June 16, 1959 E. A. BAILEY ET AL 2,890,630

PAPER BOX MACHINE

Filed March 28, 1956 6 Sheets-Sheet 1

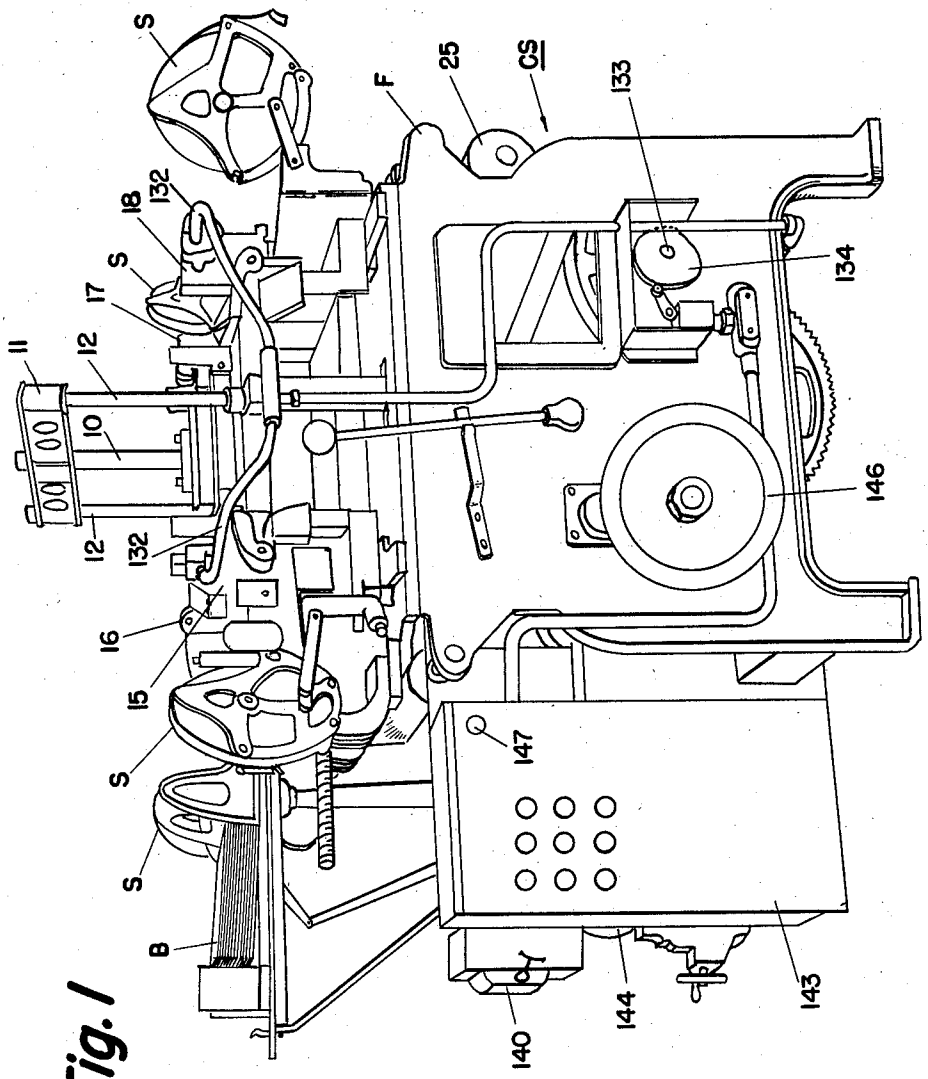


Fig. 1

June 16, 1959 E. A. BAILEY ET AL 2,890,630

PAPER BOX MACHINE

Filed March 28, 1956 6 Sheets-Sheet 2

