must all be closed before the circuit is completed to continue the operation of the machine. This insures the proper number of bags in each row to be dropped into the accumulator hopper and thereafter into the case.

A limit switch is provided in proximity to the empty case such that the switch is closed if a case is in proper position for filling. If this switch is not closed, then the last row of bags will not be released and the lower trap doors will not open and dump the bags into an area when a case is not in a position to accept them.

In the first embodiment, a further switch senses the presence of a case in position just prior to the loading such that the operation of the machine will be stopped if a case is not ready to be placed into position beneath the hopper for its fill.

Another switch is provided at the discharge end of the bag packer which senses the movement of a filled case away from the filling area of the apparatus. If these switches are not timely actuated, indicating that a filled case is present in the apparatus and possibly in a position to cause a jam, the operation of the packer is halted so the case can be removed.

It is thus an object of the invention to provide controls for a packer which allow a variation in the number and configuration of articles to be stacked in each case.

It is another object of this invention to provide controls for a bag packer which are easily and practically adjustable to allow a variation in the number of layers of bags stacked in each case, in the number of rows in each layer and in the number of bags in each row.

It is a further object of this invention to provide an electronic control for a bag packer which decreases maintenance and repair of the apparatus.

It is a further object of the invention to provide a control for a bag packer which may be easily and readily adjustable to change the time component of any single operation of the apparatus in order to attain optimum performance of the whole.

It is a further and highly important object of the invention to provide means for controlling and checking the operation of a bag packer to eliminate jams waste or errors due to the absence of a case or of bags to be packed.

These and other objects and advantages 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 diagrammatical view of a bag packer of the type for which the electrical control of this invention is particularly suited,

FIG. 2 is an enlarged diagrammatic view taken along line 2—2 of FIG. 1,

FIG. 3 is an enlarged diagrammatic view taken along line 3—3 of FIG. 2,

FIG. 4 is an enlarged diagrammatic view showing the discharge end of the bag packer with the upper and lower traps in a closed attitude, the upper trap supporting the last layer of bags of a four layer drop in a position to be dropped and the lower trap supporting three layers of bags of a four layer drop,

FIG. 5 is a view similar to FIG. 4 with the upper trap open and the last layer of a four layer drop falling onto the stack of the lower trap,

FIG. 6 is a view similar to FIG. 4 with the lower trap open and the four layers of bags deposited into a carton below the trap,

FIG. 7 is a view taken along line 7—7 of FIG. 4, illustrating the orientation of a plurality of bags,

FIG. 8 is a view showing an alternate embodiment of the case loading structure,

FIG. 9 is a view showing a further alternate embodiment of the case loading structure.

FIGS. 10A–10D are circuit diagrams showing the control circuit of one embodiment of a bag packer, and

FIGS. 11A–11C are circuit diagrams showing the control circuit of the bag packer with horizontal transfer.

## GENERAL ORGANIZATION AND OPERATION

For purposes of clarity as to the operation of the controlling circuit, portions of the apparatus of the bag packer are described below. For further explanation or clarification, the subject matter of U. S. application Ser. No. 4,378 filed Jan. 20, 1970, by William C. Daily et al for a "Bag Packer with Horizontal Transfer," is incorporated herein by reference.

Referring to FIG. 1 of the drawings, the bag packing apparatus indicated at **20** includes a horizontal endless belt 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 as desired. In the illustrated embodiment of the invention, three files are shown.

The bags are delivered at **26** from the channelizer to a belt conveyor **27**. Overlying the belt conveyor **27** is a check and release unit **28** which receives and holds aligned rows of incoming bags as shown more clearly in FIGS. **2** and **3**. At a preselected time, the check and release mechanism **28** releases the leading row of bags while holding the next adjacent row of bags momentarily. While three files of bags are shown in FIG. **2**, provision is made for handling an adjustable number of files. If less or more than three files are desired, movably mounted guides **76** may be adjusted between the outer guides of belt conveyor **27**. A guide may be removed if only two files are desired or guides may be added if four or more files are desired. A check and release unit **28** is provided for each file.

The conveyor **27** conveys the row of three bags to a nip **29** formed between a friction wheel **30** associated with the discharge end of the belt, 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 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.

The Channelizer

The horizontal portion **43** of the upper run of a lower elevator belt **40** discharges bags in a single file onto the channelizer **25**. A checkweight device may also be utilized in this area between the channelizer and the elevator. If a bag is not of the proper weight, the channelizer may be signaled to divert the bags into an overflow bin. The channelizer is a known device for diverting articles from a single file to plural files and is not specifically illustrated. A channelizer useful with the present invention is manufactured by Illumitronic Engineering, Sunnyvale, California, as Model No. CH4. It is adjustable to divert the single file of infed bags into the desired number of files for input onto the belt conveyor. In the event of a malfunction of the apparatus, the channelizer can be adjusted to convey all bags onto a discharge path which drops the bags into a container until the fault is cleared or the apparatus is shut down. The channelizer discharges at its downstream end **26** onto the belt conveyor **27**.

Conveyor Apparatus Between Channelizer and Hopper

The conveyor 27 as shown has one belt 75, which is preferably impregnated with an anti-friction material such as Teflon. The belt conveys the bags 19 through the check and release structure 28 to the chute 31. During this conveyance, the bags are confined to their respective paths by longitudinal adjustable guides 76, which form channels or files as well as outer walls for the conveyor 27. These guides are adjustable and may be added to in order to accommodate less or more files than the three shown.

As illustrated in FIGS. 2 and 3, a check and release mechanism 28 overlies each respective file. One mechanism 28 is provided for each file and these units may be removed, or others may be used in addition in order to handle a varying number of files. Each check and release unit includes an elongated arm 77 which is mounted on a bar 78, the bar being rotatably mounted on the guides 76 so as to allow the arm 77 to pivot between its two operative positions described below. The bar 78 is rotated by a double acting cylinder and piston 79 attached to an arm 80 fixed to the bar 78. The actuation of the piston and cylinder is controlled by the control circuit 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 onto 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, because it provides direct contact with the bags, and the curved undersurface avoids inflicting damage on the thin bag walls.

As viewed in FIG. 3, clockwise rotation of the arm 77 brings the stop into the path of a forward row of bags while raising the foot 83 to release the row 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 belt 75 runs 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 units are limit switches 2LS, 3LS and 4LS which are closed by the presence of a bag 19 underneath it. One limit switch is provided for each file of bags, and switches may be removed or added to the apparatus in the event the number of files is varied. In the absence of a bag underneath a switch, the operation of the control circuit 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. It should be understood that the limit switches may be positioned depending upon the nature of the bag. If the bag is thick, the switches may be moved rearward to sense bags behind the check and release units. If, however, the bags are thin and easily crumpled, they may tend to "shingle" or ride up on each other and jam. If this type of bag is to be packed, the limit switches should be positioned near the check and release unit. This insures that a build-up or jam will not signal a "prime" some distance behind the check and release unit when in fact no bag is ready to be released.

