Jan. 1, 1957 O. E. COTE 2,776,224

METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

Filed Feb. 10, 1954 6 Sheets-Sheet 1

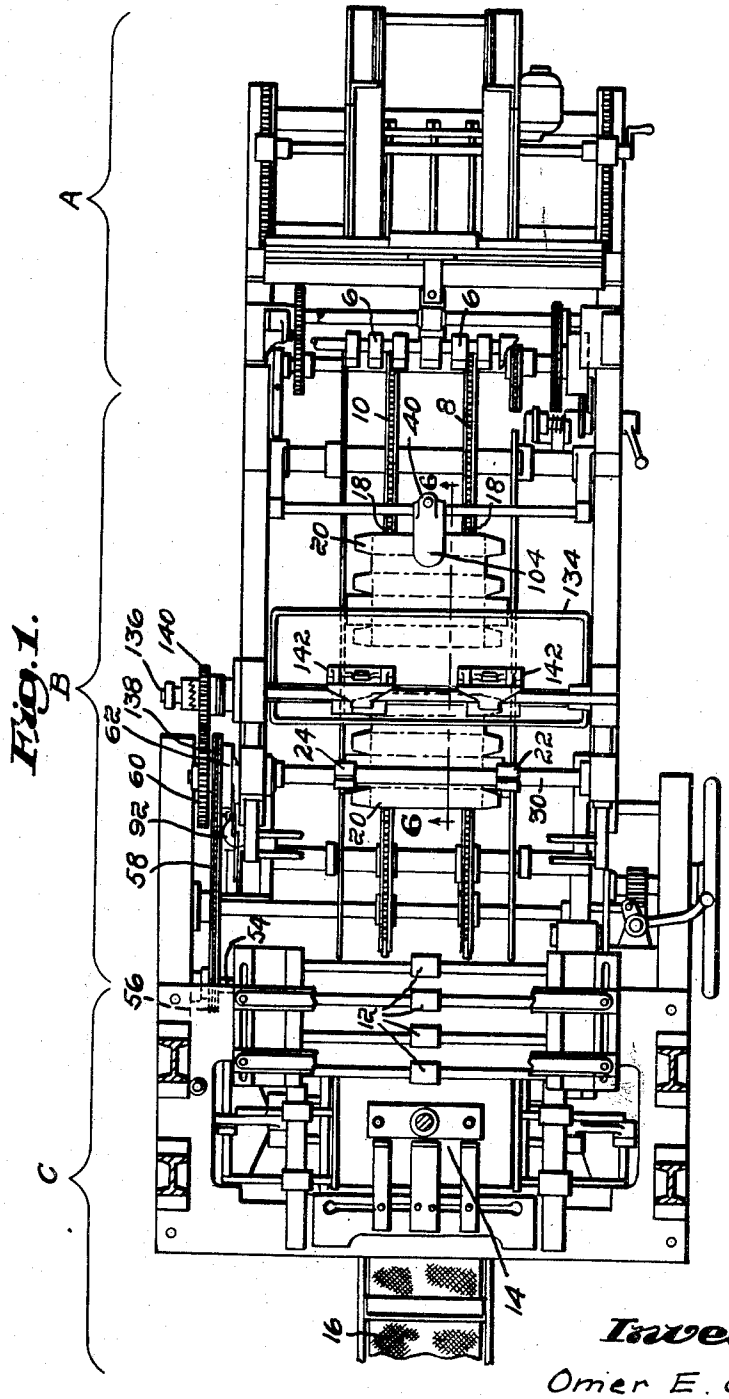

Fig. 1.

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METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

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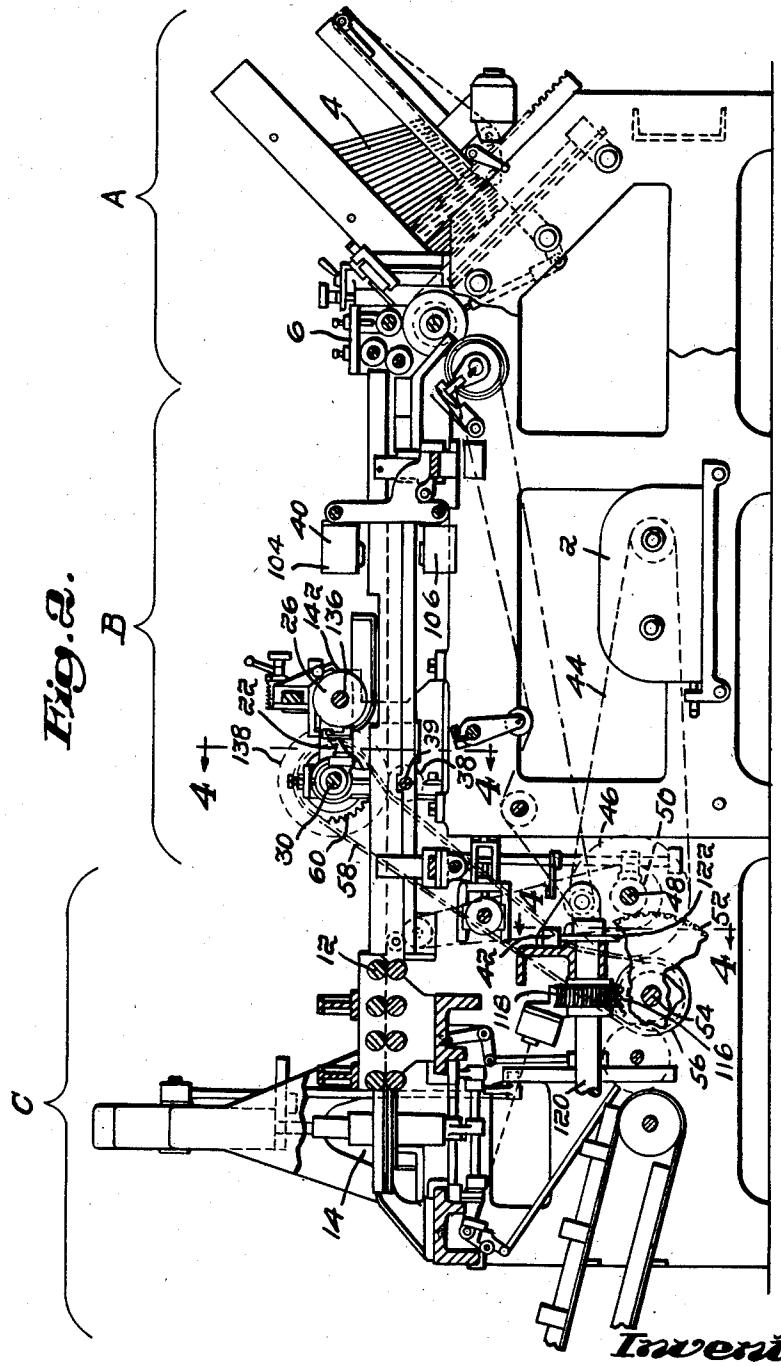