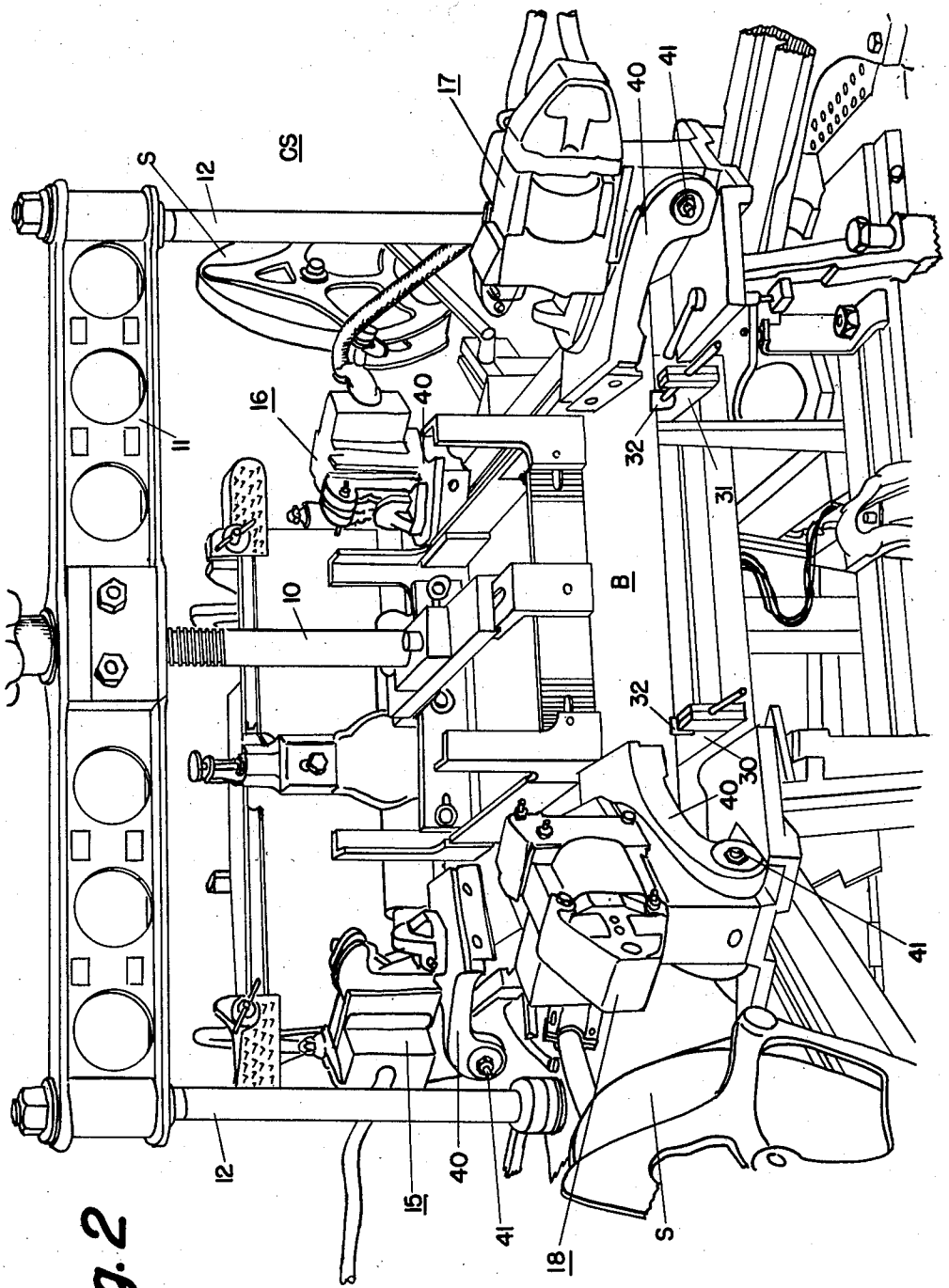


Fig. 2

June 16, 1959 E. A. BAILEY ET AL 2,890,630

PAPER BOX MACHINE

Filed March 28, 1956 6 Sheets-Sheet 3

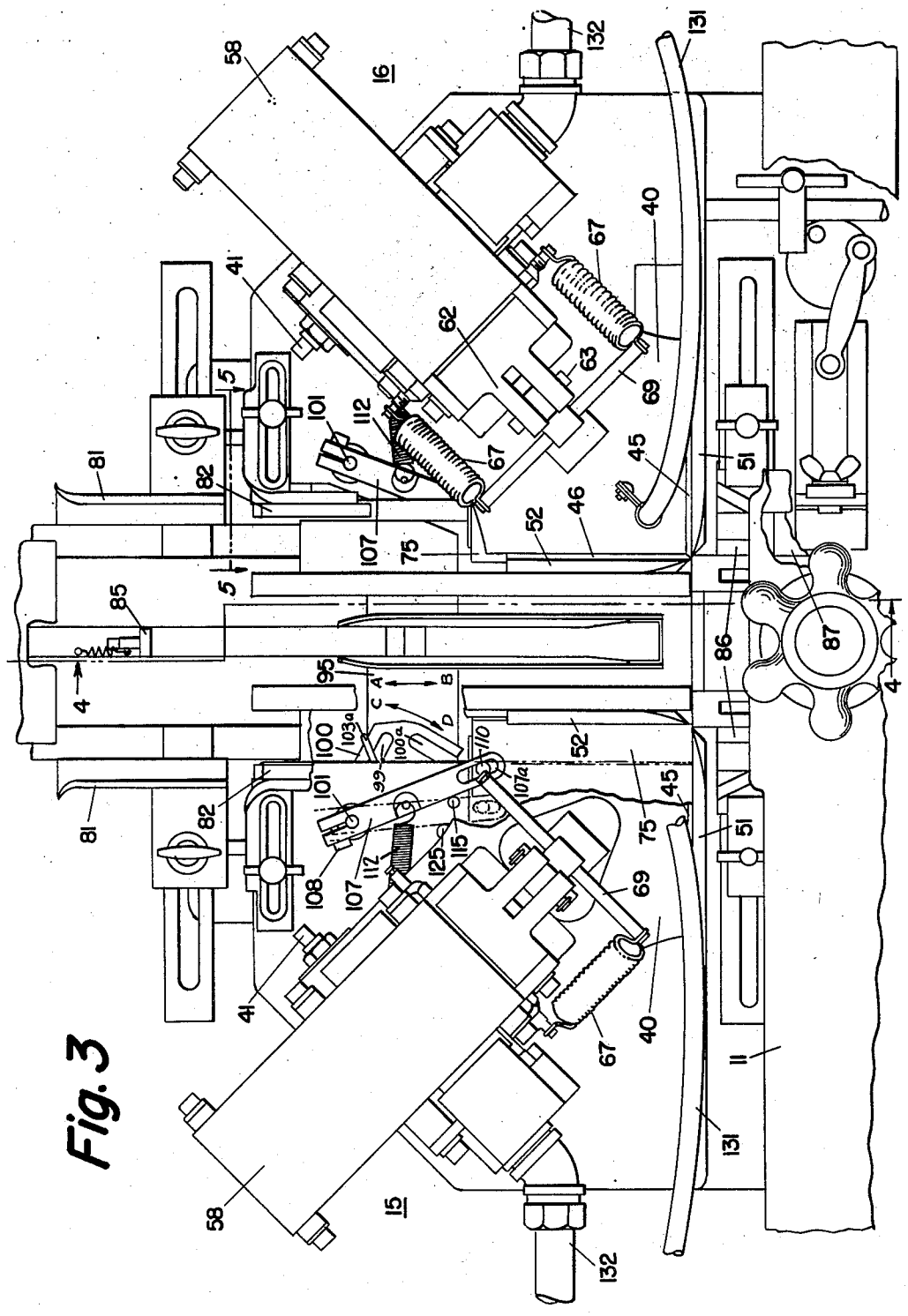


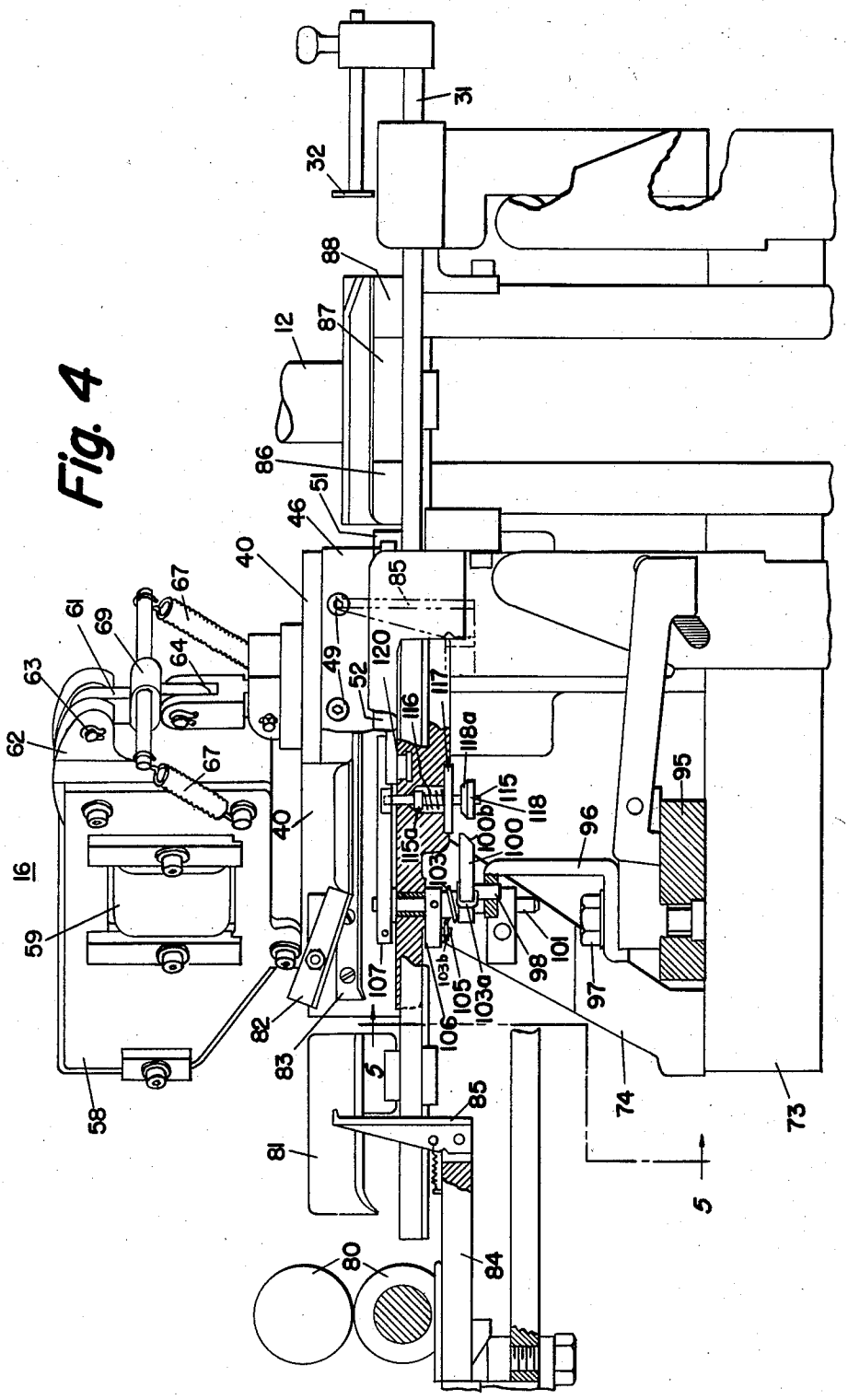
Fig. 3

June 16, 1959 E. A. BAILEY ET AL 2,890,630