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 (FIGS. 2 and 4) which form three channels 94 to guide the bags in proper alignment onto the upper trap 32 overlying the hopper and then channels may be provided if a different number of files is to be packed. The upper surface of the chute is preferably lined with nylon, Teflon or like low friction material. A safety guard 95 may be pivoted over the chute to cover it and a switch 1LS is positioned so as to be closed when the guard is in place. This switch is connected so as to prevent operation of the machine unless the guard is in position.

Immediately above the chutes are the friction wheels 30, one wheel corresponding to each chute channel 94. The wheels are fixed to a shaft 89 journalled 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 the 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 of the chute 31 at a speed sufficient to deliver it in a flat condition on the upper trap 32.

The Hopper

The hopper 33 is best shown in FIGS. 4–7 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 as well as varying row sizes and varying layer 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 bell crank lever 111 to a cylinder and piston 112. The piston and cylinder combination is operated by an electric solenoid, as will be later explained. Operation of the piston and cylinder causes the bell crank 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. 5). 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 a lower trap 35 formed by guillotine doors 114 which are actuated similarly to guillotine doors 110 through bell crank lever 115 and cylinder and piston 116. The actuation of the cylinder and piston 116 by an electric solenoid causes the bell crank 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. 6).

Immediately above the upper trap 32 is an adjustable stop 117 mounted on a rod 118 which is adjustably secured to the apparatus frame structure indicated at 105. The stop 117 positions the bags longitudinally with respect to the compartments 106 and is adjustable to provide proper spacing for one or more rows of bags in each layer.

Case Transfer Mechanism

Cases may be formed and presented under the hopper for loading by an suitable known automatic apparatus, not shown, such as structure driven by a clutch and brake cooperation and controlled by the control circuit as later described.

Alternate Embodiments

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 an alternative embodiment shown in FIGS. 8, 9, and 11A–11C, the accumulated bags are dropped from the hopper onto a platform and are then thrust transversely into a case lying on its side so that the bags in their final orientation will be on their side edges or end edges.

Referring to FIG. 8, 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 case 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. The case support 181 is pivotable about an axis 183 so that it can hold a case in position for filling, as shown in solid lines in FIG. 8, and then lower (phantom lines in FIG. 8) the filled case into an upright position and onto an appropriate take-away mechanism such as a conveyor 185. The pivotable case support 181 may be actuated by a known mechanical means such as by an air cylinder and piston 170 actuated by an electric solenoid of the control circuit, as will be described. The air cylinder is pivotally mounted and the piston rod pivotally connected to a lever 171 which is firmly attached to the support 181. When the piston is retracted, the lever pivots about axis 183 to in turn pivot the case support into a vertical position.

The case support is provided with case stop checks 179 which are controlled to hold the case in position against the force of the lateral insertion of bags. These case stop checks may be pivoted into an inoperable position so as to allow the case to be deposited upon an appropriate take-away mechanism. The case stop 179 may be pivoted by an air cylinder and piston combination 178 which may be pivotally mounted and is actuated by an electric solenoid to pivot lever 177 so as to pivot the case stop itself. Only one stop is shown; however, it is to be understood that a plurality may be provided and may be cooperatively pivoted by any appropriate means.

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. 8, bags are loaded into the hopper 33 in the manner described above until a full case load is received. Thereafter, the lower trap doors 35 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.

When the case is filled, the support 181 is pivoted to lower the case onto the appropriate take-away mechanism 185. 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. 8 is shown in FIG. 9. The principal difference between the two apparatus is that in FIG. 8 the bags are thrust into a case in a generally longitudinal direction and will stand on their end edges when the case is in an upright position. In FIG. 9, 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. 9, the 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 side walls 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. 8, the case is brought into position on its side 197 with 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. 9, 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 pivoted to an upright position, it will be observed that the bags will be stacked on their side edges. Mechanism 199 similar to that used in FIG. 8 pivots the loaded case to an upright position and deposits it upon a takeaway mechanism (not shown) which may be similar to the takeaway mechanism 185 of FIG. 8.

The control circuit for the bag packer of the preferred embodiment is shown in the circuit diagrams of FIGS. 10A–10D. For convenience of following the description, the lines on the ladder diagrams of the circuit have been numbered and reference will be made to those numbers and the prefix in parentheses in order to identify quickly the location of the relays or contacts. Numbers to the right of a particular line on the diagrams indicate the other lines where the various contacts of the relays or timers on that line may be found.

The relays or contacts used are of a type well known in the art, such as those manufactured by the General Electric Company, Allen Bradley, or Regent Controls. While a number of known actuators may be used to operate the movable elements of the bag packer, it has been found suitable to power the check and release unit, the upper trap and the lower trap by an air cylinder and piston combination as known in the art. These actuators are controlled by electric solenoids to open and/or close the various elements as will be described. It will be noted that some cylinder and piston combinations automatically return to their home positions while others must be controlled by their solenoids for movement in either direction.

In the general operation of both embodiments of the invention it will be understood that the solenoids, timers and relays are connected between positive and negative power sources and that manually operated switches or relay contacts are closed to energize the various solenoids, timers and relays.

Operation of the Preferred Embodiment

Accumulation

The preferred embodiment of the control circuit for the bag packer is shown in the circuit diagrams of FIGS. 10A–10D. To begin operation of the bag packer, the layer selector switch (L24–L27) is set for the desired layers, a pulse counter PC (L21) is set for the desired number of rows in each layer, and a switch 2PB (L3) is actuated to close its contacts, thus starting the motors of the apparatus. Electrical power is supplied from the motor circuit shown in FIG. 10A for clarity, through a transformer $T_1$.

Six motors are utilized in this embodiment, and while a number of suitable motors may utilized, the following have proved to be satisfactory. The filler conveyor motor MTR1 is a ⅓ horsepower, three phase squirrel cage motor. The elevator conveyor motor MTR2 is a ½ horsepower, 155 RPM concentric shaft gear motor. The check and release conveyor motor MTR3 is a ⅓ horsepower 56 RPM concentric shaft gear motor. The channelizer motor MTR4 is furnished with the channelizer unit. The case feed motor MTR6 is a ½ hor-

sepower, 1,800 RPM, squirrel cage flange mounted motor with clutch and brake, and the checkweight motor MTR5 is provided with the checkweight unit. A checkweight unit manufactured by Icore Industries of Sunnyvale, Calif. and known as Model No. CH 4–36 may be utilized if such is desired.

A first case to be filled is positioned under the hopper by actuation of switch 4PB (L5) which begins operation of the case feed motor MTR6 and by actuation of switch 5PB (L16) which, through (L18A, L44 and L46), initiates movement of the first case under the hopper by energizing a clutch as will be later described. After the packages have come onto the filler conveyor and up the incline, they are weighed at the checkweight station and divided by the channelizer and are conveyed by the conveyor belt 75 underneath the prime switches 2LS–4LS to indicate a "prime" condition and close the "prime" circuit through (L9) of the diagram. If more than three bags to a row is desired, a limit switch is provided for each file as stated. If less than three files are utilized, then one limit switch is held closed so that a "prime" condition can be signalled.

