Dec. 23, 1958 J. FRADENBURGH 2,865,262

FEEDER CUT-OUT FOR BOX MAKING MACHINE

Filed March 31, 1954 5 Sheets-Sheet 1

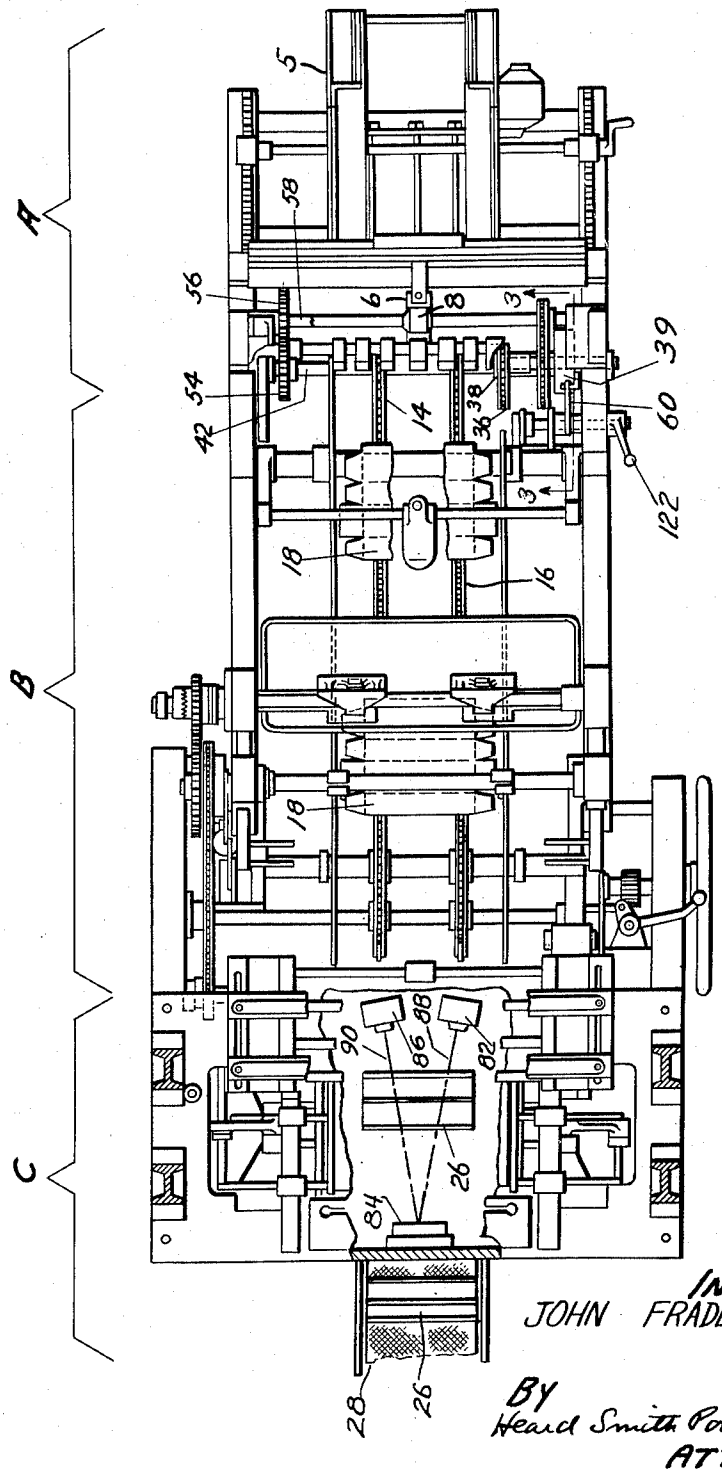


FIG. 1

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FEEDER CUT-OUT FOR BOX MAKING MACHINE