Fig. 2.

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METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

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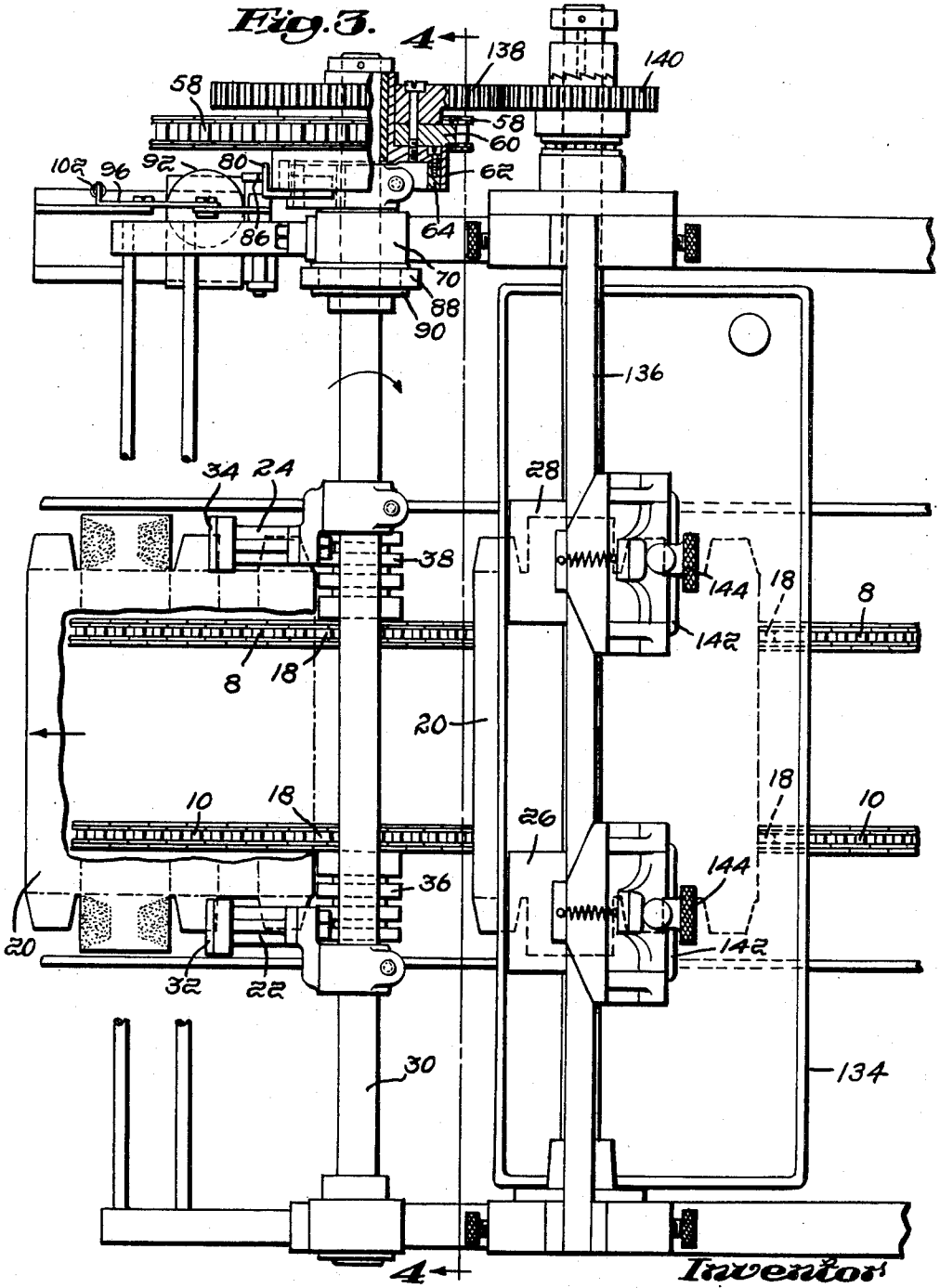
Fig. 3.