Switch 1LS (L9) is located so as to be closed by the positioning of a guard 95 over the chutes above the accumulator hopper 33. If this guard is not in operative position to cover the chute, switch 1LS remains open and a circuit cannot be completed through (L9) of the diagram.

After the bags back up behind the check and release mechanism 28 so as to close the limit switches and after a set time as determined by timer 1TR (L9), which is actuated by the circuit through (L9), the switch 1TR–1 (L11) closes.

It has been found that the use of electronic timers greatly decreases maintenance and downtime of the machine since there are moving parts such as the reeds of a normal reed-type switch. While any suitable electronic timers may be utilized, those manufactured by Regent Controls, Inc. of Stanford Conn. have proved useful. Timers 1TR, 2TR and 5TR are Regent Models No. TM 401D5S, timer 3TR is Regent Model TM 410D5S, and timer 4TR is Regent Model TM 2111D1S.

When switch 1TR–1 closes, current runs through (L11) via 1TR–1, the normally closed contact 6CR–1, normally closed contact 3TR–1 and the closed contacts 4TR–1 of reset timer 4TR energizing relay 1CR (L12) and timer 2TR (L13). The timer 4TR allows the circuit to close through it, but once it is interrupted, it will wait for a preset time before it will reclose again. This presents a subsequent check and release operation, where "prime" exists, before the upper trap has closed from its last movement to drop a layer of bags.

Energization of relay 1CR (L12) closes normally open contacts 1CR–1 (L13), locks in around the prime timer contact 1TR–1, and (assuming one row of bags to each layer) clocks the counter relay 2CRB (L16) through wire 19W, since timer 2TR (L13) has at the same time closed its contact 2TR–1 (L16). Of course, for the 2CRB relay (L16) to be energized in order to clock the timer, pulse counter contacts PC–1 must be closed. If each layer of bags is to have one row, then the pulse counter PC (L15) is set so that contact PC–1 (L16) is closed just after each release of bags from the check and release mechanism. Pulse counter PC (L15) is a pulse counter of the type well known in the art. Its function is to close its contacts PC–1 (L16) and PC-2 (L23) upon receipt of a set number of pulses. It can be seen that each time the contact 2TR– 1 (L16) is closed to energize the 2CRA relay (L17), a pulse of current is directed through the pulse counter PC. If two rows of bags for each layer is desired, the pulse counter is set to close its contacts upon receipt of two impulses. Thus each second time after the check and release unit is energized, the pulse counter closes its contacts, PC–1 (L16) to clock the binary counter, and its contacts PC–2 (L22A), to close a circuit to energize the dump gate or upper trap as will be explained. In this manner, the binary counter only counts each layer and not each release of a single row of bags, and the upper trap only opens when the desired number of rows have been released to it. In the following description the pulse counter is set for one row in each layer and contacts PC–1 and PC–2 close, just after each time the check and release unit is activated to clock the binary counter and to energize the upper trap. It will be noted that the pulse counter indirectly counts each check and release movement since it receives it pulse through a timer contact (2TR–1 (L16)) which itself is timed closed by the same circuit as that which energizes the check and release unit (wire 21W). When current is directed through (L11) and wire 21W, as indicated above, it energizes the electric solenoid 1SOL (L21) to operate the air cylinder and piston 79 which actuates the check and release unit via normally closed 2CRA–2 (L21). The stops 81 of check and release unit 28 will remain open while contacts 2CRA–2 remain closed, i.e. until timer 2TR times closed.

The coils of timer 2TR (L13) are connected to wire 21W which is connected to the power source through line 11. As soon as 2TR times closed, relay 2CRA (L17 and L18) picks up through closed 2TR–1 (L16) and the check and release gates close. This occurs since the normally closed contacts 2CRA–2 (L21) of relay 2CRA are opened, breaking the circuit to 1 SOL (L21). Activation of relay 2CRA also closes its normally open contact 2CRA–1 (L19) to energize timer relay 3TR (L19–L20).

With the contacts 2CRA–1 (L19) and PC–2 (L19) closed and, as a result of current through wire 21W, a solenoid 2A SOL (L22A) is energized to actuate air cylinder and piston 112 which causes the upper trap to open and then allow the bags that have just come down the ramp to fall into the accumulation hopper. Simultaneously, the coil of timer 3TR is energized and it will start to time. The contact of 3TR–1 is shown on line (L11). As long as 2TR–1 (L16) is closed, the upper trap is kept open through closed 2CRA–2 (L21). But as soon as 3TR times out, it opens its contact 3TR–1 (L11), and thereby drops out relay 1CR (L12) and timer 2TR–(L13). Contacts 2TR (L16) open and thereby drop out relay 2CRA (L17–L18) to return their contacts to the condition shown in the drawings. This also breaks one energization path to wire 19W by opening up 1CR–1 (L13), but an energization path to wire 19W is maintained through (L11). Since 2CRA–2 (L21) is normally closed, the upper trap or dump gate, by way of the solenoid 2B SOL (L23A), is energized closed when 2CRA (L17–L18) switches to its normal state, and power or current is available in wire 21W again through (L11). Thus, it can be seen that when 2CRA–2 (L21) is at its normally closed position and when power is available in wire 21W, the check and release gates 28 are opened and the upper trap or dumpgate 32 is closed (L23A). When 2CRA–2 (L21) opens and 2CRA–1 (L19) closes, the upper trap opens (L22A) but no power is available to the check and release gates through (L21) and they remain closed.

Timer 3TR (L19 and L20) is set so that, simultaneously, contacts 3TR–1 (L11) open and drop out the coils of 4TR, 1CR and 2TR. As soon as the coil of 2TR drops out, it opens its contact 2TR–1 (L16) which allows 2CRA (L17 and L18) to drop out again, which will of course immediately drop out timer 3TR again via contacts 2CRA–1 (L19), so that 3TR closes instantly as soon as it opens. Thus 3TR is opened for only a short time. This short delay is the reason timer 4TR is provided. It opens for an approximate time of one-tenth to one-fifth of a second and thereby allows these other timers a minimum time to reset so that they can repeat themselves.

At this point, a first drop, i.e. one layer of bags, has been made into the hopper and upper trap 32 is closed. If there is a primed circuit (2LS–4LS (L9) closed) at this time, 1TR–1 (L11) is closed and picks up 4TR, 1CR and 2TR. This will start the entire cycle over again for the second "count" or second layer of bags.

The counting of the layers is accomplished through relay 2CRB (L16). A reed type relay counter of the binary type is used and is shown for clarity at (L50–L61D). A counter made by Allen Bradley and listed as Model No. 1614 L has proven suitable. The counting is done through flip-flops designated as 1FF, 2FF, 4FF and 8FF. While the counter is wired in this em-

bodiment to set the packer up to load three, four, or eight layers of bags into a case, it can be readily appreciated by those of ordinary skill that it could be wired for selection of any variation in the number of layers to be packed by, for instance, setting up the desired numerical flip-flops to pick up the required relays. The counter will only be described as is necessary to the operation of the invention, it being understood that the counter itself is of a type known to those familiar with the art.