PAPER BOX MACHINE

Filed March 28, 1956 6 Sheets-Sheet 4

Fig. 4



June 16, 1959 E. A. BAILEY ET AL 2,890,630

PAPER BOX MACHINE

Filed March 28, 1956 6 Sheets-Sheet 5

Fig. 5

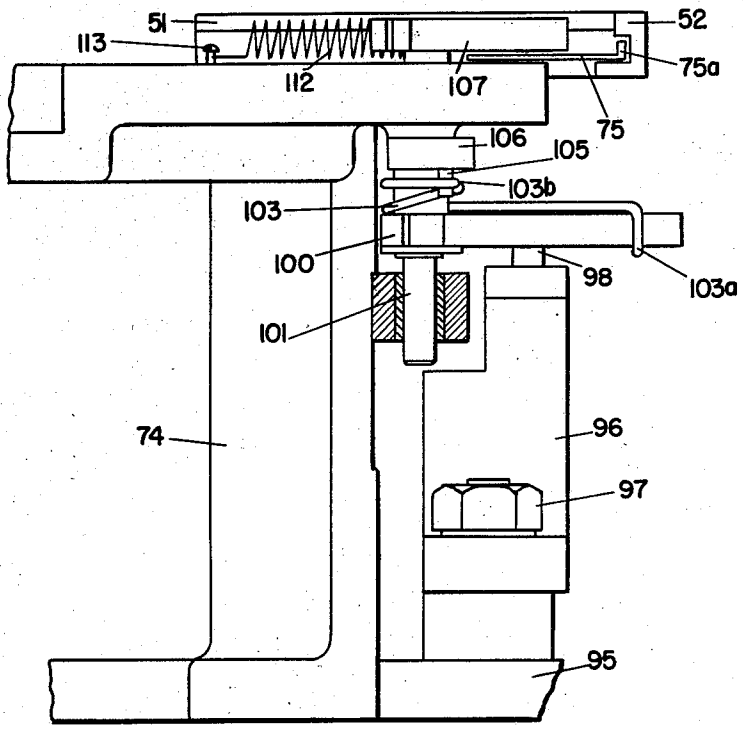
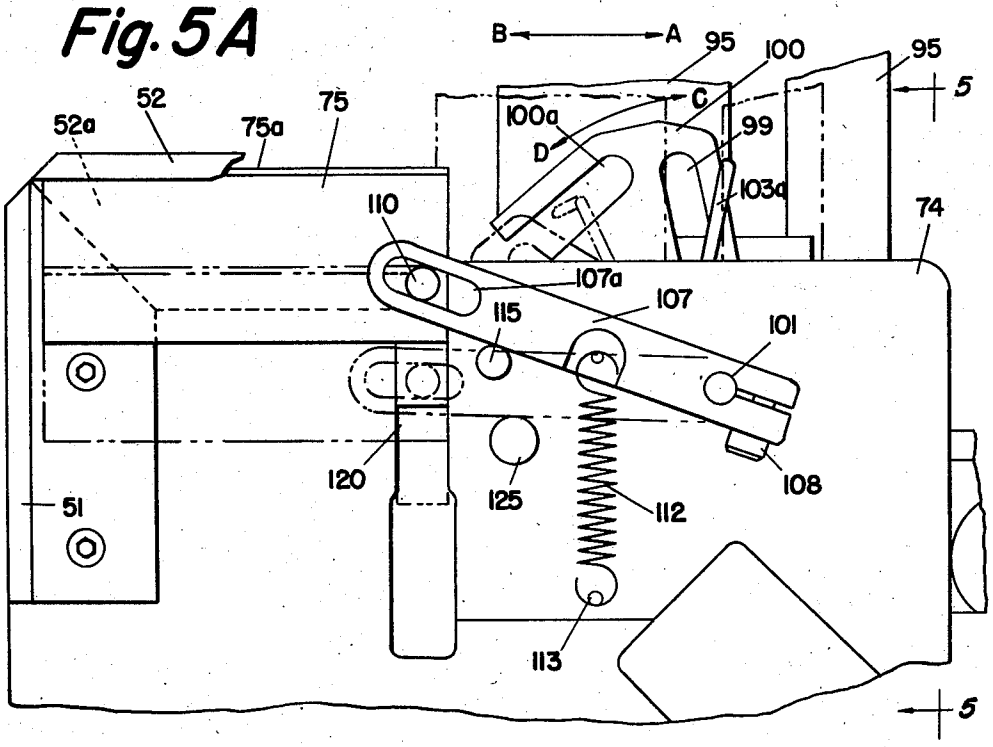