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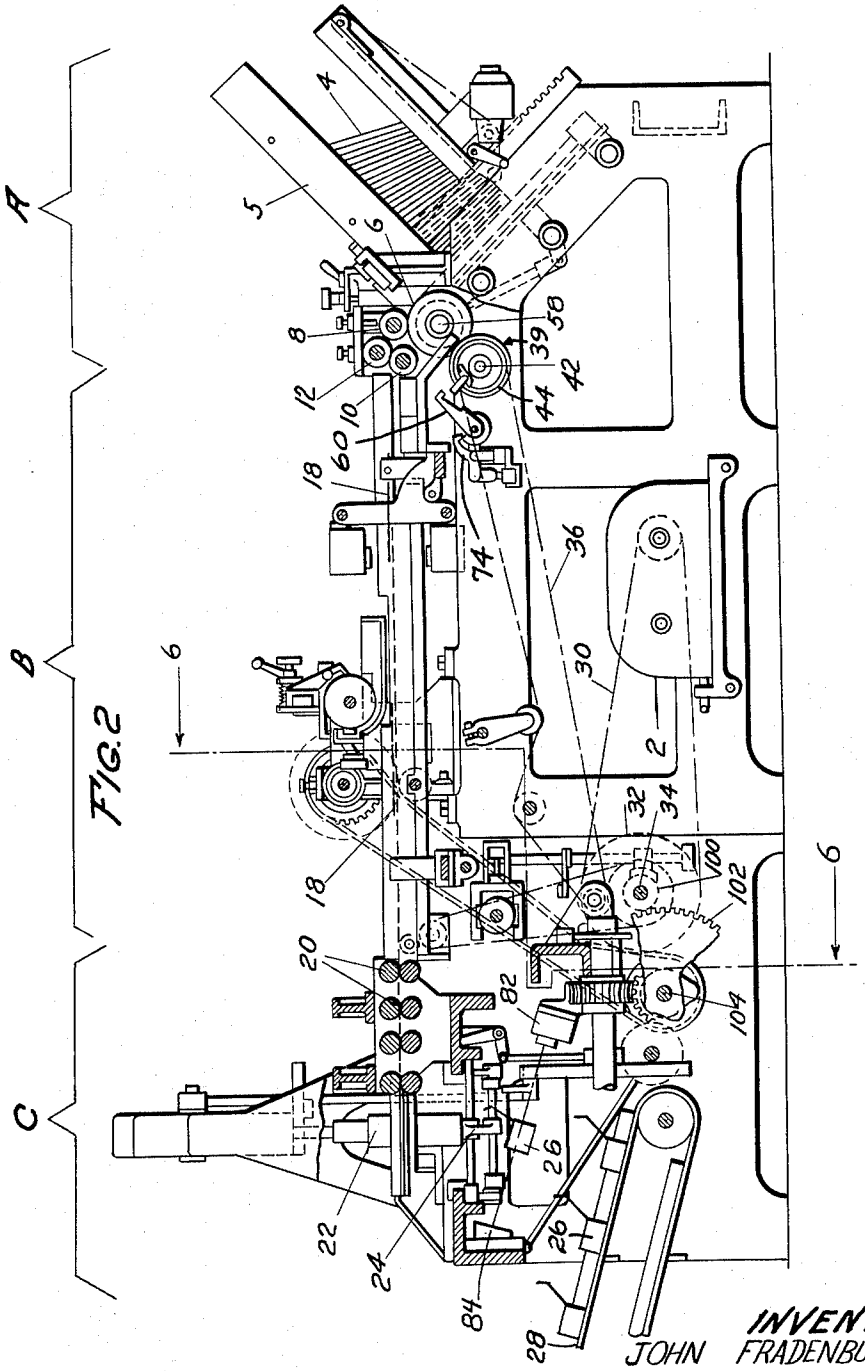


FIG. 2

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FEEDER CUT-OUT FOR BOX MAKING MACHINE

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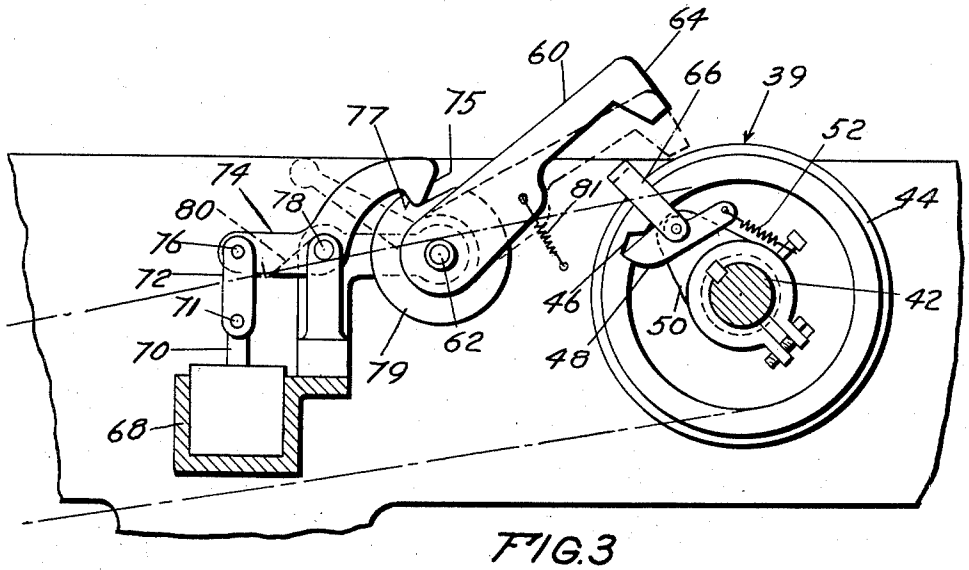