As soon as 2TR–1 (L16) is closed, which means that the upper trap opened to allow the first layer to accumulate, the coil of 2CRB (L16) is energized through closed contact PC–1 (L16). This causes 2CRB–1 (L50) to open, and 2CRB–2 (L53) to close. The count of one is then thereby placed into the counter at 1FF. The final count depends upon the position of the selector switch (L24–L27). As previously stated, it is positioned so as to select either three, four or eight layers. Thus the above cycle is repeated for either three times, four times, or eight times, depending on the count set.

Although the selector switch is shown (FIG. 10C) in its position for selecting four layers of bags, for convenience of description the circuit will be described as set for three layers of bags, for instance, with the selector switch connecting contacts D and D1 in line 24 to energize relay 3CR. The case is to be loaded when there are two layers in the hopper and one on top of the upper trap rather than with three in the hopper as shown in FIGS. 4, 5 and 7–9. When a count of two is present in the hopper, a check is made to determine that a case is ready to accept the load. This check does not vary the normal operation of the apparatus, the counting and gate movements continuing in the same manner. When the count of two is reached, flip-flop 2FF is energized.

The check is made as follows and is shown diagrammatically beginning at (L32). There is not a count of one so 1FF–1 (L32) is closed. Contacts 9CR–1 (L32) is closed since 9CR (L38) is energized whenever there is a count of two (2FF) and 9CR picks up through contacts 2FF–1. Relay contacts 3CR–1 (L32) is also closed because the selector switch (L24) is set for a count of 3. Relay 10CR (L39) is in its normal state so that its contacts 10CR–1 are normally closed. It will only pick up through 4FF–1 on the count of four on 4FF and since there is no count of four 10CR remains in its normally de-energized position. Relay contacts 13CR–1 (L32) are closed because relay 13CR (L31) only picks up on the count of eight which closes contacts 9FF–1 (L31) and since there is no count of eight on 8FF, 13CR (L31) will remain in its normally de-energized position. With these conditions met, an energization path is established through (L32) to relay 6CR which picks up or opens at the count of two.

The contacts 6CR–1 of relay 6CR are on (L11). Thus, before the third accumulation for the last drop begins, contacts 6CR–1 (L11) are opened. The only way current can get over to wires 19W and 21W to initiate the check and release and dumping operation for the last drop is to run through the "-closed by case in position" limit switch 6LS (L12) and by the "closed by case prior to loading" limit switch 8LS (L14). As best seen in FIG. 7, switch 6LS is located in a position such that it is activated by a case only when the case is in correct position to receive the bags dropping from the accumulator hopper. Switch 8LS is positioned to be activated by a case located in position to be next moved under the hopper. Both of these switches are closed by cases in their respective positions.

It will be readily appreciated that, for continued operation, the two cases must be in their respective positions. The first case must be in position to receive the bags from the accumulator hopper and there must be a case in position to be placed under the hopper when the first case is filled and moved. If one or both of these cases is not in position so that one or both of these switches is open, no current will be available to wires 19W and 21W and the check and release will not operate to release a row of bags, nor will the upper or lower trap open. This failsafe feature prevents the continued operation of the packer which would cause a load of bags to be deposited in the path of an empty case under the hopper and would jam the machine.

Relay 11CR (L28) has its contacts −1 (L12), −2 (L29), and −3 (L30) in their normal condition. This relay 11CR (L28) will pick up only after a case is loaded, as will be explained. Since a case has not been loaded, contacts 11CR–1 (L12) remain closed. Thus, where the cases are in their proper positions, there is a circuit via 6LS, 8LS and 11CR–1 to wires 19W and 21W and the last count is started. Once the last drop is made the count of three is completed and the next step is filling the case.

Case Fill

Relay 7CR (L35) has to be picked up to energize the lower trap 35 for the case fill via its contacts 7CR–3 (L23). It will be noted that solenoid 3B SOL (L22) is normally energized through normally closed contacts 7CR–2 (L22) to close the lower trap. Contacts 7CR–2 (L22) will open when 7CR (L35) picks up, so that the lower trap may be energized to open position. Relay 7CR (L35) will only pick up when the proper count is present in the hopper which can only occur when one of several circuit paths are completed through the various contacts of (L32–L37) so as to close a circuit or in effect generate a signal to energize relay 7CR. For a count of three, there must be a one and a two count on the binary counter. That means that 1FF–2 (L33), indicating a count of one, will be closed. Relay 9CR (L38), which will be energized to indicate a count of two is present because contacts 2FF–1 (L38) were closed so that contacts 9CR–2 (L33) will close. From these closed relay contacts (L33) current runs through wire 41W to (L35). Relay contacts 3CR–2 (L35) have been closed because relay 3CR (L24) was energized earlier by the desired position of the layer selection switch. As stated, this position of the layer selection switch is not illustrated on the drawing. Relay contacts 10CR3 are normally closed because a count of four has not closed the contacts 4FF–1 (L39) and the normally closed relay contacts 13CR–2 will be closed because we do not have a count of eight to close contacts 8FF–1 (L31) and thus 7CR (L35) is picked up. Relay 7CR has a set of contacts 7CR–3 (L23) to the solenoid (3A SOL) for energizing the air cylinder and piston 116 to operate the case fill gates or lower trap 35, and when these gates are opened, the load is dropped into the case. It will be noted that, since current for this operation is received through wire 21W, the opening of the lower traps occurs at essentially the same time that the upper dump gate (L22A) opens to allow the third layer of bags to fall into the hopper.

Relay 7CR also has some other contacts. The contact 7CR–1 (L15) closes, which will then cause relays 8CRA (L14) and 8CRB (L15) to pick up. These relays pick up since they are connected through normally closed relay contacts 12CR–1 (L14) of relay 12CR (L18A) which will not open contacts until 11CR–3 (L30) closes to energize timer 5TR (L30) to time closed its contacts 5TR 1 (L18A). Thus normally de-energized relay 12CR indicates that a case is still present in part of the case positioning mechanism. With contacts 1TR–2 (L15) closed, when contacts 7CR–1 close, relays 8CRA and 8CRB pick up. Relay 1CR had been previously energized because the cycling position had not yet changed, but as soon as timer 3TR times out, 1CR, 2TR, 3TR and 4TR drop out. When that happens, the normally closed contact 1CR–2 closes and allows 8CRA and 8CRB to pick up. Relay 8CRA closes its two sets of contacts. One set, 8CRA–1 (L14), locks around contacts 7CR–1 (L15) and another set 8CRA–2 (L28) completes a circuit to relay 11CR. When relay 11CR picks up, it locks itself onto its own contact 11CR–2 (L29) so it will stay picked up until limit switch 7LS (L28) is opened by a filled case moving away from the loading position or filling area under the hopper Switch 7LS is positioned so as to be opened by a case moving away from the hopper after it has been filled. As previously stated, relay 11CR also has normally closed contacts 11CR–1 in line 12 which forms a portion of the bypass around contacts 6CR–1 (L11). Relay contacts

11CR–1 (L12) thus remain open while the relay 11CR (L28) is picked up and current will not be conducted through the bypass (L12) until limit switch 7LS (L28) is opened by a case moving away from its loading position so as to drop out relay 11CR (L28) and thereby close contacts 11CR–1 (L12). The case's movement out of the loading area is thus checked to determine that it is not still sitting underneath the hopper and in a position to jam it if another fill operation was carried out.