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METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

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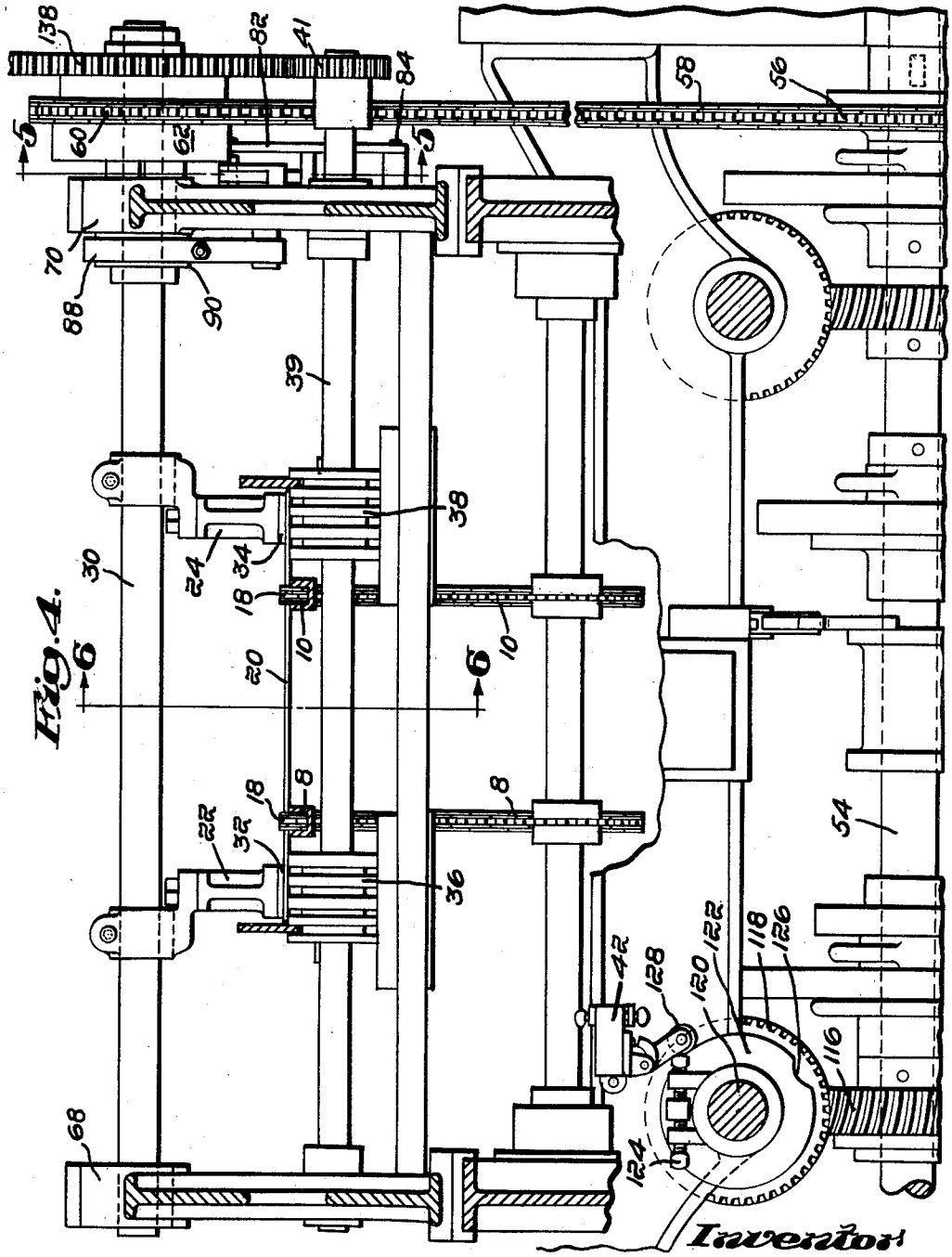

Fig. 4.

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METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

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Fig. 5.

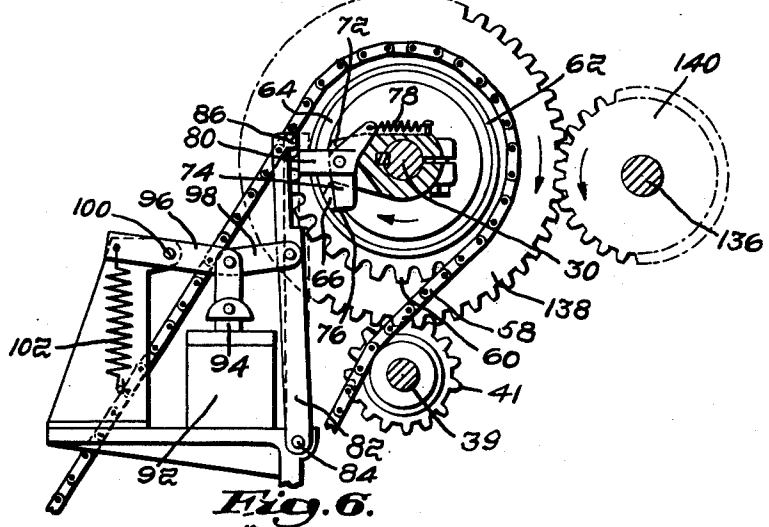


Fig. 6.

