March 17, 1964 H. L. BYLAND 3,124,818

AUTOMATIC BINDING MACHINE

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Fig. 2

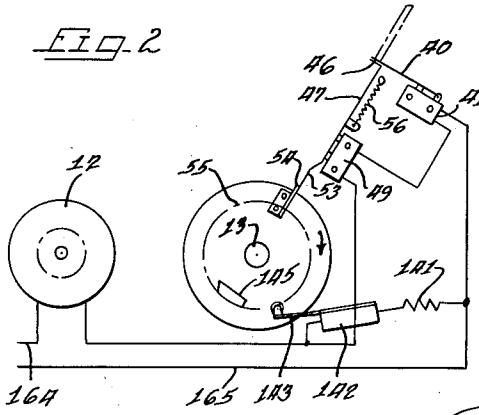
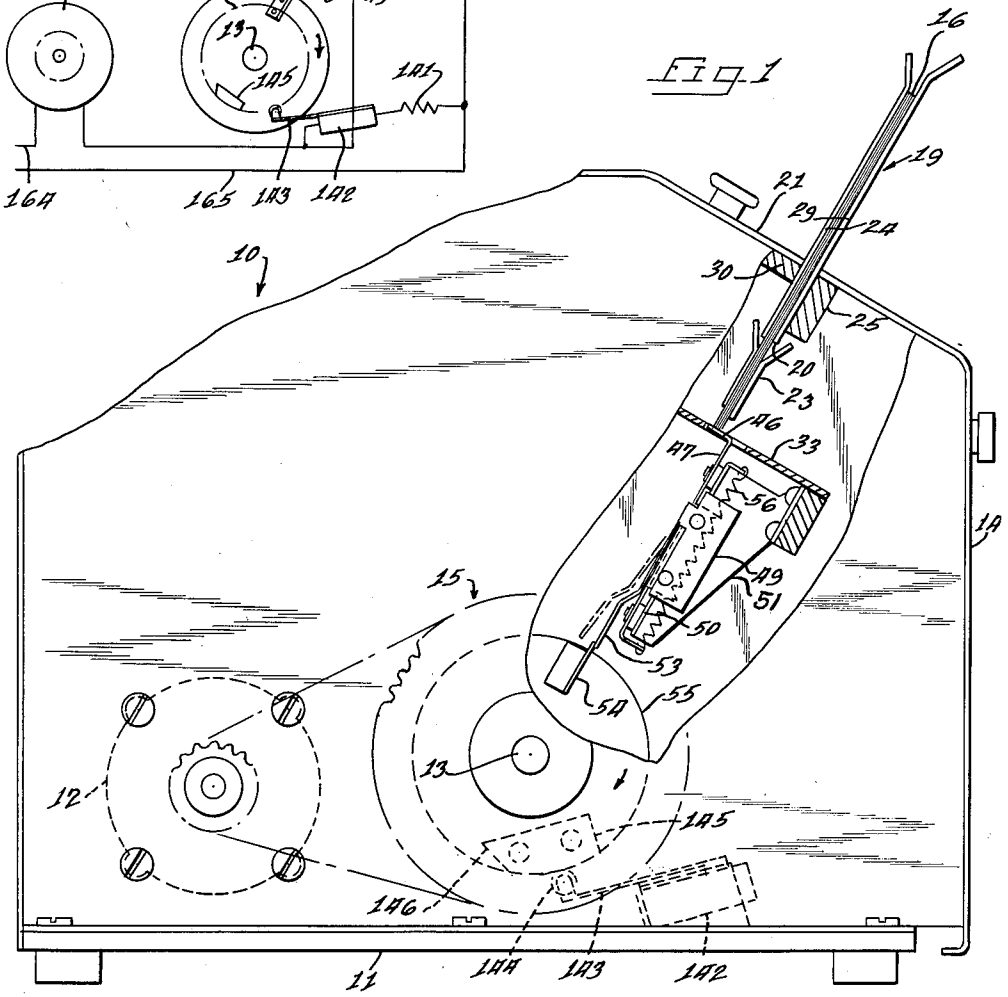