At this time, the counter is reset to zero. Relay 8CRB has a set of −1 contacts (L50) and a set of −2 contacts (L52). The purpose of these two contacts is to reset the counter to zero on the next line. As is known, the counter is reset by making and breaking the circuit to it. Normally closed contact 9CRB–1 (L50) must open and reclose and normally open contact 8CRB–2 (L52) must close and reopen. The counter reset is tied in with the control circuit for moving the filled case. In order for a filled case to be moved, contacts 12CR–3 (L44) must be closed to energize 4 SOL (L43) to engage the clutch for moving the case away and additional contacts of 12CR–4 (L46) must be opened to de-energize 5 SOL (L45) to release the brake. As soon as 3TR–1 (L11) opens and allows 3TR, 4TR, 1CR, and 2TR to drop out, all of their contacts return to their normal home positions as shown. As relay 11CR (L28) picked up and closed its −3 contact (L30), it energized timer 5TR to time out. Timer 5TR has its contact 5TR–1 (L18A) and is timed to allow the lower trap or case fill gates a slight interval (about one-half second) to close before the filled case is moved in order to prevent tearing the open flap of the case. As soon as 5TR times out, it closes its contact on line 18A and picks up relay 12CR. As soon as relay 12CR picks up, its contacts 12CR–1 (L14) are opened, which now drops out 8CRB. Thus, the normally closed contact 8CRB–1 (L50), which had previously been opened, recloses and the normally open contact 8CRB–2 (L52) reopens. This completes the resetting of the counter.

In line 18B, contacts 12CR–2 close so that a circuit may be completed through the other half of 6LS, the "case in position" switch. As soon as the next case gets into position, 6LS (L18B) will be opened. This portion of the limit switch cases relay 12CR (L18A) to be dropped out (5TR has timed closed and reopened) which will then open and close respectively the contacts 12CR–3 (L44) and 12CR–4 (L46). As stated, when relay 12CR picked up, it energized 4 SOL (L43) to the clutch, which started to drive the case out and bring the new one in, and as soon as relay 12CR is dropped out, 5 SOL (L45) to the brake is energized and the clutch disengages. The circuit is now ready to begin the next count.

It will be appreciated that the movement of the filled case does not have to occur before the second drop of bags into the accumulator hopper. When the circuit is set for three layers of bags, no check is made for a case until the completion of the second drop, and the third drop is not started without a case present. Checking the position of a case ready to be filled at the end of the second drop allows the mechanism time to remove the filled case and reset the counter.

The circuit works on the same principle whether the circuit is set for three, four or eight layers. When set for four layers, a check for the case is made after the third drop and when you set for eight, a check for the case is made after the seventh drop. The check is made also regardless of the number of rows in each layer.

The flip-flops of the binary counter work in generally the same way for any set of layers. In each case, relay 7CR (L35) must be energized to in turn activate the lower trap or case fill gates 35. Where a count of four is set, another series of contacts in (L32–L37) is closed to activate relay 7CR. Flip-flop contacts 1FF–1 (L32) and relay contacts 9CR–3 (L36) are normally closed and are not opened since there is not a count of one on the counter. The contacts of relay 9CR (L38) are in their normal condition because there is not a count of two on 2FF to close its contacts 2FF–1 (L38), 4CR–2 (L36) is picked up and closed since the layer selector switch (L36) is closed to select a count of four, thus energizing relay 4CR (L26), 10CR–4 (L36) is closed since there is a count of four on 4FF closing its contacts 4FF–1 (L39) and 13CR–2 (L35) are in their normally closed state since there is no count of eight on 8FF, which leaves the contacts 8FF (L31) open. Thus a circuit is complete to 7CR (L35) via (L32) and (L36) and it is energized to close contacts 7CR–3 (L23) to energize 3A SOL and activate the lower trap 35.

Where a count of eight is set, still another series of contacts in lines 32–37 is closed to activate relay 7CR. Contacts 1FF–1 (L32) of flip-flop 1FF are in their normally closed condition since there is not a count of one to energize 1FF, contacts 9CR–3 (L36) are in their normally closed state since there is not a count of two on 2FF to close its contacts 2FF–1 (L38), contacts 5CR–2 (L37) are closed due to the position of the layer selector switch closing its contacts A and A1 (L27), contacts 10CRA–1 are in their normally closed condition since there is not a count of four in 4FF to close its contacts 4FF–1 (L39), and contacts 13CR–3 of relay 13CR (L31) which are normally opened are now closed since there is a count of eight in 8FF, closing its contacts 8FF–1 (L31). Relay 7CR is thereby energized to close its contacts 7CR–3 (L23) and draw in 3A SOL for the lower trap 35.

Thus, for any number of layers to be cased, the control circuit operates in essentially the same manner. The accumulation is begun if there is a prime signal at the check and release station. Each release of the final row of bags in a layer from that station is accompanied by a timed cycle allowing the upper trap to close before another release is made. The timing of this release and dump operation may be adjusted simply by varying the set time intervals of timers 3TR, 2TR and 1TR in order to achieve maximum efficiency of the whole apparatus.

Prior to the release of the last row of bags from the check and release mechanism, a check is made through switch 6LS to determine that a case is in position for loading and through switch 8LS to determine if a case is in position for insertion into the loading area upon removal of a filled case. If these switches are open, no circuit is made through the bypass around opened contacts 6CR–1 (L11) and the last drop and consequently the fill will not be made. This insures that a fill drop will not be made onto the case conveying apparatus when no case is present, and thereby cause a jam. It also insures that another case is ready to be moved into the filled area. At the end of the fill operation the counter is reset to begin another accumulation while the filled case is discharged and another moved into position.

Back-Up Control

A further circuit is provided for controlling the channelizer to divert all packages reaching it into an overflow bin, for instance. The channelizer is connected to receive a signal from a photo-electric signal generator 1PE (L47) physically located just upstream of the check and release station and prime switches, as shown in FIG. 1. The photoelectric signal generator is shown located to indicate a back-up extending to the upstream end of the belt conveyor and includes a common lamp and photocell. The photocell is connected to a timer such that, if the cell does not receive light for a set period of time (indicating no intervals between the bags and hence a back-up of bags at that point) the timer is operable to time closed a set of contacts 1PE–1 (L62) which conduct a signal to the channelizer. Upon receipt of this signal, the channelizer begins to divert bags onto an additional path and into an overflow bin, for instance.