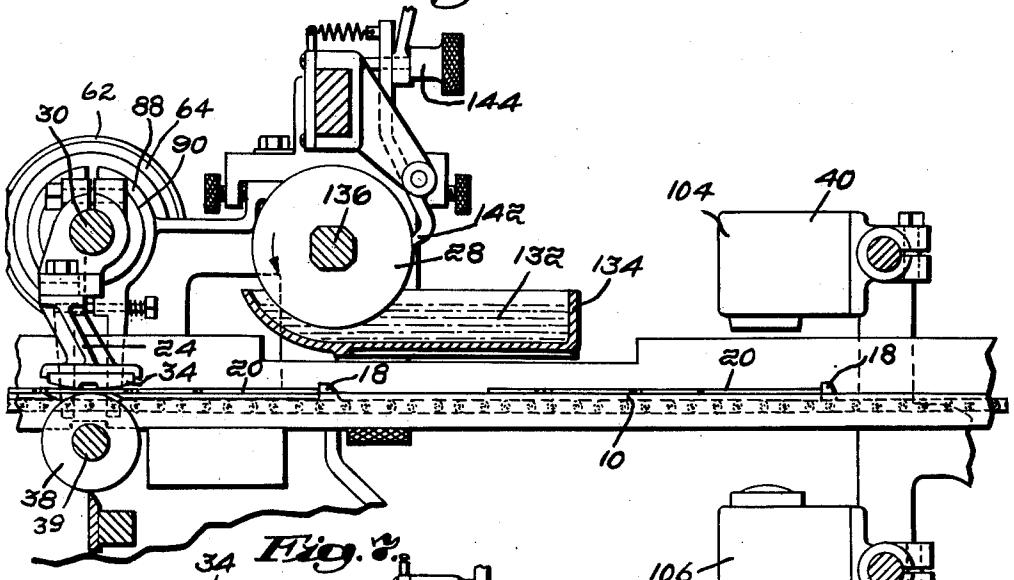
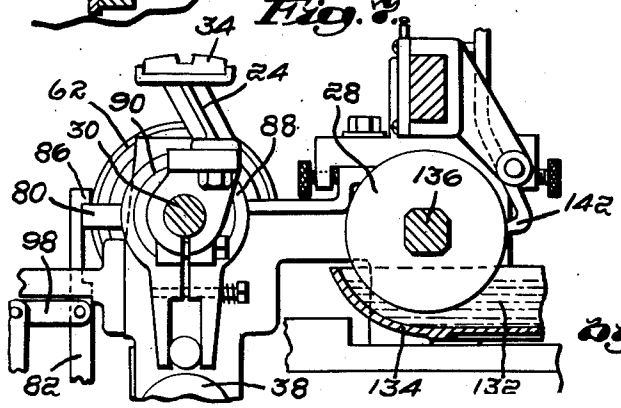


Fig. 7.



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METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

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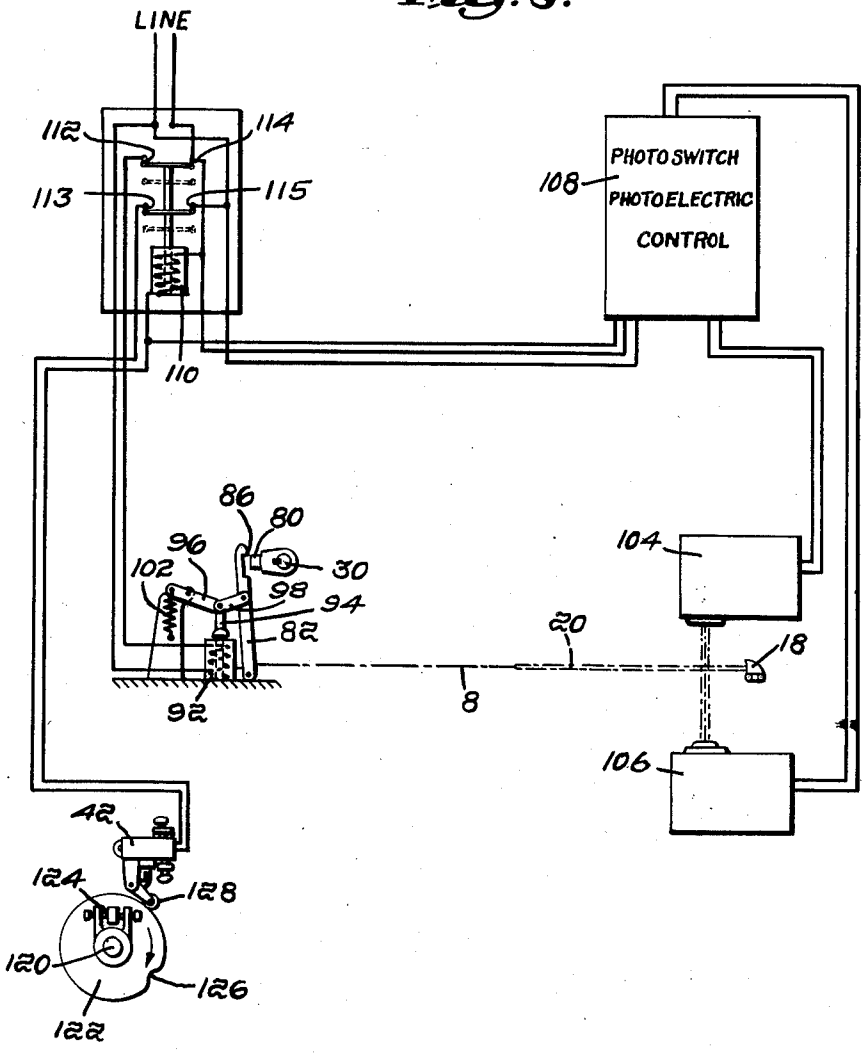
Fig. 8.