FIG. 3

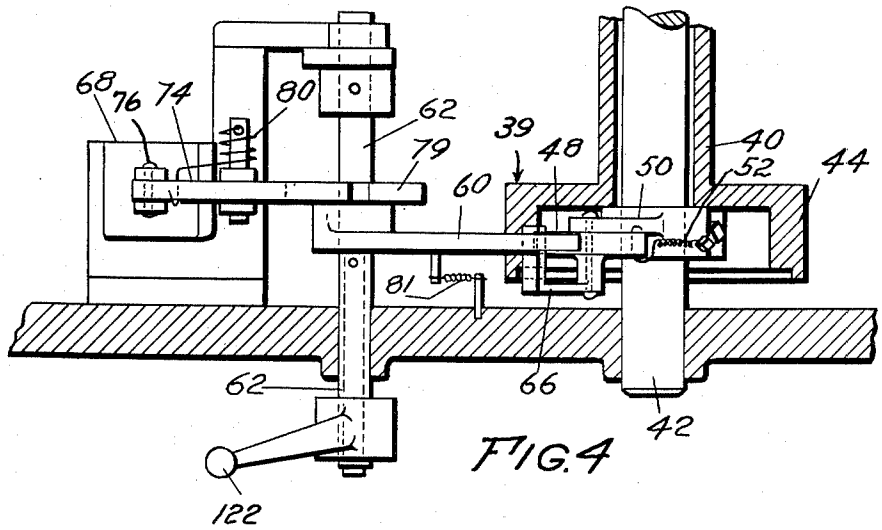


FIG. 4

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FEEDER CUT-OUT FOR BOX MAKING MACHINE

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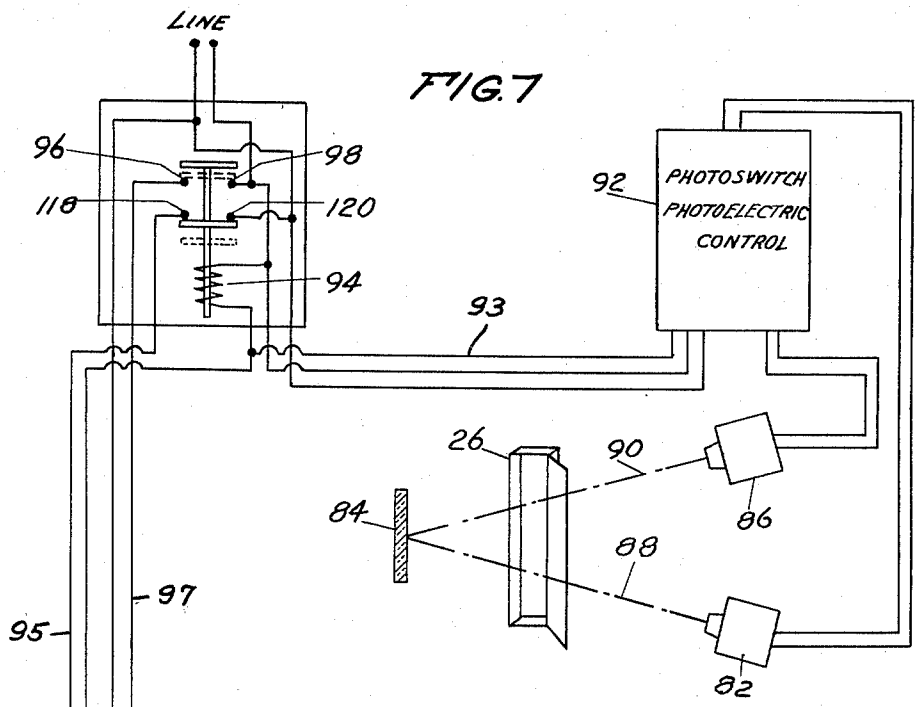