The 1LS guard limit switch has one set of its contacts in (L64) of FIG. 10D. These contacts are normally open when the guard is in position over the chutes. If the guard is raised, these contacts close and thus also conduct a signal to the channelizer which will then divert packages into the overflow bin or other reception area. The other set of contacts of the 1LS guard switch are in (L9) and, as previously stated, are closed when the guard is in position so that a circuit may be made through the prime switches. Thus, if the guard is opened during the operation of the apparatus, the channelizer will begin to divert bags into an additional or overflow path and

the operation of the check and release unit and the upper and lower traps will cease at the end of the cycle the apparatus is performing, since 1TR (L9) will not begin to time (1LS (L9) is open) and thus contacts 1TR–1 (L11) will not close.

Furthermore, a variable number of photoelectric units could be connected in parallel between wires 4W and 61W (L64) and be physically placed at variable positions on the apparatus to detect undesired back-ups at any location.

It can thus be appreciated that the invention contemplates a bag packer of great versatility. An operator can select the number of layers to be packed in a case by merely selecting a switch position corresponding to the desired number. The number of rows of bags in each layer is selected by positioning a pulse counter to allow a selected number of rows of bags to accumulate in one layer on the upper trap before being dropped into the accumulator hopper. The number of bags in each row is controlled by programming the channelizer to divert an incoming file into the desired number of files by adjusting movable guides to accommodate the proper number of files and by providing a limit switch and a check and release unit for each file of bags. These latter changes may be accomplished by known mechanical expedients and preferably by means which allow the changes to be easily and quickly made.

Control Circuit for Bag Packers with Horizontal Transfer

The control circuit of the second embodiment operates in a manner somewhat similar to the circuit of the preferred embodiment.

In this embodiment, circuits are provided to control the operation of the ram which is operable to urge a "dump" of packages or bags into a case which is positioned to the side of the area immediately beneath the accumulator hopper. Means are provided for timing the ram's operation, for preventing a drop of accumulated bags until the ram is in its retracted position and for controlling the movable case support 181 and the case stop check 179. The cases to be filled are placed onto this stop as has been described and are pivoted into position for a fill in an area adjacent to the drop area immediately beneath the hopper.

It is to be understood that, while not diagrammatically shown, the motors for controlling the conveying portions of the bag packer are similar to those of the first embodiment and are similarly wired with the exception that no "case feed" motor is provided. Further, it is to be understood that the air cylinder and piston actuators operate in the same manner, i.e. actuated by an electric solenoid which is electrically controlled by the circuit. No checkweight device is utilized in this embodiment although it could easily be provided similarly to that of the first embodiment.

As shown in FIG. 11A, an electrical power source for the control circuit is provided through a transformer $T_2$ in the same manner as shown in FIG. 10A for the first embodiment. The channelizer control (L103) and a photo-electric back-up indicator 1PE (L104) are connected between the power leads 101W and 102W. The photo-electric back-up indicator 1PE operates in the same manner as in the first embodiment. The unit may be placed anywhere it is desired to receive a back-up signal. This photocell 1PE is connected to a timer such that, if the cell does not receive light for a set period of time (indicating a back-up at that point) it times closed a set of contacts 1PE–1 (L106) which conducts a signal to a relay 11CR (L106). Relay 11CR has a set of contacts in line 179 and is connected to the channelizer, such that, if the relay is closed, the channelizer will divert bags into a non-critical area such as an overflow bin, for instance. Additional photocell units may be connected in parallel to 1PE and positioned at predetermined points where a back-up signal is desired.

A limit switch 1LS has a first set of contacts 1LS–1 (L107) which are closed if the guard 95 is not in its proper position. If the guard is out of place, this switch will close and will energize relay 11CR (L106) to signal the channelizer to begin its diversion.

Thus, in the event that the guard is out of place or of a back-up which may cause the bag packer to jam if allowed to continue, the channelizer diverts bags off the normal route and into an overflow bin.

Accumulation

The accumulation cycle of this embodiment is somewhat similar to that of the first embodiment. FIG. 11B, depicts a layer selector switch (L148 and L149) for selecting either four or six layers of bags to a case. It should be understood that one of ordinary skill in the art may connect flip-flops of the counter to the required relays so as to give an operator a choice of a different variation of layers.

To begin operation of the apparatus, the layer selector switch is set to the desired number of layers, pulse counter PC (L131) is set to the desired number of rows in each layer, and switch 2PB (L110) is depressed to start the motors. For this description the pulse counter is set for one row in each layer. If the guard 95 is down so that a second set of contacts 1LS–2 (L115) of switch 1LS are closed, and if there are a "prime" number of bags at the check and release station so as to close the prime switches 2LS, 3LS and 4LS (L115), current then energizes timer 1TR which times closed its contact 1TR–1 (L120). Current then runs through normally closed contacts 12CR–1 (L120), timed closed contacts 1TR–1, normally closed contacts 4CR–1, normally closed contacts 3TR–1, and normally closed contacts 4TR–1. Timer 4TR (L120) allows the circuit to close through it but once it is interrupted it will wait for a preset time before it will reclose again. As in the first embodiment, this presents a subsequent check and release operation, where "prime" exists, before the upper trap has closed from its last opening to drop a layer of bags. Normally closed relay contacts 12CR–1 (L120) are provided so that the operation cannot begin unless the lower trap is closed as will be explained.

When current runs through (L120), relays 1CR (L124) and 2CRB (L130) are energized. Relay 1CR has a set of contacts 1CR–1 (L122) which close to provide a holding circuit around prime timer contacts 1TR–1 (L120). Relay 2CRB has two sets of contacts, –1 (L165) and –2 (L168) which clock the counter in a manner to be described.

Also, when the circuit is made through (L120), current runs through wire 122W and normally closed relay contacts 2CRA–1 (L127) and energizes the electric solenoid 3 SOL to operate the air cylinder and piston which actuates the check and release unit to release one row of bags down the chute and onto the upper trap. The check and release unit will remain open while contacts 2CRA–1 (L127) remain normally closed, i.e. until timer 2TR (L126) times out and opens its contacts 2TR–1 (L129). The coils of timer 2TR (L126) are connected to the power source through (L120) and wire 122W. As soon as 2TR times closed, relay 2CRA (L129) picks up through closed contacts 2TR–1 (L129), opens its contacts 2CRA–1 (L127), and allows the check and release gates to return to their home or closed position.