Fig. 1



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AUTOMATIC BINDING MACHINE

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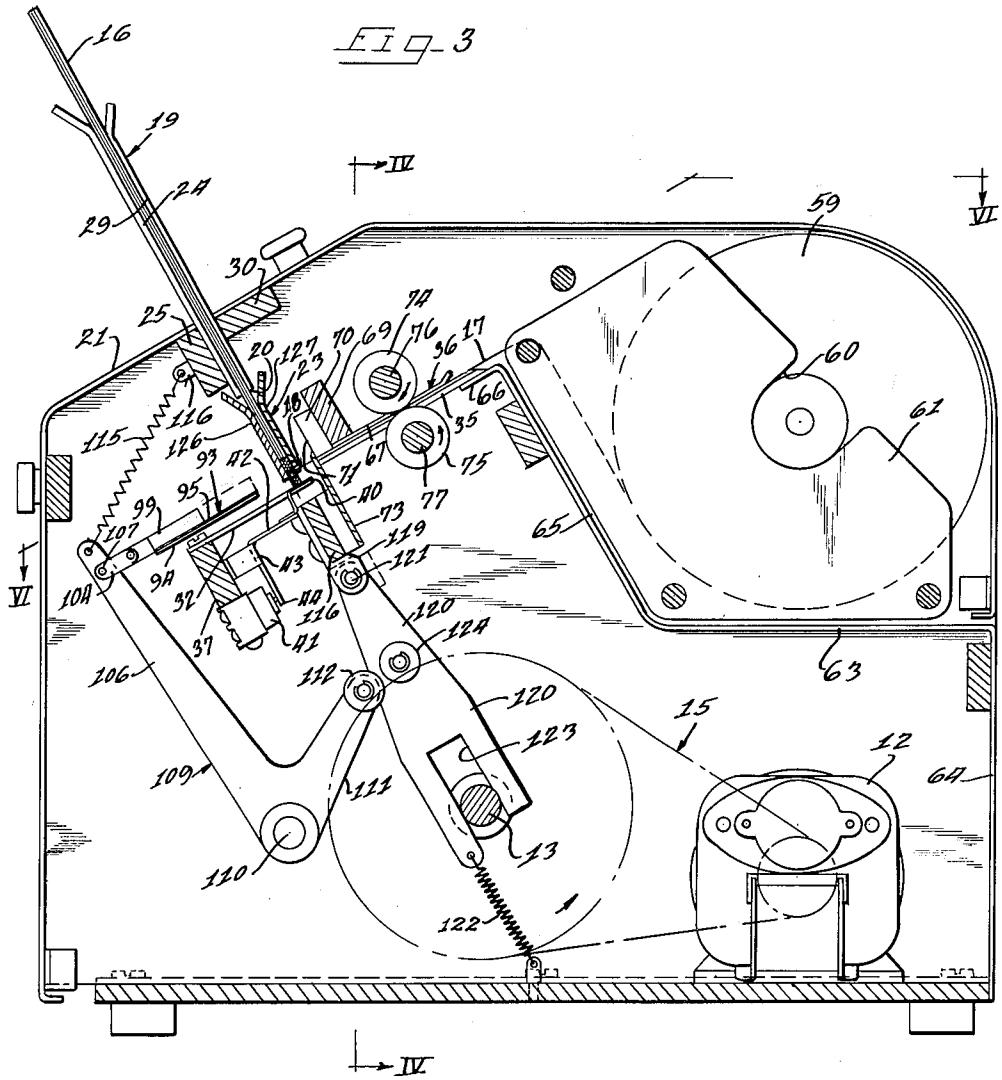
Fig. 3