Fig. 5A



June 16, 1959 E. A. BAILEY ET AL 2,890,630

PAPER BOX MACHINE

Filed March 28, 1956 6 Sheets-Sheet 6

Fig. 6

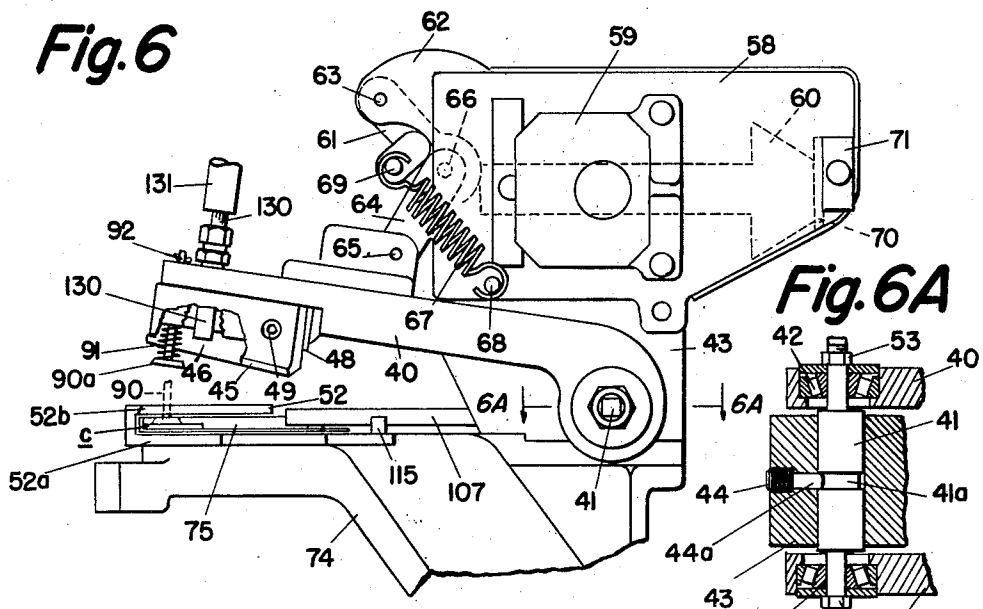
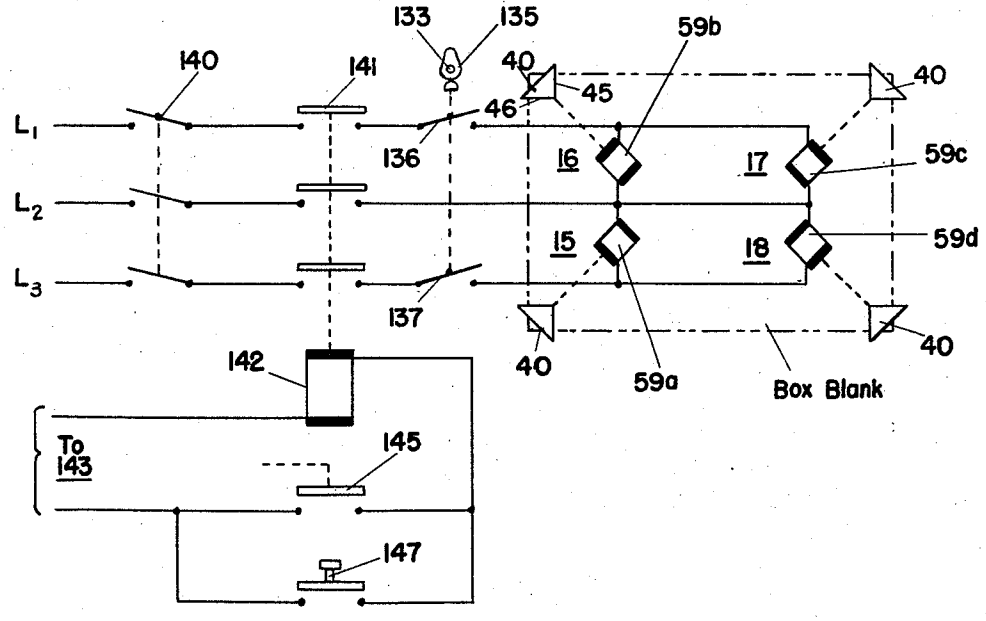


Fig. 6A

Fig. 7



United States Patent Office 2,890,630
Patented June 16, 1959

2,890,630

PAPER BOX MACHINE

Edward A. Bailey, Contoocook, John B. Bradicich, Warner, and Charles F. H. Crathern, Contoocook, N.H., assignors to Food Machinery and Chemical Corporation, San Jose, Calif., a corporation of Delaware

Application March 28, 1956, Serial No. 574,405

21 Claims. (Cl. 93—41)

This invention relates to improvements in paper box machines for cutting and staying paper box blanks such as cardboard sheets or the like and has for an object the provision of novel means for cutting corners from paper box blanks followed by the folding and application of stays to the folded corners to form "set-up" boxes.

In the manufacture of set-up boxes sheet material such as cardboard blanks are scored along the edges thereof to indicate the fold lines of the sides of the boxes. The corners of the sheets are then cut out forming box blanks followed by the folding and staying of the blank to form completed set-up boxes. In the interest of saving time as well as expense for additional equipment, it is preferable that the same machine be capable of performing the corner cutting operation as well as the bending and staying operations. Such machines are particularly useful in box wrapping systems, either automatic or semi-automatic, capable of high rates of output such, for example, as outputs as great as 40 or more boxes per minute. To insure that the box wrapping system will have a sufficient supply of set-up boxes, the machine for cutting the corners from the box blanks likewise must be capable of speeds as great as 40 or more operations per minute. As a result there has arisen the problem of rapidly eliminating the scrap or waste material from the machine resulting from each corner cutting operation in order to avoid interference with a subsequent cutting operation.

In accordance with the present invention there is provided improved corner cutting means for a staying machine and means for receiving corners cut from the cardboard sheets and forcibly ejecting them from the machine in a predetermined direction after each cutting operation.

In accordance with a further aspect of the invention there is provided electrical means for operating each of the corner cutter devices. The upper knives of the devices are carried by a pivoted arm actuated by a solenoid. The pivots for the arms include eccentric portions for adjusting the upper knives relative to the cooperating lower knives to insure proper cutting alignment. The upper knives are resiliently mounted to prolong the life of the cutting edges and to minimize the force required to separate the upper and lower knives.

In accordance with a still further aspect of the invention there is provided a system of making set-up boxes comprising means for feeding scored cardboard sheets in succession along a path to an operating station, means for cutting the corners from the sheet at the operating station to form a box blank, means for bending the edges of the box blank along the score lines and means for applying stays to each corner of the box blank at the operating station to form a set-up box, and ejecting means including spring means operable by the staying means for storing energy in the spring means during the cutting operation and thereafter releasing the stored energy with a snap action forcibly to eject from the system in a predetermined direction the corners cut from the cardboard

sheet to remove the corners from the system prior to delivery of a subsequent sheet to the operating station.

It is another object of the invention to provide an electrical control for the box making machine to insure maximum safety during adjustment and operation of the machine.

For a more detailed disclosure of the invention and for further object s and advantages thereof reference may be had to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a perspective view of the corner cutting and staying machine embodying the present invention;

Fig. 2 is a fractional perspective view showing the novel corner cutter devices disposed at the four corners of the machine;

Fig. 3 is a fractional top plan view showing two of the corner cutter devices;

Fig. 4 is a sectional view taken along the line **4—4** in Fig. 3;

Fig. 5 is a fractional view of the tray for receiving a corner cut from a cardboard sheet and the ejector mechanism for operating the tray, the view being taken along the lines **5—5** in Fig. 4;

Fig. 5A is a top plan view of Fig. 5 showing the tray in its two positions;

Fig. 6 is an elevational view of one of the corner cutter devices with the top knife holder in raised position;

Fig. 6A is a sectional view taken along the lines **6A—6A** in Fig. 6; and

Fig. 7 is a schematic wiring diagram showing the electrical control for the solenoids for operating the corner cutters.

Refering to Fig. 1 there is shown a paper box machine CS including provisions for corner cutting and staying box blanks and embodying the present invention. The portion of the machine CS for bending the paper box blanks and applying the stays to the corners while the blank is in folded position is generally similar to the staying machine shown in Davis et al. Patent No. 728,086. As may be seen in Fig. 1 the scored cardboard sheets or blanks B are arranged in a stack at one side of the machine and are adapted to be fed in succession to an operating station beneath the plunger **10**. The plunger **10** is carried by a cross-head **11** which in turn is supported for reciprocating vertical movement by the upper ends of slide-rods **12**. The drive mechanism for cyclically operating the slide-rods **12** and the pressers for the stay strips is disposed within the frame F of the machine as disclosed in said Davis et al. patent. The stayer drive mechanism preferably is driven from suitable means such for example as an electric motor **144**.