FIG. 7

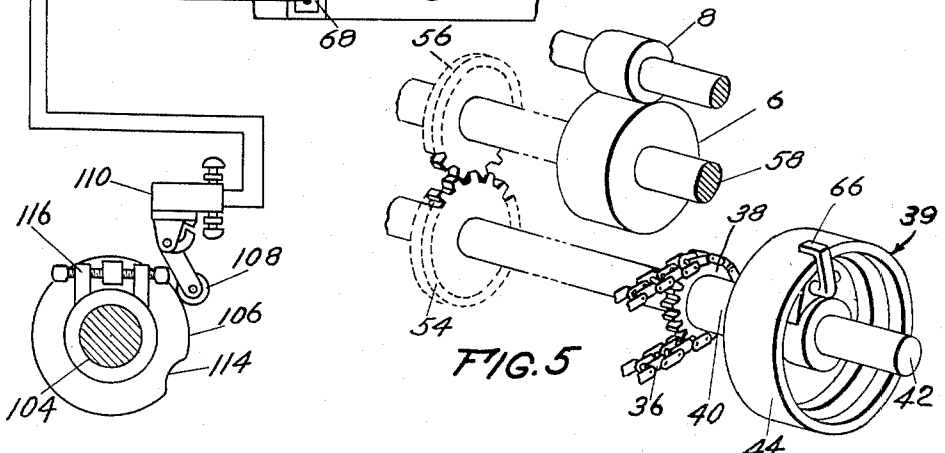


FIG. 5

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FEEDER CUT-OUT FOR BOX MAKING MACHINE