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United States Patent Office 2,776,224
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2,776,224

METHOD AND APPARATUS FOR SPOT COATING BOX BLANKS

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Application February 10, 1954, Serial No. 409,407

8 Claims. (Cl. 117—38)

This invention relates generally to box machinery and is particularly concerned with that type of box machine in which a flat pre-cut blank is fed through the machine and to which 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 this position by the engaging glued areas.

Automatic box 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 feeding mechanism, the glue applying mechanism and the forming mechanism. This present invention is concerned particularly with the glue applying mechanism and with special means for preventing the glue applying mechanism from functioning when a box blank is not present to receive the glue in the normal manner. The failure of a blank to appear in sequence occasionally happens when the feeding mechanism fails to deliver a box blank on time to the conveyor which would then normally carry such blank to the glue applying position and thence on to the forming mechanism.

In the machinery of the prior art, the failure of a box blank to arrive on schedule at the gluing station would have no effect on the glue applying mechanism. As a result those rollers over which the box blank passes at the time the glue is being applied would receive a thin layer of glue. The next box blank passing over these rollers would receive glue not only from the glue applying mechanism on the upper side of the blank but also from the roller on the under side of the blank to which glue had just previously been applied due to the failure of the previous blank to arrive on schedule. This would produce an imperfect box and in time after a number of failures of the feeder which is likely to happen in the course of an ordinary run, the rollers over which the blank passes at the gluing position would become so coated with glue that the machine would have to be stopped and these rollers cleaned. This would result in a serious loss of production to say nothing of the imperfect boxes created in the meanwhile.

Accordingly, an object of my invention is to provide mechanism which will result in the glue applying mechanism coming to a halt in the absence of a blank being present to receive the glue in the normal manner.

Another object of the invention is the provision of means which will cause the glue applying mechanism to go back into operation as soon as and only when the next box blank presents itself following any break in the sequence of the feeding of the blanks. The invention also contemplates the practice of the method involved.

Another object of the invention is to utilize in connection with the feeding mechanism of a box forming machine a photoelectric cell circuit so positioned and timed as to be able to cooperate with other mechanical means to maintain a clutch controlling solenoid circuit closed so long as box blanks appear in proper succession and to break such circuit when a box blank fails to appear on time to cause a clutch mechanism to function substantially instantaneously and thereby to stop operation of the glue applying mechanism.

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 and 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 an enlarged plan view of the central section of the machine shown in Fig. 1 and includes the glue supply means and the glue applicators.

Fig. 4 is an enlarged vertical cross-section taken on the lines 4—4 of Figs. 2 and 3 showing further details of the glue applicator mechanism.

Fig. 5 is a vertical section taken approximately on the line 5—5 of Fig. 4.

Fig. 6 is a vertical section taken approximately on the line 6—6 of Fig. 4 showing the gluing arms in the same position in which they are shown in Fig. 4. Fig. 6 is also taken to enlarged scale approximately on the line 6—6 of Fig. 1.

Fig. 7 is a view similar to the left hand portion of Fig. 6 but showing the gluing arm in stopped position which position is assumed and held whenever a box blank fails tao appear on schedule.

Fig. 8 is a wiring diagram showing the position of the various elements during proper operation of the feeding mechanism.

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 the glue applying mechanism and controls therefor shown generally at the portion B, with reference being made to the feeding and box forming mechanisms only so far as is necessary to an understanding of the operation of the glue applying mechanism.

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, so that when the machine is running a box blank from the pile of blanks 4 will be taken off the bottom of such pile and by suitable feeding rollers shown collectively at 6 will be deposited on a pair of chain conveyors 8 and 10 (see Fig. 1) which are in continuous movement and function to carry the blank so deposited to the left through the structure of Figs. 1 and 2, past the glue applying station B, and thence to the box forming mechanism where the blank is picked up by a plurality of feeding rollers generally referred to at 12 to be passed on to the box forming station 14 after which the box is arranged to fall on to the conveyor 16 to be carried away from the machine for subsequent use.

As can be seen in Fig. 6 the conveyor chains 8 and 10 have upwardly extending fingers 18 spaced longitudinally at suitable distances to receive the box blanks. These fingers 18 pick up the box blank after it has been carried to the chains 8 and 10 by the feed rolls 6. The box blank, one of which is shown for example at 20 in Fig. 1, moves steadily through the machine under the force applied by fingers 18 and, on reaching the gluing station B, glue is applied to appropriate end tabs by a pair of continuously rotating gluing arms 22 and 24 which have glue pads on the faces thereof adapted to pick up a proper supply of glue from the glue rollers 26 and 28.

The gluing arms 22 and 24 are carried by shaft 30 which under normal circumstances is rotating continu-

ously to cause the pads 32 and 34 of the arms 22 and 24 to apply glue to appropriate places on the box blank 20 as the box blank in the course of its travel passes over the rollers 36 and 38 which are directly under shaft 30 and the related gluing arms 22 and 24 when the latter are in lowermost position. Rollers 36 and 38 are on shaft 39 which is rotated by gear 41 in timed relation to shaft 30 to give pads 32 and 34 and rollers 36 and 38 equal circumferential speeds.

The spacing of the fingers 18 on chains 8 and 10 is such that a blank will be properly positioned on rollers 36 and 38 to receive glue from the arms 22 and 24 on each rotation of the shaft 30. If a blank should fail to be present on rollers 36 and 38 as the glue covered pads 32 and 34 pass thereover it is obvious that glue will be applied to the rollers 36 and 38. Then, when the next blank 20 arrives at this glue applying station the blank will receive glue on its under side from the rollers 36 and 38 as well as properly applied glue on its upper surface from the pads 32 and 34. This will result in a defective box.