At each of the four corners of the machine CS there is disposed a corner cutter device or assembly **15–18** respectively. The details of construction of the corner cutter devices **15–18** include novel arrangements and their operation will hereinafter be described. Also at each of the four corners of the machine is a presser for applying stay strips supplied from each of the adjacent stay rolls S. The pressers may be of the type disclosed in the aforesaid Davis et al. patent for applying stays with adhesive of the water activated type or they may include heating provisions for applying stays of the heat activated type. The pressers and the corner cutters are both mounted on the corner blocks of the machine which blocks are adjustable in accordance with the range of sizes of box blanks to be handled by the machine. Thus adjustment of the corner blocks to adjust the pressers of the stayer for boxes of different size will concurrently adjust the novel corner cutter assemblies relative to the common vertical axis of the operating station for the proper box size. The machine CS is of the type known in the art as a quadruple or "quad" stayer and thus the

four corners of the cardboard blanks are cut concurrently followed by the concurrent staying of the four corners. During each cycle of the machine CS the cardboard blanks B automatically are transformed from rectangular sheets to corner notched box blanks and thence to stayed set-up boxes in which form they are delivered from the machine CS on the conveyor belt 25 adjacent the right hand end of the machine as shown in a Fig. 1.

As may be seen in Fig. 2 the cardboard blanks B are fed in succession to an operating station below the plunger 10 on blank supports on spaced rails 30 and 31. The forward movement is limited by the adjustable end stops 32, 32 which are adapted to cooperate with the supports on rails 30 and 31 in aligning the blank B underneath the plunger 10. The corner cutter assemblies 15–18 are positioned at each of the four corners of the machine so that when the score lines of blank B are properly aligned underneath the plunger 10 the corners of the blank B likewise will be aligned properly with the respective corner cutter assemblies 15–18. The corner cutter assemblies 15–18 form an important part of the present invention and will now be described in detail.

The diagonally opposite pair of corner cutter devices 15 and 17 are of identical construction as are the other diagonally opposite pair of corner cutter devices 16 and 18. For that reason only corner cutters 15 and 16 (one from each diagonally opposite pair) have been shown in the enlarged fractional view of Fig. 3. Corner cutters 15 and 16 are of substantially the same construction except that they are adapted for disposition on opposite sides of the machine: thus certain parts thereof are reversed as may be seen from the drawings. As each of the corner cutter devices 15–18 operates in the same manner the like parts thereof will be identified with the same reference characters without regard to their reversal of position, if any.

Referring to Figs. 2, 3, 4 and 6, each of the corner cutter devices 15–18 includes an upper knife holder 40 in the form of an arm pivoted at one end thereof on a shaft 41. That end of the knife holder preferably is bifurcated and is provided with anti-friction bearings 42, 42 which are mounted on the journals of the shaft 41, Fig. 6A. The shaft 41 includes an eccentric central portion which is adapted to be secured to a support 43 by means of a lock screw 44 and plug member 44*a* which engages a groove 41*a* in the eccentric portion of shaft 41 to prevent endwise movement of the shaft 41. The upper knife holder 40 at its opposite end is provided with a pair of cutter blades or knives 45 and 46 which are disposed at right angles to each other to form a corner as shown in Figs. 3 and 6. The knives 45 and 46 are resiliently mounted on the knife holder 40 and this may be accomplished by placing a shim of resilient or rubber-like material 48, such as oil-resistant rubber, between each knife 45 and 46 and the knife holder 40. The knives 45 and 46 may be secured to the knife holder 40 in any suitable manner for example by screws 49, Figs. 4 and 6. The resilient mounting of the upper knives 45 and 46 permits them to yield slightly and exert an outward pressure when they come into cooperation with and move past a pair of lower knives 51 and 52, Figs. 3 and 6. The resilient mounting of the upper knives 45 and 46 provides for an improved cutting operation by reason of the whetting action between the upper and lower knives which helps to maintain them in sharp condition and also minimizes the power required to withdraw the upper knives 45 and 46 from engagement with the lower knives 51 and 52, Fig. 4, at the end of a cutting operation and return them to their upper position shown in Fig. 6.

The eccentric portion on the pivot shaft 41 for the upper knife holder 40, described above, is particularly useful for adjusting the upper knife holder 40 along a line bisecting the right angle formed between the pairs of knives 45, 46 and 51, 52. By rotating the eccentric shaft 41 the pair of upper knives 45 and 46 may be carefully adjusted into the proper cutting relationship with the bottom knives 51 and 52.

Adjustment of the nuts 53, 53 at the opposite ends of eccentric shaft 41 permits transverse movement of the top knife holder 40 across the aforesaid bisecting line so that the upper and lower V's formed by the pairs of knives 45, 46 and 51, 52 are correctly aligned for cooperation in cutting the corners from cardboard blanks.

Each of the corner cutting devices 15–18 is provided with separate actuating means in the form of a solenoid 58. As may be seen in Fig. 6 each solenoid 58 includes an energizing coil 59 and a reciprocating plunger 60, one end of which is adapted to actuate a toggle joint which is connected to the upper knife holder 40. The toggle joint comprises an upper link 61 which is pivoted at its top end to a fixed support 62 by a top link pivot pin 63 and a lower link 64 which is pivoted at its bottom end to the upper knife holder 40 by means of a bottom link pivot pin 65. The toggle links 61 and 64 are pivotally interconnected by means of a link connector pin 66. The links 61 and 64 of the toggle joint are normally biased to collapsed position, Fig. 6, by means of a pair of tension springs 67, 67 one end of which is connected to a fixed support at 68 and the other end of which is connected to a member 69 carried by the upper toggle link 61. One end of the solenoid plunger 60 is adapted to engage a curved surface on the upper toggle link 61. When the plunger 60 is moved to the left as shown in Fig. 6, upon energizing of the solenoid coil, the toggle joint will be straightened out and the upper knife holder 40 will be moved from its upper position, Fig. 6, to its lower cutting position, Fig. 4, by rotation of holder 40 about the journals of shaft 41 against the bias of tension springs 67.

After the corner has been cut from the cardboard blank the coil of the solenoid 58 is deenergized and the tension springs 67, 67 collapse the toggle joint raising the top knife holder 40 to the position shown in Fig. 6. The springs 67, 67 likewise return the solenoid plunger 60 to its original position as illustrated in Fig. 6. To absorb the shock as the plunger 60 is returned to its original position there is preferably provided a pad 70 of resilient or rubber-like material on the plunger return stop 71.

The lower knives 51 and 52 are carried by a base 74 which also supports the top knife holder 40 and the solenoid mechanism 58 of the corner cutter assembly. The bases 74 are mounted on the respective corner blocks 73 of the machine, Fig. 4. The bottom knives 51 and 52 are arranged at right angles to each other to form a square corner in the same manner as the top pair of knives 45, 46, Fig. 3. As may be seen in Fig. 6 the bottom knive 52, which is parallel to the line of feed of the box blanks, is of channel like construction including a bottom portion 52*a* which is adapted to be secured to the base member 74 such for example as by screws, not shown. The knife 52 also includes an upper blade portion 52*b* which overhangs the vertical portion of the knife 52 thus providing a recess for receiving a tray or ejector member 75, Figs. 3 and 6. For successful operation of the corner cutting machine it is necessary that the scrap or corners cut from the cardboard blanks be discharged in a positive manner and predetermined direction from the corner cutter assemblies in order that such scrap will not interfere with subsequent cutting operations of the machine. The novel ejectors 75 perform the foregoing function and their operation will now be described.