Filed March 31, 1954 5 Sheets-Sheet 5

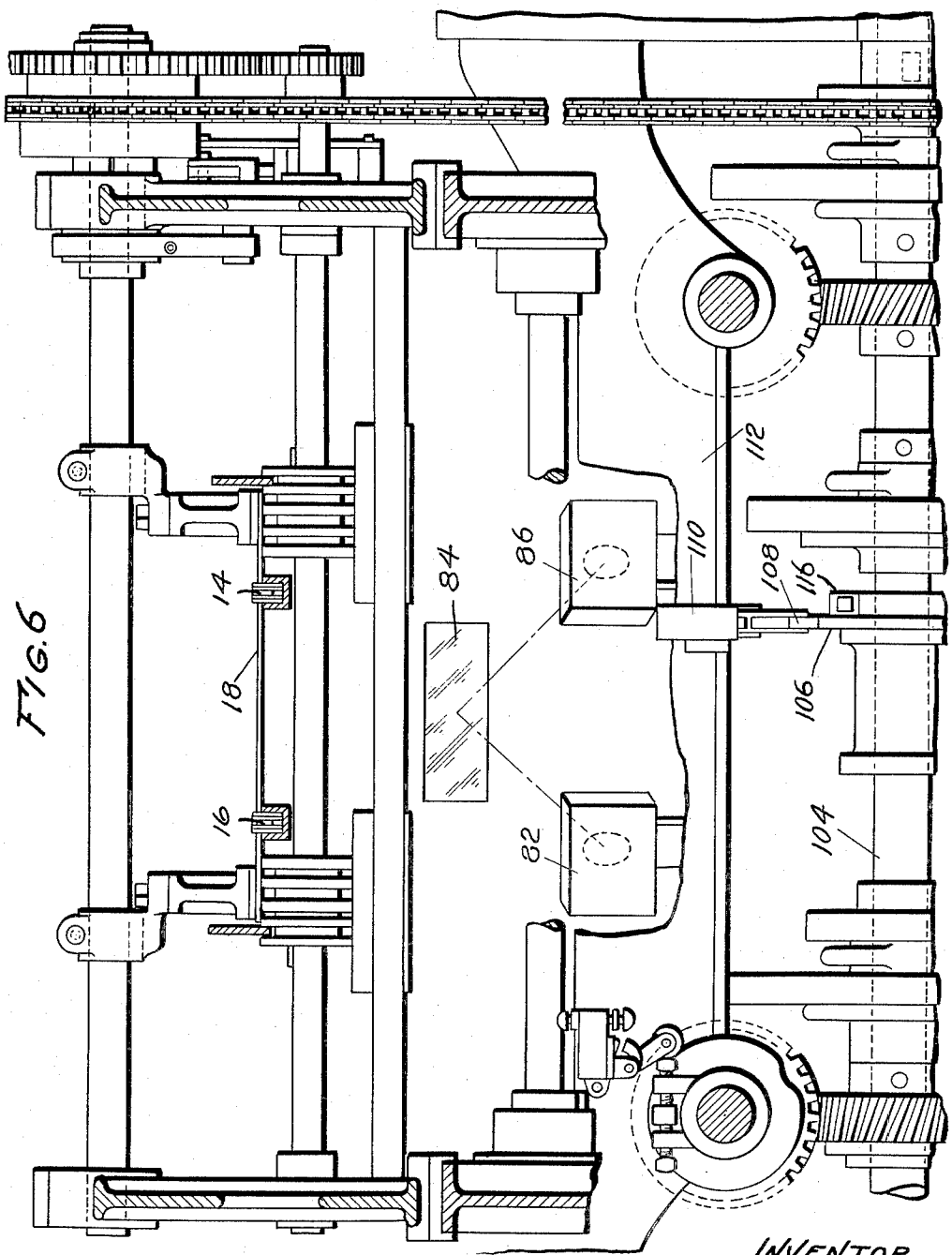


FIG. 6

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2,865,262

FEEDER CUT-OUT FOR BOX MAKING MACHINE

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Application March 31, 1954, Serial No. 420,023

1 Claim. (Cl. 93—36)

This invention relates generally to box making machinery and is particularly concerned with that type of box machine in which a flat pre-cut blank is fed through the machine and in the course of its travel glue is applied to appropriate portions of the blank after which the blank arrives at the forming mechanism where it is formed into box shape to be maintained in completed condition by the engaging glued areas.

Automatic box making machinery of this general type has been in use for many years and it may be said in general that such machines consist broadly of three principal stages—the feed mechanism, the glue applying mechanism and the forming mechanism. This present invention is concerned particularly with mechanism which will function to stop the operation of the feeding mechanism only if a completed box is not delivered in the usual sequence from the forming mechanism to the conveyer belt or other box receiving point.

Box making machines of the present type operate at very high speeds, producing completely formed boxes in excess of one hundred per minute. It occasionally happens that a box after having been formed on the plunger of the machine by conventional mechanism is not thereafter immediately freed therefrom in the normal manner and hence does not drop down from the plunger to the belt conveyer to be removed from the machine. When this happens, the next succeeding blank coming to the forming position is formed on the plunger around the previously formed blank which is still on the plunger. As a result a series of defective boxes may be produced, each succeeding blank building up on the others that are already on the plunger. The increase in thickness of the blanks piling up on the plunger would soon reach a point where the forming mechanism could be seriously damaged.

Accordingly, when a box has been formed on a plunger, but through failure of the stripping mechanism is not removed therefrom at the end of the box forming cycle the machine should be stopped so that the difficulty may be corrected. However, quick stopping of the operation of the entire machine might not be desirable because of the large inertia force present. The same safety precautions against building up too many blanks on the forming plunger may be obtained by stopping the feeding mechanism thereby to prevent further introduction of box blanks into the machine. If the feeding mechanism is stopped, only those box blanks that are already in the machine will travel on to the forming position. In the ordinary case, there will be no more than four blanks in the machine and if these should build up on the plunger at the forming position, no serious damage will occur. The machine may then be stopped in the normal manner and the defective blanks removed after which the machine can be put back into operation will all parts functioning in the normal manner. That is to say, the feeder will be restarted, the glue applying means will be reactivated and the forming mechanism will function again as soon as the next box blank reaches it.

The basic concept of the present invention contemplates the positioning of a light source and photo electric cell at a location below and to one side of the box forming plunger so that a box when properly formed and stripped from the plunger according to conventional procedures will fall through a path in which it will intercept the light source of the photo electric eye. The photo electric cell controls an electric circuit which operating in conjunction with a circuit controlled by a cam actuated switch will permit the feeding mechanism to continue in operation so long as a box is delivered properly on each cycle from the forming mechanism. If a box is not delivered on schedule, then the circuits under the control of the photo electric cell and the cam operated switch will function cooperatively to cause disengagement of a clutch so that the feed roll of the blank feeding mechanism is instantly brought to a halt so that no more blanks will be fed into the machine. After the difficulty at the forming mechanism has been corrected, the clutch is then manually reengaged to cause the machine to go back into normal operation.

It is therefore an object of the invention to provide a box feeding mechanism which is driven by means which includes a clutch controlled by electrical means which will function to disengage the clutch whenever a completed box fails to leave the forming mechanism in its proper sequence. Another object of the invention is the provision of cooperating circuits one under the control of a photo electric cell and the other under the control of a cam operated switch, each of which acts as a holding circuit for the other to keep the circuit to the clutch solenoid open at all times except when the circuits are both open at the same time brought about by the failure of a box to appear in the path of the photo electric cell light source on schedule.