Accordingly, as has been previously mentioned an object of this invention is to provide means for stopping rotation of the arms 22 and 24 whenever a box blank 20 does not appear at the gluing stations over rollers 36 and 38 on schedule.

This result is accomplished by the inclusion of a photoelectric cell mechanism 40 positioned along the line of travel of the box blanks 20 and a cam operated switch 42 which are arranged to cooperate to actuate a clutch mechanism shown generally in Figs. 3, 4, 5 and 7. Thus, if the blanks are advancing properly without any gaps in the blank sequence, the clutch will remain engaged to cause continuous rotation of shaft 30, but, on the other hand, if one or more blanks is missing in the sequence of advancing blanks a clutch mechanism will be disengaged to stop rotation of shaft 30 thereby to prevent glue from being applied to rollers 36 and 38.

The rotation of shaft 30 will not be recommenced until after the next blank appears at the photoelectric cell station 40. Upon the appearance of the next blank at station 40, the shaft 30 will then resume rotation so that glue will be applied in the normal manner by the arms 22 and 24 to this next blank as it passes over the rollers 36 and 38.

The driving mechanism for shaft 30

Motor 2 drives belt 44, pulley 46, shaft 48 and gear 50. Gear 50 in turn drives large gear 52 and its shaft 54. Shaft 54 on its far end has a sprocket 56 (see Figs. 1 and 4) which in turn drives chain 58 and sprocket 60.

The conveyor chains 8 and 10 are also driven by sprockets and chains running from shaft 48 so that there is a fixed relationship between the advance of chains 8 and 10 and one rotation of sprocket 60. The longitudinal spacing of the fingers 18 on the conveyor chains is arranged according to this relationship. In other words sprocket 60 will make one rotation as the fingers 18 advance the distance of their longitudinal spacing. Since the rotation of the gluing arms 22 and 24 are directly related to the rotation of sprocket 60 as will be more fully hereinafter explained, it will be apparent that the blanks carried forward by the fingers 18 will be engaged by the glue pads 32 and 34 of arms 22 and 24 at exactly the same positions on each rotation of the gluing arms.

Clutch mechanism between sprocket 60 and shaft 30

Referring to Fig. 5 sprocket 60 is shown driven by chain 58. This sprocket is mounted on suitable bearings and rotates continuously. Sprocket 60 has a drum 62 extending inwardly thereof (see Figs. 3, 4 and 5) and this drum has a liner 64 broken as at 66.

Shaft 30 carried by bearings 68 and 70 has one end thereof extending beyond the bearing 70 and within the confines of drum 62. Clamped to shaft 30 at this position and secured against rotation by being keyed thereon is the element 72 of such dimensions that it may rotate within liner 64 freely. Pivoted on the outer portion of element 72 is a pawl 74 having one end so shaped as to be able to make engagement with the end 76 of liner 64. The other end of pawl 72 is drawn by a tension spring 78 clockwise as shown so that under normal circumstances pawl 72 will be in engagement with end 76 of the liner 64. Thus, as sprocket 60 and attached drum 62 rotate clockwise as in Figs. 5, 6 and 7, pawl 74, element 72 and shaft 30 will likewise be caused to rotate clockwise.

Rigidly secured to pawl 74 is a lever 80 which extends radially outward past the side of drum 62. This lever is best seen in Figs. 3, 5 and 7 and has its outer end bent at right angles to overlie and be spaced from the surface of drum 62. Lever 80 in normal operation of the machine will be rotating continuously along with drum 62, pawl 74 and shaft 30.

A lever 82 pivoted to the frame of the machine at 84 has an overhanging end 86 which when in normal position as shown in Fig. 5 is outside the circular path of lever 80. When lever 82 however is moved to the right to the dotted line position shown in Fig. 5, the end 86 will come into the path of and stop lever 80 to cause the pawl 74 to be swung counter-clockwise about its pivot to free it from engagement with the end 76 of liner 64. That is to say, upon movement of lever 82 to the right, the lever 80 will be caught in its path of rotation to unclutch shaft 30 from sprocket 60 and these two elements will remain unclutched so long as lever 82 remains in right hand position. The result of declutching shaft 30 from sprocket 60 is to cause substantially instantaneous stopping of rotation of the gluing arms 22 and 24 which are carried on shaft 30.

To remove some of the braking load from lever 82 there is provided a brake 88 which is continuously applied to a brake drum surface 90 attached to shaft 30 (see Figs. 6 and 7). This braking force is adequate to cause substantially instantaneous stopping of shaft 30 when it is disconnected from sprocket 60 in the manner just explained.

Means for actuating lever 82

If lever 82 is actuated at a time when a blank is not coming forward to receive glue from the gluing arms 22 and 24, then it is obvious that the arms 22 and 24 will cease their rotation for so long as the arm 82 is held in right hand position of Fig. 5. The means for causing actuation of arm 82 in relation to oncoming blanks will now be explained.

The mechanical structure that operates lever 82 is a solenoid 92 which in the present case is normally energized to hold plunger 94 in down position. This in turn, pulls the toggle elements 96 and 98 downwardly. Element 96, pivoted at 100, has an extension connected to the tension spring 102 which spring is continuously urging element 96 counter-clockwise. Upon deenergizing of solenoid 92 element 96 will rotate counter-clockwise to raise plunger 94 thus moving lever 82 to the right to cause declutching of shaft 30. That is to say, so long as solenoid 92 remains energized shaft 30 will rotate with sprocket 60. When solenoid 92 is deenergized shaft 30 will immediately stop its rotation.