It will be assumed that a cardboard blank has been fed from the supply stack by means of the driven feed rolls 80, 80, Fig. 4, over the auxiliary guides 81, 81, Fig. 3, beneath the blank depressors 82, 82 and on to the spaced guides 83, 83 on the bending rails 30 and 31. After the rear end of the blank B leaves the feed rolls 80, 80 it is moved to its proper position on the spaced sets of adjustable supports or filler blocks 86–88 at the operating station beneath the plunger 10 by means of

the reciprocating pusher shaft **84**, the pivoted tip **85** of which engages the rear end of blank B and moves the front end of blank B against the pair of blank stops **32**, **32**, Figs. 2 and 4. The blank B is now in its aligned position at the operating station beneath the plunger **10** which has a form of adjustable rectangular dimensions corresponding to the inside dimensions of the set-up box to be formed. It will further be assumed that the solenoid coils of each of the corner cutters **15–18**, Fig. 2, have been energized thus operating each of the top knife holders **40** from the upper position of Fig. 6 to the lower position of Fig. 4. It will be noted in Fig. 6 that the upper knife holder **40** is provided with a chip or corner spotting plunger **90** which is slidably mounted and is adapted to be held down by the force of a compression spring **91** which surrounds the plunger shaft. The upper end of plunger **90** is provided with a stop pin **92** and the lower end of the plunger **90** is provided with an enlarged head **90***a* which is adapted to engage the chip or corner cut from the cardboard blank. The opposite ends of the compression spring **91** are adapted to engage the lower surface of arm **40** and the upper surface of head **90***a* and thus bias the chip spotting plunger **90** to the position shown in full line in Fig. 6. The head **90***a* of the plunger **90** extends below the cutting plane of the top knives **45** and **46**. Thus when the top knife holder **40** is moved to the lowered position of Fig. 4 during a cutting operation the head **90***a* of the chip spotting plunger **90** will engage the corner of the blank causing the spring **91** to compress until the corner is severed from the blank. At that time the force of the spring **91** will cause the spotting plunger **90** to press the corner piece cut from the blank into the ejector tray **75** as illustrated by the plunger **90** shown in dotted lines in Fig. 6. This arrangement insures that the chip or corner piece will be forced into the tray **75** and properly positioned ready for the ejecting operation when the top knife holder **40** is withdrawn to its original or upper position as shown in Fig. 6.

With the chip or corner cut from the blank B and now positioned in the tray **75**, the chip is ready to be ejected from the machine preparatory to a subsequent cutting operation on another blank B. The chip or corner is adapted to be forcibly ejected from the machine by movement of the tray **75** from a first position to a second position as illustrated by the two positions of the tray **75** shown in full lines and dotted lines respectively in Figs. 3 and 5A. The operation of the trigger mechanism for the ejecting tray **75** of each of the corner cutter devices **15** and **16** is effected by the reciprocating pressure bar **95**, Figs. 3 and 4. A similar pressure bar actuates the trigger mechanism for the other two corner cutter devices **17** and **18**. The reciprocating pressure bar **95**, which is part of the quadruple staying machine CS and controls the movement of the corner stay pressers, makes one forward and one reverse stroke with respect to plunger **10** as indicated by the arrows A and B during each cycle of the staying machine. When bar **95** moves in direction A, away from plunger **10**, it carries with it an operating post **96**, Fig. 4, which is adjustably secured to the pressure bar **95** by a clamp nut **97**. Projecting above operating post **96** is a pin **98**, Fig. 4, which is fixed to the operating post **96**. The pin **98** is adapted to move in a slot **99**, Figs. 3 and 5A, of a lever **100** causing arcuate travel, in the direction of arrow C, Fig. 5A, of lever **100** about the axis of its vertical pivot shaft **101**. It is to be noted that lever **100** is not fixed to pivot shaft **101** and thus movement of lever **100** does not directly cause rotation of shaft **101**. A torsion spring **103** and a lever **106** are mounted on the vertical shaft **101**. As lever **100** continues to rotate in the direction of arrow C it engages a projection **103***a* on the end of torsion spring **103** and transmits the arcuate travel of lever **100** through the spring **103** and an upper loop **103***b* thereof which is wrapped around a stud **105** on lever **106**. The lever **106** is fixed to the vertical shaft **101** and thus transmits the arcuate travel to a slottted lever arm **107** which is secured to the upper end of the vertical shaft **101** by a clamp screw **108**. The outer end of lever **107** is provided with an elongated slot **107***a* which is adapted to receive a pin **110** which is fixed to and projects above the tray **75**.

During movement of the pressure bar **95** in direction A the lever **100** moves in direction C transmitting this movement through spring **103**, shaft **101** and lever **107** to move the tray **75** to the full line position shown in Figs. 3 and 5A preparatory to receiving a cut out corner from a blank B. It will be noted that this reset movement of the tray **75** is against the bias of a spring **112** one end of which is secured to the arm **107** and the opposite end of which is secured to a stationary support as by pin **113**, Figs. 5 and 5A. With the tray **75** in this position a stop plunger **115**, Fig. 4, is pushed upwardly through the base member **74** by a compression spring **116** which surrounds the plunger **115** and is held between a shoulder **115***a* and a lower plate member **117**. The stop plunger **115** thus projects above the upper surface of member **74** into the path of the lever arm **107** and locks the tray **75** into position to receive a cut out corner, as shown in full line in Fig. 3. This is the position of the tray **75** during the cutting operation as described above.

After the corners have been cut from the cardboard blank, the corner chips deposited in the trays **75** and the upper knife holders **40** return to their raised position, as shown in Fig. 6, the ejecting mechanism is ready forcibly to eject the corner chips from the machine in a direction transverse to the feed of the blanks. To effect the ejecting operation the pressure bar **95** moves in the opposite direction B, toward the plunger **10**, and the pin **98** carried by the operating post **96** travels in slot **99** to move lever **100** arcuately in the direction of arrow D, Fig. 3. After several degrees of travel the force of torsion spring **103** is neutralized and lever **100** moves out of engagement with the projection **103***a* on the lower arm of spring **103**, Figs. 3 and 4. As lever **100** nears the end of its travel in the direction of arrow D, Figs. 3 and 5A, the open end of slot **100***a* passes around the lower end of stop plunger **115** and the cam face **100***b* at the open end of slot **100***a* on lever **100** moves into engagement with the chamfered face **118***a* of the collar **118** on the lower end of stop plunger **115** causing the latter to move downwardly. This action withdraws the upper end of stop plunger **115** from engagement with the lever arm **107** releasing the force stored in the tension spring **112** to exert a trigger-like or snap action to the ejector tray **75** to move it from its full line position in Figs. 3 and 5A to its dotted line position with lever **107** against a stop **125**. The tray **75** is guided in a track **120** which is adapted to receive the lower end of pin **110**. The forward ejecting movement of the tray **75** is halted when the lever **107** strikes the stop **125** which projects above the base **74**, Fig. 5A. During the movement of the pressure bar **95** in direction B it operates the corner pressers for application of stay strips to the corners of the set-up box. The pressure bar **95** then starts on its travel in the opposite direction A to reset the tray and trigger mechanism for the next cutting operation and ejection cycle and to withdraw the corner pressers for the stays.