These and other objects of the invention will become more apparent as the description proceeds with the aid of the accompanying drawings in which—

Fig. 1 is a plan view of a box making machine of the type in question including therein the feeding mechanism, the glue applying means and the box forming mechanism.

Fig. 2 is a side elevation of the machine shown in Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1 showing in enlarged detail the clutch mechanism which is thrown out when the light to the photo electric cell is not intercepted on schedule by a falling box through the failure of the forming mechanism to function properly.

Fig. 4 is a plan view of the apparatus of Fig. 3, with the clutch drum shown in section.

Fig. 5 is a view in perspective of the clutch drum and certain members associated with the shaft which carries the drum.

Fig. 6 is a section on the line 6—6 of Fig. 2 to enlarged scale.

Fig. 7 is a wiring diagram showing the position of the various elements during proper operation of the box forming mechanism and under which conditions the clutch of the feeding mechanism will remain engaged.

Referring to Figs. 1 and 2 the feeding mechanism is shown at that portion of the machine indicated at A, the glue applying mechanism at that portion indicated at B and the box forming mechanism at that portion indicated at C. The subsequent description will be concerned particularly with portions A and C in which the failure of a box to be delivered on schedule by the forming mechanism at portion C will result in the clutch of the feeding mechanism at the portion A being disengaged. It will be understood that the glue applying mechanism in portion B may take any desired form and has no relation to the present invention.

The entire machine is driven by a single motor shown at 2 in Fig. 2 which motor through suitable belting, pulleys, gears, chain drive etc. causes all of the parts to move in synchronized fashion in a manner well understood in the art. When the machine is running, box blanks will be taken off the bottom of the pile of blanks 4 located in the magazine 5 of the feeding mechanism by suitable feeding rollers 6, 8, 10 and 12 to be deposited in series on a pair of chain conveyers 14 and 16 (see Fig. 1) which are in continuous movement and function to carry the blanks so deposited thereon to the left through the structure of Figs. 1 and 2. The box blnaks, being indicated at 18, move past the glue applying station B and thence to the box forming mechanism where the blanks are first picked up by a plurality of feeding rollers 20 to be passed on to the box forming station 22 where each blank is formed one after the other according to known procedures on the plunger 24 after which the finished box is stripped from the plunger to fall downwardly as indicated at 26 onto the conveyer 28 to be carried away from the machine for subsequent use.

The feeding mechanism

The motor 2 shown in Fig. 2 drives, through the belt 30, pulley 32, shaft 34 and suitable gear trains, the details of which are not shown as they are conventional and well known, the chain 36 which drives a sprocket 38 mounted on shaft 40 which shaft is hollow and rotates on shaft 42. As can be seen in Fig. 3, a special clutch mechanism 39 is provided to connect shaft 40 with shaft 42. The drum 44 is integral with shaft 40 and has in its interior a notch 46. This notch is adapted to be engaged by a pawl 48 pivotally mounted on a short arm 50 keyed to shaft 42. The pawl 48 is urged clockwise by spring 52 and so long as it is in this position, clockwise rotation of the drum 44 will cause corresponding rotation of shaft 42. Upon disengagement of pawl 48 from the notch 46 which is achieved by turning the pawl counter-clockwise, shaft 42 will come to an immediate halt. Since shaft 42 drives the feed roll 6, it follows that when rotation of shaft 42 stops, feeding of blanks will cease.

Feed roll 6 is driven by shaft 42 in the following manner. As shown in Figs. 1 and 5, a gear 54 is mounted on the end of shaft 42 to be in engagement with gear 56 carried by shaft 58 on which is mounted feed roll 56. Therefore, if there is provided means for disengaging the clutch mechanism 39 just described, upon failure of a box to drop on schedule from the box forming plunger, the feeding of additional blanks into the machine will instantly be suspended. The means for causing the clutch 39 to become disengaged when a box does not drop on schedule will now be explained.

Referring to Fig. 3, an arm 60 is pivoted at 62. This has an overhanging end 64 which when in position to permit the clutch to be engaged will be far enough to the left to clear the end of lever 66 which is attached to pawl 48. When lever 60 is moved clockwise to the right, its overhanging end 64 will be engaged by lever 66 on its next turn-around, causing pawl 48 to be rotated counterclockwise to swing out of engagement with notch 46. So long as the hook end 64 remains in engagement with lever 66, the shaft 42 and the feeding roll will remain stationary.