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AUTOMATIC BINDING MACHINE

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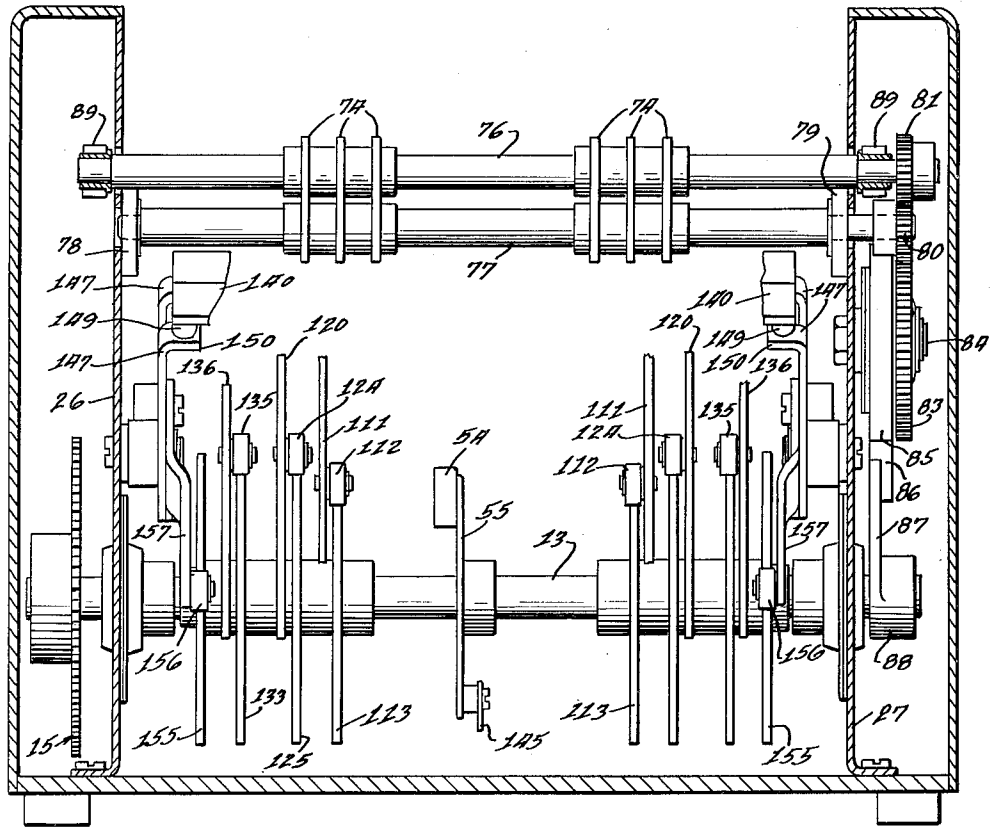
Fig. 4