By transmitting the movement from pressure bar **95** to lever **100** through the torsion spring **103** there is eliminated any need for resetting of parts which might be thrown out of proper relation in the event some of the scrap material from the cutting operations becomes lodged between the rear shoulder portion **75***a* on the tray **75** and the recess in the bottom knife **52** into which the shoulder **75***a* normally is adapted to extend, Fig. 5. With the construction as described above, resetting of the various parts will not be necessary after the foreign

or scrap material has been dislodged. If any scrap material should become lodged in the recess in the bottom knife **52** all that will occur during an ejecting operation is that the torsion spring **103** will be deflected by a greater amount during that cycle of operation of the machine than it is during a normal cycle. To prevent the accumulation of cardboard lint and dust in the recess of the bottom knife **52** there is provided an air blast system which is effective in each ejection cycle to direct a blast of air into the recess in the bottom knife **52** when the tray **75** has been moved away from it to the phantom line position shown in Figs. 3 and 5A. This is accomplished by providing the upper knife holders **40**, Fig. 6, with a nozzle **130** which extends through the knife holder **40** and is adapted at its upper end to receive a suitable tubing member **131**. The opposite end of the tubing member **131** is adapted to be connected to a suitable source of air supply, not shown, such for example as an air pump the motion of which may be derived from the action of the plunger operating levers in the quadruple staying machine.

As previously described the corner cutter assemblies **15–18** are electrically operated by their individual solenoids **58**. As the machine CS is of the quadruple type the corner cutting assemblies **15–18** are energized concurrently. This is accomplished by means of a cam **135**, Fig. 7, which is adapted to make one revolution during each cycle of operation of the machine. The cam **135** is carried at the opposite end of a one-time shaft **133** from a brake operating cam **134**, Fig. 1. The cam **134** is part of the regular quad staying machine and is shaped to operate a switch for controlling a brake on the stayer motor in manner such that the plunger **10** will stop at its up position, Fig. 1, at the end of each cycle of the staying machine. When the staying machine is used in complete box wrapping system the rotation of the shaft **133** is normally controlled from a pedal on the box wrapping machine in manner well known in the art. The cam **135** is adapted to engage a cam follower for closing and opening the pair of switches **136**, **137** during each cycle or revolution of one-time shaft **133**.

The solenoid coils for the corner cutting assemblies **15–18** have been illustrated in Fig. 7 as **59***a*–**59***d* respectively. The solenoids are adapted to be energized from a three phase line and to balance the line the coils **59***b* and **59***c* have been connected across lines L1 and L2 while the other pair of coils **59***a*, **59***d* have been connected across lines L2 and L3. The conductors leading to the individual solenoid coils preferably are disposed in protective housings such as conduit sections **132**, Fig. 3. The switches **136** and **137** are placed in lines L1 and L3 respectively, Fig. 7. The fused main switch **140** is fed from the three phase line L1, L2, L3, and when in the closed position carries current to the contacts of the magnetic contactor diagrammatically illustrated at **141**. The holding coil **142** of the magnetic contactor **141** will not be energized unless the magnetic motor starter in the stayer control cabinet **143**, Fig. 1, is closed and feeding current to the stayer motor **144**. At such time the contacts in the interlock **145** on the magnetic motor starter will be closed and current will be fed to the holding coil **142** of the magnetic contactor **141**.

Since the corner cutter heads are electrically operated and the machine is adapted for automatic operation precaution has been taken to avoid the possibility of an accident when the machine is to be turned over by hand for a test cut without first moving the power switch **140** to the off or open position. It is customary to make a test cut after setting the machine up for a new size of work. When the machine operator desires to make a test cut the machine may be turned over by hand by means of a hand wheel **146**, Fig. 1, until the normally open cam operated switches **136** and **137**, Fig. 7, are closed by the cam **135**. The normally open push button switch **147** is then closed by the operator thus bypassing the interlock **145** on the stayer motor starter and feeding current to the holding coil **142** of the magnetic contactor **141**. From the foregoing description it will be seen that the wiring circuit for the machine is such that the corner cutters **15—18** can be operated only when the stayer motor is running or when the operator actuates the push button switch **147**.

Summarizing the operation of the corner cutting and staying machine CS, during each cycle a blank B is fed from the supply stack to the operating station beneath the plunger **10**. While the blank B is at this position the one-time shaft **133** is rotating and turning the switch operating cam **135** to a position for closing the switches **136** and **137** to energize the coils of the individual solenoids **58** of the respective corner cutter devices **15—18** thus cutting the corner chips from the rectangular blank and transforming it into a box blank. The cam **135** continues its rotation permitting the switches **136** and **137** to open. This action deenergizes the coils of the solenoids **58** causing the springs **67** to raise the top knife holder arms **40** to their original upper position while leaving the corner chips deposited in the ejector trays **75**. At this time the pressure bar **95** is moving in direction B, Fig. 3, to actuate the corner pressers for applying the stay strips to the respective corners of the set-up boxes. This same movement of the pressure bar **95** rotates the arm **100** in the direction of arrow D, Fig. 3, to depress the stop plunger **115** and enable the trigger mechanism to move the ejector tray **75** from its full line position to its dotted line position with a snap action by spring **112**, Fig. 5A. The pressure bar **95** then moves in reverse direction A returning the ejector tray **75** to its original position and resetting the trigger mechanism preparatory to another cycle of operation of the machine.

From the foregoing description it will be seen that the present invention has numerous advantages. The novel corner cutter devices **15–18** are individual units and can be readily mounted on existing staying machines. By mounting them on the corner blocks of the machine which likewise carry the corner pressers for applying the stay strips, it is only necessary to adjust the corner pressers for different sizes of work as such adjustment will automatically correctly reposition the corner cutters. As the corner cutter devices **15–18** are electrically operated by the solenoid and lever arrangement there is eliminated any need for mechanical connection between the corner cutter devices, thus providing a simplified construction and ease in adjustment. In corner cutting and staying machines capable of relatively high speeds such as disclosed herein there is not sufficient time to depend upon gravity for the removal of the corner chips from the machine between cutting operations. The novel chip ejectors described herein insure that the scrap or waste material resulting from each cutting operation is forcibly ejected from the machine within a minimum of time and along a predetermined path. For example waste receptacles such as boxes or the like may be disposed on opposite sides of the machine along the path of feed. The chip ejectors are adapted to shoot the corner chips from the machine through suitable guides or piles to direct the chips into the waste receptacles.

While a preferred embodiment of this invention has been illustrated and described, it is to be understood that other modifications thereof may be made within the scope of the appended claims.

What is claimed is:

1. In corner cutting apparatus for cutting the corners from cardboard sheets or the like in the manufacture of box blanks, a cutting device including cooperating knife means for receiving and cutting a corner from a cardboard sheet, movable tray means for receiving the corner as it is cut from the cardboard, and operating means imparting a snap action to said tray means for forcibly ejecting the corner from said apparatus in a predetermined direction.

2. In corner cutting apparatus according to claim 1 wherein said cooperating knife means includes a movable knife and a stationary knife, said movable knife being carried by a movable knife holder having a resilient mounting for said movable knife to permit the said movable knife to yield slightly and exert an outward pressure when it is in engagement with said stationary knife.

3. In corner cutting apparatus according to claim 2 wherein said resilient mounting for said movable knife comprises a rubber-like member disposed between said movable knife and its holder.

4. Apparatus for cutting the corners from cardboard sheets or the like in the manufacture of box blanks comprising a cutting device including upper knife means, lower knife means, both of said knife means cooperating for receiving and cutting a corner from a cardboard sheet, movable tray means disposed adjacent said lower knife means during a cutting operation for receiving the corner as it is cut from the cardboard sheet, and operating means imparting a snap action to said tray means for forcibly ejecting the corner from said apparatus in a predetermined direction.