The means for holding hook end 64 out of engagement with lever 66 when the machine is operating normally and for actuating lever 60 so as to cause its hook end 64 to engage lever 66 when a box is not delivered on schedule from the forming mechanism will now be explained.

Lever 60 is provided with a collar 79 having a shoulder 77 adapted to be engaged by overhanging hook or latch 75 of lever 74. Collar 79 is integral with lever 60. Secured to the other end of lever 74 is a link 72 which is pivotally connected to plunger 70 of solenoid 68. Plunger 70, link 72 and lever 74 are pivoted at 71, 76 and 78 respectively. A spring 80 urges lever 74 clockwise. When solenoid 68 is de-energized so that plunger 70 is allowed to assume its up position, lever 74 is urged clockwise by spring 80 so that its overhanging hook portion 75 engages shoulder 77 of collar 79 and holds lever 60 in its up position out of engagement with lever 66. When solenoid 68 is energized, plunger 70 is drawn to its down position, drawing link 72 with it. This causes lever 74 to rotate counterclockwise about 78, drawing hook 75 out of engagement with shoulder 77. Thereupon lever 60 is drawn clockwise by spring 81 into position to engage lever 66 to stop rotation of shaft 42.

The clutch can be re-activated manually by operation of lever 122 which when pulled counterclockwise causes shaft 62 to rotate in the same direction. As a result lever 60 moves away from clutch 39 causing its hook end 64 to become disengaged from lever 66.

The controlling circuits for solenoid 68 are shown in Fig. 7 to which reference is now made.

Attached to the frame of the machine as shown in section C of Figs. 1 and 2 is a light source 82, a mirror 84, and a photoelectric cell 86. These three elements are so positioned that when a box 26 is stripped from plunger 24 and allowed to fall downwardly toward conveyor 28, it passes through one or both of light rays 88 and 90 to momentarily break or interrupt the impingement of light on photoelectric cell 86. During the period between the departure of one box at the light intercepting position and the arrival of the next box on schedule, the passage of light will not be intercepted. So long as the light source 82 is blocked by a box 26 passing through the light rays, photo switch 92 will remain closed, thus energizing solenoid 94 to hold contacts 96 and 98 open. With contacts 96 and 98 open, solenoid 68 will be de-energized and lever 60 will be held to the left out of engagement with lever 66.

When a box is not intercepting the light from light source 82, photo switch 92 will be opened, and if switch 110 is also open, solenoid 94 will be de-energized, causing contacts 96 and 98 to close. When contacts 96 and 98 close, solenoid 68 will be energized and the clutch will become disengaged to stop rotation of shaft 42.

It will be understood that shaft 42 is to stop only when a box is missing in the normal sequence of boxes coming from plunger 24, and is not to be stopped merely because there is a space present between boxes falling in normal sequence. Accordingly additional mechanism is provided including switch 110 referred to hereinabove for causing solenoid 94 to be continually energized until such time as one or more boxes is missing from the normal sequence of boxes falling from plunger 24. As long as solenoid 94 is energized, solenoid 68 is de-energized and the clutch remains engaged.

The additional mechanism for preventing shaft 42 from being stopped when the light rays from source 82 are not interrupted because of the space existing between successive boxes falling in normal sequence from plunger 24 is shown in Figs. 2, 6, and 7. As shown in Fig. 2 motor 2 drives belts 30, pulley 32, gear 100, gear 102, and shaft 104 to which gear 102 is affixed. Referring to Figs. 6 and 7 it will be seen that shaft 104 has mounted thereon a cam 106 which is in engagement with follower 108 of switch 110 which is mounted on frame 112. Cam 106 has a depression 114 into which follower 108 drops on each revolution of the cam. Follower 108 is attached to the operating lever of micro switch 110, the switch being normally closed so long as follower 114 is on the high part of cam 106. Switch 110 opens when follower 108 drops into depression 114. The gearing that drives shaft 104 is so timed that there will be one revolution of cam 106 for each descent of plunger 24 and correspondingly one box will fall downwardly to intercept light rays 88 and 90 for each revolution of cam 106. Means 116 is provided for adjusting the position of cam 106 on shaft 104 so that switch 110 will remain closed dur-

ing the time interval that light from source 82 is not interrupted when boxes are falling in their normal sequence from plunger 24.