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AUTOMATIC BINDING MACHINE

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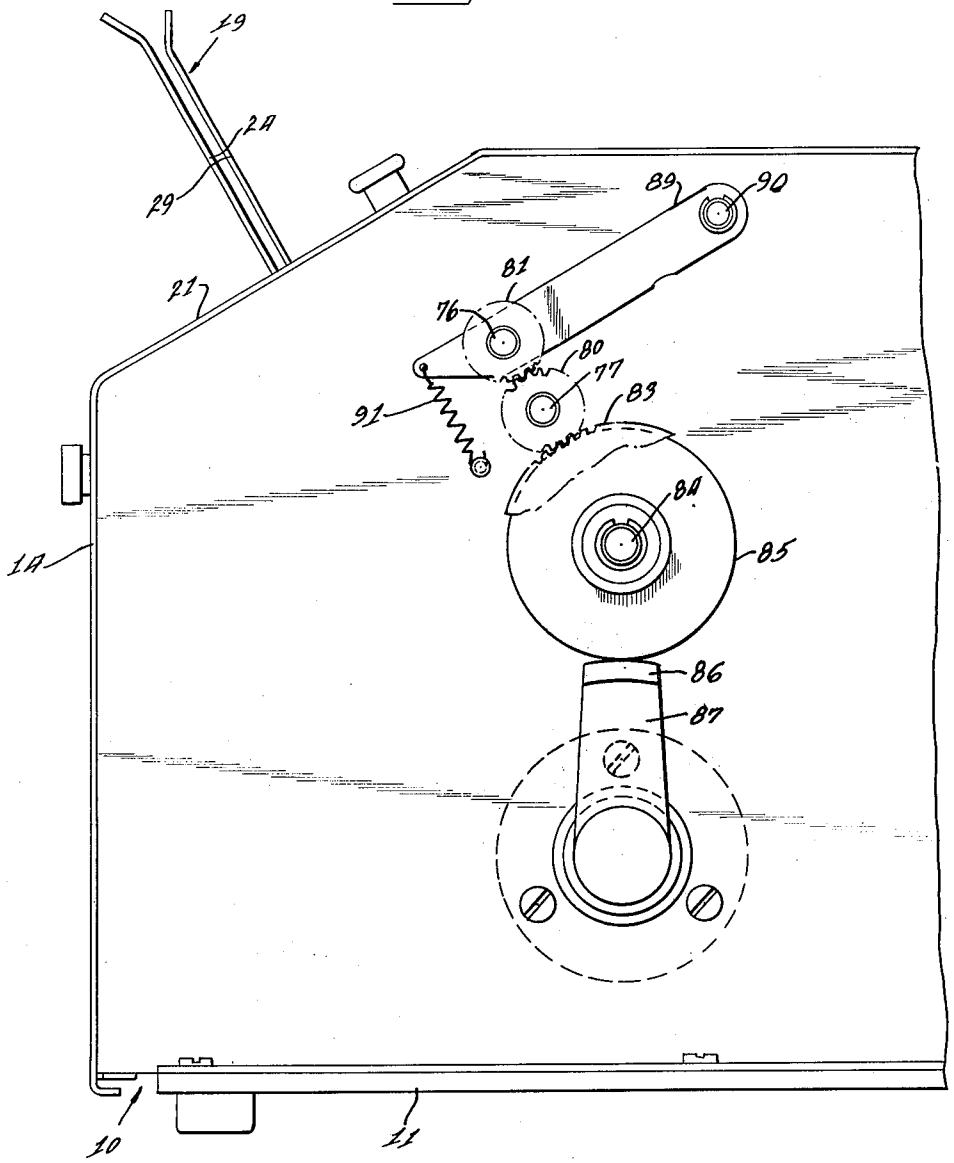
Fig. 5



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AUTOMATIC BINDING MACHINE

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Fig. 6

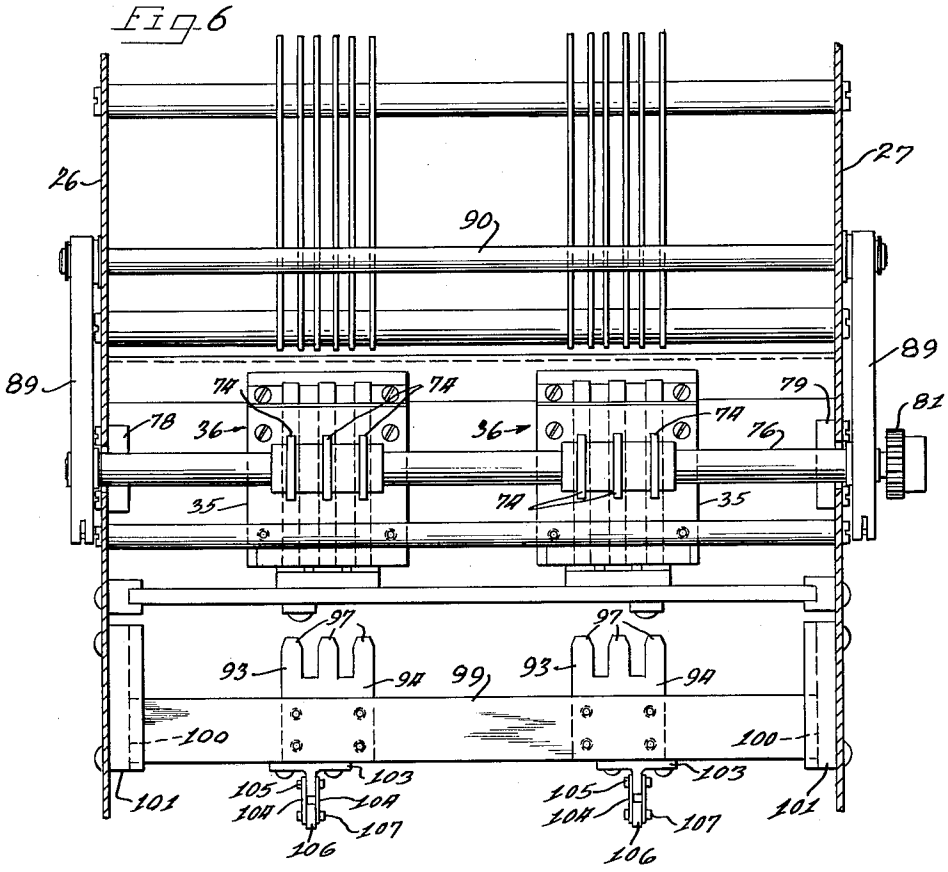
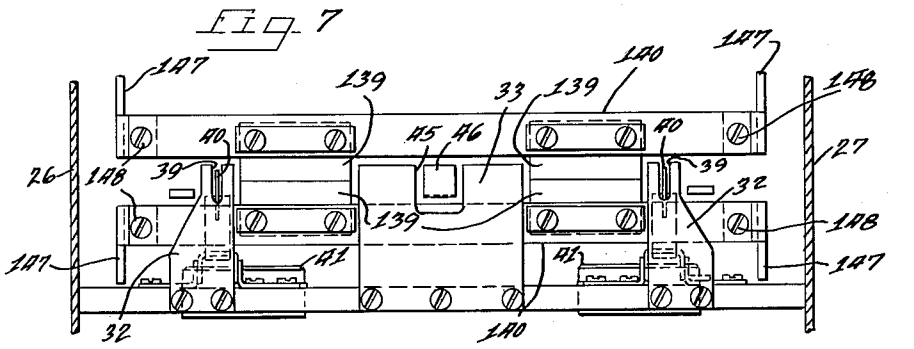