The explanation that will now follow will show how solenoid 92 remains continuously energized so long as box blanks come along the conveyor chains 8 and 10 in regular sequence but when a box blank is missing from the sequence, solenoid 92 will be deenergized thereby to stop rotation of shaft 30 and gluing arms 22 and 24 so that no glue application will be made during that period when a box blank 20 is missing in its passage over rollers 36 and 38.

Referring now to Fig. 8 the conveyor chains are indicated schematically at 8 and positioned thereon is a blank

20 propelled by fingers 18. Positioned above the space over which the blank travels is a light source 104 directed to impinge on a photoelectric cell 106. Whenever a box blank is passing between elements 104 and 106 the light will be intercepted. During the period between the departure of one blank and the arrival of the next, the passage of light will not be intercepted.

So long as the light source 104 is blocked by a blank 20 passing thereover the photoswitch 108 will be maintained closed thus energizing solenoid 110 to hold contacts 112 and 114 closed. With contacts 112 and 114 closed it is obvious that solenoid 92 will be energized and lever 82 will be held to the left out of engagement with lever 80.

When a blank 20 is not intercepting the light from light source 104, photoswitch 108 will be opened to cause deenergizing of solenoid 110 which will deenergize solenoid 92 by breaking contacts 112 and 114 and thus stop rotation of shaft 30.

However, it will be understood that shaft 30 is only to stop when a blank is missing in a sequence and is not to be stopped merely because there is a space normally present between the advancing blanks. Therefore means has been provided which will cause solenoid 110 and solenoid 92 to be continuously energized until such time as one or more blanks 20 is missing from the advancing blank sequence. This adidtional mechanism is shown in Figs. 2, 4 and 8.

As shown in Fig. 4, shaft 54 has mounted thereon a helical gear 116 which drives gear 118 mounted on shaft 120. Also mounted on shaft 120 is a cam 122 with means 124 for adjusting the angular position of the cam on the shaft. The cam 122 has a depression 126 into which follower 128 drops on each revolution of the cam. Follower 128 is attached to the operating lever of a micro-switch 42 which switch is normally closed so long as follower 128 is on the high part of cam 122 but which opens when follower 128 drops into the depression 126.

The gearing that drives cam 122 is so timed as to cause one revolution of cam 122 for each revolution of shaft 30.

The result of this construction is that solenoid 110 remains continuously energized so long as either the light of source 104 is intercepted by a blank 120 or the follower 128 is on the high part of cam 122 causing switch 42 to be closed and contacts 113 and 115 closed providing a parallel circuit energizing solenoid 110. Solenoid 110 will be deenergized only when the light of source 104 is not interrupted and the follower 128 is dropped into the depression 126 of cam 122. These last two mentioned conditions can occur simultaneously only when a blank 20 is not coming forward in regular sequence. When a blank fails to arrive on time to interrupt light source 104 photoswitch 108 opens thus breaking the circuit through that element that would otherwise hold solenoid 110 energized. At this time however, solenoid 110 is still held energized because follower 128 is still riding on the high part of cam 122 and contacts 113 and 115 are held closed. In due course, however, as the chains 8, 10 advance, follower 128 will drop into depression 126 opening switch 42 thus causing solenoid 110 to be deenergized to open contacts 112 and 114 and 113 and 115 to break the circuit through solenoid 92 to cause lever 82 to swing to the right to declutch shaft 30 thereby stopping movements of gluing arms 22 and 24.

Depression 126 is so set with respect to shaft 120 that the declutching operation will occur after gluing arms 22 and 24 have made only a partial rotation following their applying glue to the blank that was at the gluing station immediately ahead of the position of the now missing blank. As a result when the chains 8 and 10 advance to the gluing position with no blank thereon to be glued the arms 22 and 24 will be stationary in the position shown in Fig. 7.

As has been previously pointed out the contacts 112, 113, 114 and 115 are open after the solenoid 110 has been deenergized which occurs after the opening of switch 108 (which takes out the photoelectric cell controlled circuit) and the subsequent concurrent opening of switch 42 (which takes out the cam controlled circuit). With both of these circuits open, solenoid 110 is deenergized to cause the plunger of the solenoid to drop, opening contacts 112, 113, 114 and 115. Thereafter, further rotation of cam 122 causing switch 42 to close, will not result in reclosing the contacts 112, 113, 114 and 115 because as yet no circuit has been established through solenoid 110. These contacts can only be reclosed by the reappearance of another blank which will interrupt the light source 104 to close switch 108 which will energize solenoid 110 to close the contacts.

As a result of this arrangement should there be a plurality of blanks missing from the feeding sequence the repeated opening and closing of switch 42 will have no effect on solenoid 92 with the result that the lever 82 will remain constantly in its right hand position maintaining the pawl 74 in a position where it will be declutched from liner 64 of the drum 62.

When, however, the next blank interrupts light source 104, the switch 108 will close and thus reenergize solenoid 110 to close contacts 112 and 114 to energize solenoid 92 to swing lever 82 to the left out of engagement with the pawl lever 82. This permits spring 78 to urge pawl 74 clockwise so that as the gap 66 of liner 64 advances in its rotation it will come to a point where it will pick up the end 76 of pawl 74 thereby reinstating rotation of shaft 30 and the gluing arms 22 and 24. This reinstatement of rotation will occur in exact timed relation with the new blank which has intercepted light source 104 and this blank will be at the gluing station over rollers 36 and 38 when the arms 22 and 24 recommence their gluing movement so that glue will be applied to the appropriate positions of this next oncoming blank.