5. Apparatus according to claim 4 wherein said upper knife means is carried by a pivoted arm, means for periodically pivoting said arm to move said knife means into cooperating relation for cutting a corner from the cardboard sheet prior to movement of said movable tray means for receiving and forcibly ejecting the corner cut from the cardboard.

6. Apparatus according to claim 5 wherein said pivoted arm is operated by solenoid means.

7. Apparatus according to claim 6 wherein said solenoid means includes a toggle connection between a plunger of said solenoid and said pivoted arm, and spring means for retracting said pivoted arm upon de-energization of said solenoid.

8. Apparatus for cutting the corners from cardboard sheets or the like in the manufacture of box blanks comprising a plurality of cutting devices, each of said cutting devices including cooperating knife means for receiving and cutting a corner from a cardboard sheet, means for concurrently operating said cutting devices, movable tray means associated with each of said cutting devices for receiving the respective corners as they are cut from the cardboard sheet, and operating means imparting a snap action to said tray means for forcibly ejecting the corners from said apparatus in predetermined directions.

9. Apparatus according to claim 8 including solenoid means associated with each of said cutting heads, and switch means for periodically concurrently energizing said solenoid means.

10. In apparatus for cutting the corners from cardboard sheets or the like in the manufacture of box blanks the sub-combination comprising tray means for receiving a corner cut from the cardboard sheet, and trigger mechanism operated by said apparatus in predetermined manner for moving said tray means from a first position to a second position with a snap action forcibly to eject the cardboard corner from the apparatus in predetermined direction and thereafter to return said tray means to said first position for a subsequent corner cutting operation.

11. Apparatus according to claim 10 including air blast means for directing a blast of air to said first position of said tray means when said tray means has been moved to its said second position to remove any lint or other foreign matter deposited at said first position during the cutting operation on the cardboard sheet.

12. Apparatus for cutting the corners from cardboard sheets or the like in the manufacture of box blanks comprising a movable knife holder, a stationary knife holder, a pair of knives carried by said movable knife holder and forming a right angle, a pair of knives carried by said stationary knife holder and forming a right angle for cooperation with the pair of knives on said movable holder, and means for adjusting said movable holder along a line bisecting the angle between said pair of knives carried by said movable holder to adjust the position of said pair of movable knives for proper cutting relation with said pair of stationary knives.

13. Apparatus according to claim 12 wherein said movable knife holder is pivoted on an eccentric shaft and said eccentric shaft is rotatable with respect to said movable knife holder to adjust said movable knife holder along the line bisecting said pairs of knives.

14. Apparatus for cutting the corners from cardboard sheets or the like in the manufacture of box blanks comprising a cutting head including cooperating knife means for receiving and cutting a corner from a cardboard sheet, a tray for receiving the corner cut from the cardboard sheet, means movable with one of said knife means for pressing the corner cut from the cardboard sheet and into said tray, and trigger mechanism for moving said tray between first and second positions for forcibly ejecting from said apparatus in a predetermined direction the corner cut from the cardboard.

15. A system for making set-up boxes comprising means for feeding cardboard sheets in succession to an operating station, means at said operating station for concurrently cutting the corners from the cardboard sheet to form a box blank, means at said operating station for bending the edges of the box blank, means for applying stays to each corner of the box blank to form a set-up box, and ejecting means including spring means operable by said staying means for storing energy in said spring means during the cutting operation and thereafter releasing the stored energy with a snap action forcibly to eject from said system in a predetermined direction the corners cut from the cardboard sheet to remove the corners from said system prior to delivery of a subsequent sheet to said operating station.

16. In a paper box machine a plurality of adjustable corner members, a plurality of stay applying devices, a plurality of corner cutters, one of said corner cutters and one of said stay applying devices carried by each of said corner members and concurrently adjustable therewith relative to a common central vertical axis for boxes of different sizes, and means for concurrently operating said plurality of corner cutters.

17. In a paper box machine according to claim 16 including electrical means for operating each of said corner cutters, and means in electrical circuit with said stay applying devices for controlling the energization of said electrical means.

18. In a paper box machine having a central station for operating on box blanks to transform them into stayed set-up boxes, a plurality of adjustable corner members arranged around a common vertical axis of the operating station, a plurality of stay applying devices arranged around said vertical axis, a plurality of corner cutters arranged around said vertical axis, one of said corner cutters and one of said staying devices carried by each of said corner members and concurrently adjustable therewith relative to said common vertical axis for boxes of different sizes, a set of adjustable blocks disposed at the operating station relative to said common vertical axis for supporting box blanks of different sizes beneath said corner cutters, and means for concurrently operating said plurality of corner cutters to cut the corners from the box blank during the manufacture of a paper box.

19. In apparatus for making set-up boxes including means for cutting the corners from a box blank and reciprocating means for controlling the application of stays to the corners of a set-up box, the improvement which comprises structure for receiving and supporting a corner cut from the box blank, and trigger mechanism for moving said structure between first and second positions with a snap action for forcibly ejecting from said ap-

paratus in a predetermined direction the corner cut from the box blank, said trigger mechanism being operated by said reciprocating means and including a resilient connection effective between said structure and said reciprocating means.

20. In apparatus for making set-up boxes including means for cutting the corners from a box blank and reciprocating means for controlling the application of stays to the corners of a set-up box, the improvement which comprises structure for receiving a corner cut from the box blank, and trigger mechanism for moving said structure between first and second positions for forcibly ejecting from said apparatus in a predetermined direction the corner cut from the box blank, said trigger mechanism being operated by said reciprocating means and including a pivot shaft, a first arm freely pivoted on said shaft, resilient means interconnecting said first arm with said shaft, a second arm fixed to said shaft, means for biasing said second arm for rotation in one direction about said shaft, means interconnecting said second arm and said structure receiving the corner chip, means on said reciprocating means for rotating said first arm and thereby transmitting rotation through said shaft to said second arm against the force of said biasing means to move said structure to a first position, retractable means in the path of said second arm for restraining said structure in its first position, and means on said first arm engageable with said retractable means for withdrawing said retractable means from the path of said second arm upon reverse movement of said reciprocating means whereby said structure for receiving the corner chip is moved from its first position to a second position upon release of force by said biasing means.

21. A system for making set-up boxes comprising means for feeding sheet material in succession to an operating station, means at said operating station for concurrently cutting the corners from a sheet to form a box blank, means for bending the edges of the box blank to form the walls of a set-up box, means for applying stays to each corner of the set-up box to hold the walls thereof in upright position, means for catching the corner chips after they are cut from the sheet material, means connected to said chip-catching means for storing energy for ejecting the corner chips from the system, and means for releasing the stored energy with a snap action during the application of the stay strips to the corners of the set-up box and prior to delivery of a subsequent sheet to the operating station forcibly to eject from the system in a predetermined direction the corner chips cut from the sheet.

References Cited in the file of this patent

UNITED STATES PATENTS

972,203	Malton	Oct. 11, 1910
1,576,810	Clark	Mar. 16, 1926
1,958,132	Davis	May 8, 1934
2,521,461	Jordan	Sept. 5, 1950
2,576,295	Good	Nov. 27, 1951