Fig. 7



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AUTOMATIC BINDING MACHINE

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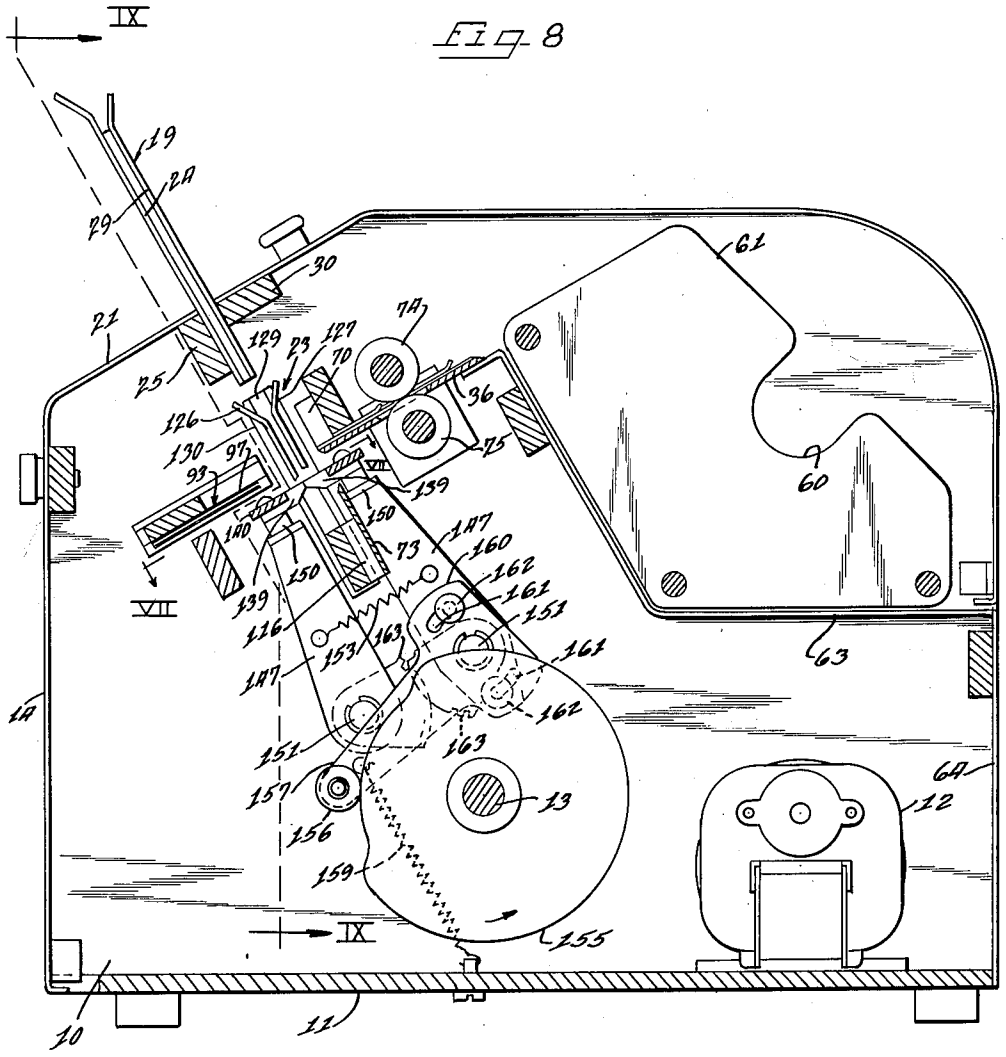
Fig. 8