When contacts 2TR–1 close, a pulse is directed to pulse counter PC (L131). Upon receipt of a set number of pulses corresponding to the times 2TR–1 closes, pulse counter PC closes its contacts PC–1 (L130) to enable relay 2CRB to clock the binary counter and its contact PC–2 (L135) to allow the upper trap to open and drop the layer into the hopper in the same manner as described for the packer of the first embodiment. When the check and release unit closes, and as a result of the current through wire 120W and now closed contacts 2CRA–2 (L133) and PC–2 (L135), a solenoid 1 SOL (L135) is energized to actuate an air cylinder and piston combination which causes the upper trap to open and allows the bags that have just come down the ramp to fall into the accumulation hopper. Simultaneously, the coil of timer 3TR (L133) is energized and it starts to time. As long as TR–1 (L129) is closed the upper trap is kept open through closed contacts 2CRA–2 and PC–2 (L133), but as soon as 3TR times out it opens its contact 3TR–1 (L120) and drops out relay 1 CR (L124) and timer 2TR. Timer contacts 2TR–1 (L129) open to drop out relay 2CRA. This breaks the holding contact 1CR–1 (L122) to wire 120W and at the same time the contact to wire 120W

is again made (L120) by the closing of prime timer contacts 1TR–1. In this embodiment the upper trap is actuated to open through the energization of solenoid 1 SOL (L135). When this solenoid is not energized, the upper trap returns to its home or closed position. It will remain in this position while normally open contacts 2CRA—2 (L133) or PC–2 remain open. Thus, it can be seen that, when contacts 2CRA–1 (L127) are at their normally closed position and when power is available in wire 122W, the check and release gates are opened and the upper trap or dump gate will always remain closed (since contacts 2CRA–2 (L133) are open). When contacts 2CRA–1 (L127) open and 2CRA–2 (L133) closes the upper trap opens (if contact PC–2 is closed) but no power is available to the check and release gates and they remain closed.

Timer 3TR (L132) is set so that contacts 3TR–1 (L120) open and simultaneously drop out the coils of timers 2TR and 4TR, and relay 1CR. As soon as the coil of 2TR drops out, it opens its contact 2TR–1 (L129) and causes 2CRA (L129) to drop out again, which will of course immediately drop out timer 3 TR. Thus, timer contacts 3TR–1 close almost as soon as the timer 3TR is energized and are reopened almost immediately. The shortness of this delay is the reason that timer 4TR is provided. The timer is open for an approximate time of one-fifth to one-tenth of a second and thereby allows the other timers a minimum time to reset so that they can repeat themselves.

At this point a first drop (one layer of bags) has been made into the hopper and the upper trap is closed. If there is again a prime circuit existing via closed switches 2LS–4LS (L115), 1TR (L120) is closed and picks up 4TR, 1CR and 2TR. This starts the entire cycle again for the second row of bags.

The counting is accomplished through relay 2CRB (L130). The same Allen Bradley counter as described with regard to the first embodiment and with several improvements not directly connected with this invention, has proved satisfactory. The counting is done through flip-flops designated as 1FF, 2FF and 4FF. While the counter is wired for illustrative purposes to set the packer up to load four or six layers of bags into a case, it can be readily appreciated by those of ordinary skill in the art that it could be wired for selection of any variation in the number of layers to be packed, by for instance setting up the desired numerical flip-flops to pick up the required relays. Again, the counter will only be described as is necessary to the operation of the invention, it being understood that the counter itself is a type known to those familiar with the art.

As soon as 2TR–1 (L129) is closed, and where the last row is released so that pulse counter PC closes its contacts, which means that the upper trap opened to allow the first layer of bags to accumulate in the hopper, the coil of relay 2CRB (L130) is energized to cause 2CRB–1 (L165) to open and 2CRB–2 (L168) to close, thereby placing the count of one into the counter. The final count depends upon the position of the layer selector switch (L148 and L149). As previously stated in this particular illustration, it may be positioned to either select four or six layers of bags. Thus, the above cycle is repeated for either four times or six times. When the circuit is set for four layers of bags, for instance where the contacts of the layer selector switch (L148 and L149) are positioned to complete the circuit through (L148), the accumulated load in the hopper is to be dropped when there are three layers in the hopper and one on the upper trap. When a count of three is present in the hopper, a check is made to determine that the case is ready to accept the load. This check does not vary the normal operation of the apparatus, the counting and the trap movements continuing in the same manner.

The check is made as follows and is shown diagrammatically at line 141. Contacts 6CR–1 (L141) are now closed since the relay coil 6CR (L145) is not energized. Relay 6CR (L145) is not energized since normally closed 2FF–2 (L145) is open through the 2FF flip-flops which have a count of two. Contacts 3CR–1 (L141) are closed since the selector switch (L148) is closed and the coil of relay 3CR is thereby energized, and contacts 1FF–1 are closed since there is a count of one on the counter 1FF. The coil of 4CR (L141) is thereby energized and opens its normally closed contact 4CR–1 (L120). Thus, before the third accumulation and the last drop begins, 4CR is opened. The only way the current can get to wires 120W and 122W to initiate the check and release dropping operation for the last drop is to run through the "-closed by case in position" limit switch 6LS (L121). As best seen in FIG. 8, switch 6LS is located in a position such that it is activated by a case only when the case is in the correct position to receive the bags after they are dropped onto a platform beneath the accumulator hopper. For this purpose a guide (not shown) may be provided for the case flap, urging it into contact with switch 6LS. If this first case is not in the correct position, switch 6LS (L121) is open and no current will be available to run through wire 120W and 122W, the check and release will not operate to release a row of bags, nor will the upper or lower trap open. This failsafe feature prevents the operation of the bag packer from continuing. Such operation would cause a load of bags to be deposited in the drop area beneath the hopper and would cause the ram to shove the load of bags into an empty case supporting mechanism, thereby jamming the packer.

Accumulation Drop and Case Load

Relay 5CR (L144) must be energized in order to close and thereby generate a signal to initiate the drop of the accumulated bags into the drop area surface beneath the hopper and then cause energization of the solenoid 5 SOL to actuate the air operated ram to load the case. To energize 5CR, one set of contacts in series in lines 142 to 144 must be closed at a count of four. Contacts 4FF–1 are closed, indicating there is a count of four present on the counter and contacts 3CR–3 (L143) are closed since the position of the layer selector switch (L148) when a count of four is set picks up the coil of relay 3CR. Current is thereby conducted to relay 5CR (L144) which picks up and closes its contacts 5CR–2 (L146). Relay contacts 9CR–2 (L146) are normally closed and current is thereby conducted to the coil of relay 7CR and to the timer 6TR. Timer 6TR times closed its contacts 6TR–1 (L150) and that in turn picks up the coil of relay 12CR and simultaneously energized the solenoid 2 SOL, which actuates the respective air piston and cylinder to open the lower gate and drop the accumulated bags into the drop area. At the same time, 5TR (L149) is energized and times closed its contact 5TR (L153), which energizes the coil of relay 9CR. Normally open 9CR–3 (L154) is thus closed and the solenoid 5 SOL which actuates the ram or load pusher to begin its movement to shove the bags into an awaiting case is energized through either 5TR–1 (L153) or (L154). As soon as the loading pusher or ram hits limit switch 7LS (L154 and L155), the switch closes in (L155), opens (L154) and releases the solenoid 5 SOL from the current in (L154) (5TR–1 (L153) has now opened). When switch 7LS closes its contact in (L155), it picks up the coil of relay 10CR at the same time as the ram begins to retract or return to its home position. Simultaneously, the solenoid 6 SOL (L159) is energized through 8LS (L159) and now closed 10CR—2 (L159), which actuates the pivotable case support 181 to lower the case onto any suitable case take away mechanism.