Glue applying mechanism

The conventional form of liquid glue 132 is provided in trough 134. Over the trough is a shaft 136 which carries the glue rollers 26 and 28. Shaft 136 is rotated by the gears 138 and 140, the first of which is affixed to sprocket 60 and the second to shaft 136 as shown in Fig. 5. Gear 138 also meshes with gear 41 which drives shaft 39 and rollers 36 and 38. Glue rollers 26 and 28 rotating counter-clockwise as viewed in Figs. 6 and 7 pick up glue 132 of which the surplus amount in scraped away by the scrapers 142 controlled by adjusting means 144. Pads 32 and 34, in their swinging movement, pick up adequate glue as they engage the rollers 26 and 28. The teeth ratios of gears 138, 140 and 41 are such as to produce equal circumferential speeds of pads 32 and 34, rollers 36 and 38 and glue rollers 26 and 28 so that there is rolling engagement between the pads and the glue rollers as the glue is transferred and then between the pads and blank 20 as the latter passes over the rollers 36 and 38.

It is my intention to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

I claim:

1. In a box making machine of the type described, means for continuously feeding a succession of uniformly spaced blanks, a rotatable gluing arm located at a gluing station for applying glue to each successive blank as such blank arrives at said gluing station, means for continuously rotating said gluing arm in synchronism with said feeding means, means for stopping the rotation of said gluing arm only when a blank is missing in said uniform sequence and means for restoring normal rotating motion of said gluing arm when the next sequential blank advances so that glue will be applied thereto upon its arrival at said gluing station.

2. The mechanism set forth in claim 1 in which the means for stopping and starting said gluing arm comprises

a solenoid operated clutch, said solenoid having its coil energized under the control of two parallel circuits, one of said circuits including a photoelectric cell controlled switch and the other circuit including a switch and mechanically operated means for periodically opening said switch for a predetermined interval of time, said solenoid operated clutch functioning to stop said gluing arm only when both the photoelectric cell controlled switch and said mechanically operated switch are open simultaneously due to the absence of a blank and said solenoid operated clutch acting to restore said gluing arm to operation only upon the subsequent closing of said photoelectric cell controlled switch caused by the presence of a blank at said photoelectric cell.

3. The mechanism set forth in claim 1 in which the means for stopping said gluing arm comprises a solenoid operated clutch, said solenoid being maintained in operation by either of two parallel circuits controlling the operation of said clutch solenoid, one of said parallel circuits including a first switch and a photoelectric cell for opening said switch in response to light received by said cell, the other parallel circuit including a second switch and mechanically operated means for periodically actuating said second switch, said photoelectrically controlled first switch being continuously open in the absence of a blank in the sequence of blanks and said mechanically operated second switch opening for a short period in timed relation to the blank feeding mechanism, rotation of said gluing arms being stopped whenever both said switches are open at the same time.

4. In a machine of the type described mechanism for applying glue at identical places to box blanks as said box blanks advance in succession to a gluing station, said means comprising a continuously moving conveyor for advancing a series of blanks in uniform predetermined spaced relation, means for feeding blanks successively onto said conveyor, said feeding means operating in synchronism with said conveyor, a shaft having a gluing arm thereon and rotating in timed relation to said conveyor, means for applying a limited quantity of glue to said gluing arm on each rotation of said gluing arm, continuously rotating drive means for said shaft timed with respect to said conveyor, a clutch between said drive means and the said shaft, said clutch normally being engaged continuously as said blanks are advanced in said predetermined sequence by said conveyor, means for actuating said clutch to stop said gluing arm in the course of its next rotation after having applied glue to a blank at said gluing station if the next blank that would normally be present on said conveyor to arrive at said gluing station is missing, said clutch actuating means remaining inoperative if said next blank appears on schedule at said gluing station, and means for restoring rotation of said gluing arm in timed relation with said carrier when the next box blank appears in position on said carrier whereby said gluing arm will apply glue to said next blank at the proper position when said blank reaches said gluing station.

5. The mechanism set forth in claim 4, said clutch being actuated by a solenoid which is caused to be disengaged by the joint opening of a photoelectric switch positioned in the path of oncoming blanks and mechanically operated switch timed with respect to said conveyor.

6. The mechanism set forth in claim 5, said clutch comprising a movable finger on said shaft, means normally urging said finger into engagement with a finger receiving element on said drive means and a lever actuated by said solenoid upon the joint opening of said switches to move said finger from said receiving element, thereby to free said shaft of said drive means.

7. The mechanism set forth in claim 4, said means for actuating said clutch comprising a solenoid, a lever actuated thereby, a disengageable driving finger between said drive means and said shaft, said lever when actuated by said solenoid causing disengagement of said driving finger, said solenoid having a control circuit which is maintained closed by two other parallel circuits one of which opens and closes as blanks move in series past a photoelectric cell and the other opens and closes under the influence of a cam operated switch geared to the blank movement, said parallel circuits arranged so that both of said circuits cannot be open simultaneously so long as blanks are being fed in proper sequence, said cam operated switch opening while said photoelectric cell controlled circuit is open due to the absence of a blank, said simultaneous opening of said parallel circuits causing said solenoid to function to cause disengagement of said clutch.

8. A method of applying glue to selected portions of a series of box blanks moving in predetermined spaced relation to each other, comprising the steps of continuously swinging a glue applying arm at a constant rate in a fixed circular path, applying glue to said arm during each revolution of said arm, feeding a blank against and tangent to said arm and at a speed equal to the peripheral speed of said arm, stopping said arm in the course of its rotation if the next oncoming blank would not be in position to engage said glue applying arm in the course of its normal continuous rotation, and restarting the rotation of the said arm to engage properly the next oncoming box blank.

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