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AUTOMATIC BINDING MACHINE

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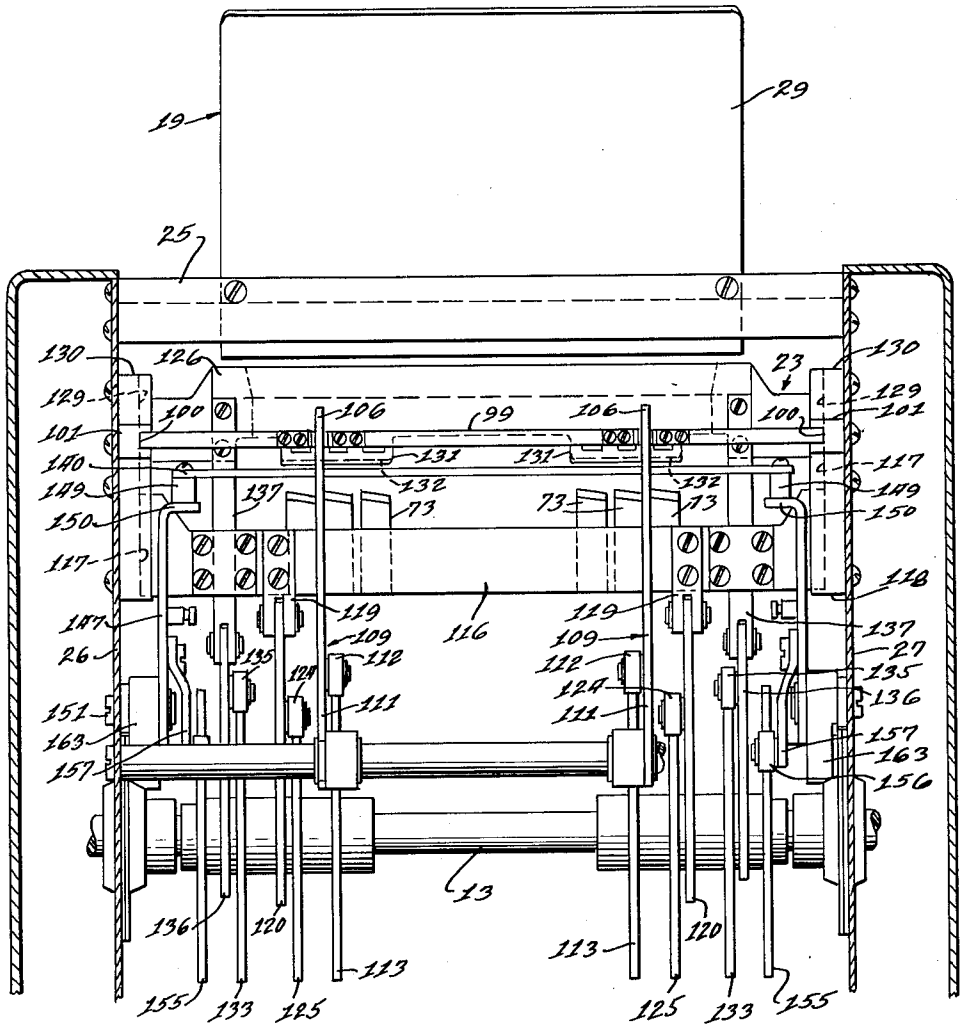
Fig 9