As a result of this construction solenoid 94 remains continuously energized so long as either the light of light source 82 is intercepted by a falling box 26 or the follower 108 is on the high part of cam 106, causing switch 110 to be closed. Under these alternating circumstances, contacts 118 and 120 are maintained closed with switch 110 providing a parallel circuit to keep solenoid 94 energized when the photo switch 92 is open during the absence of a box in the light path. The simultaneous opening of switch 110 and photo switch 92 can occur only when a box is not dropping in regular sequence from plunger 24.

When a box fails to leave the plunger on time to interrupt light rays from source 82, photo switch 92 of course remains open and the solenoid 94 therefore remains unenergized as far as photo switch circuit 93 is concerned. At this time, however, solenoid 94 is still energized by the parallel circuit 95 because follower 108 is still riding on the high part of cam 106 and contacts 118 and 120 are closed. In due course, however, as plunger 24 moves through its cycle in timed relation with shaft 104, cam 106 mounted on shaft 104 will rotate to a point where follower 108 will drop into depression 114. This opens switch 110, breaking circuit 95 and causing solenoid 94 to be de-energized, whereby contacts 96 and 98 close and contacts 118 and 120 open. This closes circuit 97 and causes solenoid 68 to be energized. When solenoid 68 is energized it draws plunger 70 to its down position, thereby causing lever 74 to be pivoted counter-clockwise about 78 and drawing hook end 75 out of engagement with shoulder 77. Thereupon lever 60 is pulled by spring 81 into position to be engaged by lever 66 to declutch shaft 42 and to stop rotation of feed roll 6. Depression 114 of cam 106 is so set with respect to shaft 104 that the declutching operation will occur immediately upon failure of a box to be stripped from plunger 24 on schedule and thereby fail to interrupt the light from light source 82 at the time follower 108 is in depression 114.

Upon the stopping of feed roll 6, no more blanks 4 will be fed to the box forming plunger 24. Those blanks already in the machine may accumulate on the plunger but will do not damage. The box forming mechanism is then stopped in the usual manner and the malformed blanks are removed from plunger 24. The machine is then restarted and clutch 39 reactivated by swinging lever 122 counter-clockwise. Feeding of blanks 4 from the magazine 5 will then be resumed upon rotation of feed roll 6 occasioned by reengagement of clutch 39. Lever 122 will be manually held to keep lever 60 disengaged from lever 66 until the boxes resume their normal falling from plunger 24 which occurs as soon as three or four blanks have been fed into the machine by feed roll 6.

As soon as the first box falls from plunger 24 to intercept the light from light source 82, circuit 93 will be closed to energize solenoid 94 thereby closing contacts 118 and 120. This instantly puts circuit 95 back in operation to hold contact 118 and 120 closed during the period of noninterruption of light source 82.

The energizing of solenoid 94 breaks contacts 96 and 98 and opens circuit 97 to deenergize solenoid 68 thereby permitting latch 74 to hold lever 60 in open position so that clutch continues thereafter in engaged condition until subsequent failure of a box to drop from plunger 24 on schedule.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. Therefore, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts specifically set forth hereinabove and that within the scope of the appended claim it may be practiced otherwise than as specifically described or illustrated.

I claim:

In a box making machine of the type described, means for feeding a succession of blanks at uniform intervals into said machine, means for driving said feeding means, a box-forming mechanism operable in timed relation to the feeding succession of blanks for forming each successive blank into a box, and means controlled by boxes leaving said box-forming mechanism for stopping said feeding means wherever said box-forming mechanism fails to deliver a box in predetermined sequence, said means for stopping said feeding means comprising a solenoid operated clutch mechanically connecting said driving means and said feeding means, said solenoid clutch being connected for energization under the control of two parallel circuits, one of said circuits including a photocell and a first switch controlled by said photocell, the other of said circuits including a second switch and means for mechanically opening and closing said second switch periodically in timed relation to said box-forming mechanism operation, said latter means being operable to open said second switch at the time a box is adapted to leave said box-forming mechanism, said photocell circuit including a photocell located on the output side of said box-forming mechanism and further including a light source positioned to direct a beam of light at said photocell across the path of boxes leaving said forming mechanism whereby said light beam is adapted to be interrupted each time a box leaves said forming mechanism and providing for the closure of said first switch in response to the interruption of said beam of light on said photocell for maintaining energization of said solenoid operated clutch, said photocell acting to open said first switch whenever said light beam shines on said photocell, said solenoid operated clutch functioning to stop said feeding means only when both of said switches are opened simultaneously.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,865,262 December 23, 1958

John Fradenburgh

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 23, for "wherever" read -- whenever --.

Signed and sealed this 31st day of March 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON

Commissioner of Patents