The case support 181 may also be manipulated by an air cylinder or piston combination 170 which may be controlled by an electrically operated solenoid in much the same manner as the electronically controlled air piston and cylinder combination which actuates the traps. As soon as the case arrives at the takeaway mechanism it opens a limit switch 8LS (L159) which opens the existing circuit to relay 10CR (L155) and opens contacts 10CR–2 (L159). When the case passes the switch 8LS, its contact (L159) recloses. Since the ram has retracted, switch 8LS (L155) is now opened. It will be appreciated that, if switch 8LS is not opened, the case support will remain in its lowered position, switch 6LS will not be tripped, contacts 6LS (L121) will not close and thus the lower trap will not subsequently operate. Thus the packer will stop if there is the possibility of a filled case in such a position as to cause a jam in the filling area.

When switch 8LS (L159) is opened by a case at the takeaway mechanism, the circuit to the solenoid 6 SOL is interrupted and the case support returns to its home position. At this same time, relay 10CR (L159) is dropped out, closing its normally closed contact 10CR–1 (L152). For clarity, neither switch 8LS nor the takeaway mechanism is shown in the apparatus of FIG. 9; however, it will be understood that the switch is located so that the filled case actuates it upon being lowered and removed on the appropriate takeaway apparatus, which may be similar to that shown in FIG. 8.

A second set of contacts of switch 6LS (L152) are closed, since the contacts are only open when a case is in position. This energizes solenoid 4 SOL to actuate the air cylinder and piston 178 to open the case stop check 179. When a case is inserted into position on the case support, it opens contacts 6LS (L152), and the case stop checks return to their home in operative position to hold the case against the force of a subsequent load of bags being horizontally transferred into the case.

Relay 9CR (L153) has one set of contacts 9CR–2 (L146). When 9CR (L153) is energized through the closing in sequence of timers 6TR and 5TR, it opens its normally closed contacts in line 146. This opens the circuit to timer 6TR (L147), which allows contacts 6TR (L150) to open and thereby opens the circuits to the lower trap solenoid actuator, 2 SOL, the timer 5TR (L149), and relay 12CR (L150). When relay 12CR (L150) is de-energized, its –1 contacts (L120) reclose so that a subsequent accumulation can begin. It can readily be appreciated that, while the solenoid 2 SOL is energized to open the lower trap, relay 12CR is energized. Contacts 12CR–1 (L120) are thus open when the lower trap is open and a check and release operation cannot begin since no current is available in line 120. This feature assures that no accumulation can be attempted while the lower trap is open and thus that no single layer of bags will be dropped through the accumulation hopper onto the area below. Furthermore, since the contacts 9CR–2 (L146) are opened by the energization of relay 9CR (L153), no current is subsequently available to 5TR (L147) or to 7CR (L146) and contacts 7CR–1 (L147) are returned to their normally open position. Also, 5CR–2 (L146) is now open and will not be closed until there is another full count for a case load. This prohibits a circuit from being made through (L146) and positively prohibits a further actuation of the lower trap and case fill mechanism including the case support and the ram, until a new accumulation has been made.

Counter Reset

In order to reset the counter, relay 9CR (L139) must be energized to open its –1 contact (L165) and to close its –2 contact (L167) and then be de-energized to close and open these contacts respectively. Since contacts 1CR–2 and 9CR–1 (L139) are normally closed, when contact 5CR–1 (L139) closes, relay 8CR is energized to open and then close its respective contacts (L165 and (L167). Relay 5CR (L144) is energized to close its normally open 5CR–1 contact (L139) at the same time that it is energized to initiate an accumulation drop and case load, as previously explained. Thus, relay 9CR is energized to open contacts 8CR–1 (L165) and close contacts 8CR–2 (L167), respectively. When relay 9CR (L153) picks up as explained during the case load operation, its normally closed contact 9CR–1 (L139) opens, thereby dropping out relay 9CR and allowing the contact 8CR–1 (L165) to again close while contact 8CR–2 (L167) again opens. This completes the counter reset and it is thus in condition to begin the next count.

It can be appreciated from this description that the bag packer with the horizontal transfer provides the advantages of the packer of the first embodiment including the versatility of providing for a variation in the number of layers to be packed, the number of rows in each layer and the number of bags in each row.

From the foregoing disclosure of the general principles of the present invention and the above description of preferred and secondary embodiments, those skilled in the art will readily comprehend the various modifications to which the invention is susceptible. Accordingly, we desire to be limited only by the scope of the following claims.

Having specifically described our invention, we claim:

1. In a bag packing apparatus including a channelizer for directing bags from a single file into a variable plurality of files, a conveyor at the discharge end of said channelizer having overlying guides defining a plurality of channels, check and release means associated with each channel and an accumulator chamber downstream of said conveyor, an upper trap means to receive bags from said conveyor and thereafter drop them into said accumulator chamber, a means for transferring accumulated layers of bags into a case in proximity to said chamber and variable means for controlling the upper trap means and the transferring means to transfer a selected number of layers of bags into a case.

2. Apparatus as in claim 1 including second variable means for controlling the check and release means and the upper trap means to deposit one or more rows of bags upon the upper trap means before a layer comprised of the row or rows of bags is deposited in the accumulator chamber.

3. Apparatus as in claim 1 wherein the guides defining the channels are adjustable to define a variable number of channels and wherein the check and release means are adjustably mounted such that one check and release means is provided for each of the number of channels defined by said guides.

4. Apparatus as in claim 1 including variable means for electrically timing and actuating the operation of the check and release means and the upper trap means.

5. Apparatus as in claim 1 including first detecting means for sensing the presence of at least one bag in proximity to each check and release means, second detecting means for sensing the position of a case to be filled, third detecting means for sensing the position of a case next to be filled, and means for preventing continued operation of the apparatus when said first, second or third detecting means do not detect bags or cases in their proper positions.

6. Apparatus as in claim 5 including fourth detecting means for sensing an undesired back-up of bags at a predetermined point and means for diverting bags into an overflow bin in response to the detection of a back-up of bags.

7. Apparatus as in claim 1 wherein the transferring means includes a ram positioned to push a stack of bags dropped from the accumulator chamber into a case positioned adjacent an area beneath said chamber.

8. Apparatus as in claim 7 including means for actuating said ram a preset time after the bags are dropped from the accumulator chamber.

9. Apparatus as in claim 8 including means for supporting a case in its position to receive the stack of bags and for transferring said case onto a take-away mechanism.

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