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United States Patent Office 3,124,818 Patented Mar. 17, 1964

3,124,818

AUTOMATIC BINDING MACHINE

Henry Lowell Byland, Deerfield, Ill., assignor to General Binding Corporation, a corporation of Illinois

Filed June 29, 1962, Ser. No. 206,215
7 Claims. (Cl. 11—1)

This invention relates to an improved apparatus for binding stacks of perforated sheets with a thin non-self-supporting heat sealable ribbon like plastic material.

A principal object of the present invention is to provide an improved apparatus for binding a plurality of perforated sheets in a simpler, faster and more economical manner than formerly.

A further object of the invention is to provide a simple apparatus for automatically binding a plurality of perforated sheets with thin non-self-supporting plastic ribbons fed through the perforations of the sheets.

A still further object of the invention is to improve upon the automatic binding apparatus heretofore known, for binding a stack of perforated sheets with a thin ribbon like plastic material, by providing a series of successively operated mechanisms driven in timed relation with respect to each other for feeding and inserting binding ribbons through the perforations of a plastic binding element and then holding and cutting off the ribbons to length, feeding the ribbons along the perforated edge of the sheets and sealing the depending ends of the ribbons in a series of automatic operations instigated by the insertion of a stack of perforated sheets into the apparatus into a binding position.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawings wherein:

FIGURE 1 is a fragmentary view in end elevation of a binding apparatus constructed in accordance with the principles of the present invention looking at the apparatus from one end thereof, with certain parts broken away and certain other parts shown in section in order to illustrate certain of the elements for terminating a binding operation;

FIGURE 2 is a wiring diagram illustrating the control circuit for the apparatus;

FIGURE 3 is a fragmentary transverse sectional view taken through the apparatus looking at the apparatus in an opposite direction from FIGURE 1 with certain parts removed in order to illustrate the cut-off position of the apparatus;

FIGURE 4 is a fragmentary longitudinal sectional view taken substantially along line IV—IV of FIGURE 3, with certain parts removed;

FIGURE 5 is a fragmentary end view of the apparatus looking at the opposite end of the apparatus from the end shown in FIGURE 1;

FIGURE 6 is a fragmentary sectional view looking substantially along line VI—VI of FIGURE 3 with certain parts removed;

FIGURE 7 is a fragmentary detail plan view of the apparatus looking at the apparatus at the angle of travel of the ribbon substantially along line VII—VII of FIGURE 8 and showing the heat sealing bars for sealing the ends of the ribbon in the form of loops;

FIGURE 8 is a fragmentary transverse sectional view

with certain parts broken away in order to show the heat sealing bars in a heat sealing position; and

FIGURE 9 is a longitudinal transverse sectional view taken through the apparatus substantially along line IX—IX of FIGURE 8 with certain parts removed.

In the embodiment of the invention illustrated in the drawings, I have shown in FIGURE 1 a casing 10 having a base 11 having a drive motor 12 mounted thereon and driving a cam shaft 13 through a chain and sprocket drive 15 for effecting the sequential binding operation of a book or stack of sheets 16 with at least one ribbon 17. The casing 10 has a detachable cover 14 extending along the front and top of said casing and downwardly along the rear thereof for a portion of the height thereof. The cover 14 has an inclined front wall 21 having a book or sheet guide chute 19 extending perpendicular thereto, within said casing.

The drive motor 12 may be a well known form of magnetic braking type of motor in which the brake is applied as the motor is deenergized and vice versa, so need not be shown or described in detail herein.

The stack of sheets or book 16 has rectangular perforations 18 extending along one edge thereof, which is the lower edge thereof, when the stack of sheets is in a binding position in the guide chute 19.

The chute 19 has delivery or terminal end portion 20 within the casing 10, in direct alignment with ribbon folders 23 for clamping one end portion of the ribbons to the book during the operation of severing the ribbons and for folding the ribbons 17 around the edge of the book to depend from the book for heat sealing.

As shown in FIGURES 1, 3, 7 and 9 the chute 19 includes a plate 24 extending for substantially the length of the casing 10 and secured to a transverse bar 25 mounted at its opposite ends in plates 26 and 27, mounted on and extending upwardly of the base 11. The chute 19 also includes a parallel wall 29 spaced from the wall 24 and mounted on a bar 30, mounted at its ends in the plates 26 and 27. The plates 24 and 29 are outwardly flared at their upper ends to accommodate a stack of sheets to be readily inserted in the space therebetween, the spacing between said plates determining the thickness of the stack of sheets to be bound. The spacing between the plates 24 and 29 may be varied as required, and said plates 24 and 29 may be adjustable toward and from each other, to accommodate stacks of sheets of varying thicknesses, in a conventional manner, which is no part of the present invention so is not herein shown or described.

Beneath the robbon folder 23 are two outer stop plates 32, 32 and a central stop plate 33, limiting downward movement of the book or stack of sheets 16, with the perforations 18 thereof in alignment with support surface of a plate 35 for a ribbon feed and guide 36 (FIGURE 7). The outer stop plates 32 extend parallel to the support plates 35 and are mounted on the top surface of a bar 37, mounted at its opposite ends on the plates 26 and 27. Each stop plate 32 has a slot 39 formed therein in alignment with the sheets 16 when placed in the chute 19 and moved downwardly therealong. An arm 40 of a limit switch 41 projects upwardly through the slot 39 in position to be engaged by the book or stack of sheets 16, to actuate the limit switch 41 to close said switch and start the motor 12 and thereby instigate a binding operation as the stack of sheets engages the stop plates

32 and 33. It will be understood from FIGURE 7 that two limit switches 41 are provided, one being beneath each stop plate 32, and that the circuit to the motor 12 is not closed until the two switch arms 40 are depressed by the stack of sheets 16 to close the two switches 41.

As shown in FIGURE 3 the arm 40 is one arm of a bell crank 42, pivoted intermediate its ends on a bracket 43, mounted on the bar 37 and having a depending arm 44 engaging the operating button for the limit switch 41.

The stop plate 33 as shown in FIGURE 7 has a slot 45 therein into which projects a right angled engaging end portion 46 of an arm 47 secured to and extending upwardly of a normally closed limit switch 49. The limit switch 49 is slidably mounted in a slide 50 mounted on a bracket member 51. The slide 50 extends parallel to the path of movement of the book or stack of sheets 16. The limit switch 49 has a yieldable switch arm 53 depending therefrom in outwardly spaced relation with respect to the body of the limit switch, and extending into position to be engaged by an actuator 54, projecting radially from a disk 55, mounted on the cam shaft 13.

The actuator 54 is so located with respect to the cams on the cam shaft 13 that it will engage the yieldable switch arm 53 and open the normally closed limit switch 49 to deenergize the motor 12, and apply the motor brake at the completion of a binding cycle. A tension spring 56 biases the limit switch 49 to position the engaging end portion 46 of the arm 47 through the slot 45 in the stop plate 33 above the stop plate 33. When there are no sheets in the guide chute 19 in engagement with the stop 33 the engaging end portion 46 of the arm 47 will extend through slot 45 and the switch 49 will be in its normally closed position. The arms 40 actuating the limit switches 41 will also extend through the slots 39 in the stop plates 32 and the switches 41 will be in their normally open positions. The actuator 54 will then be free to pass by the yieldable arm 53 as the limit switches 41 are closed by a stack of sheets, it being understood that the travel of the limit switch 49 is greater than the travel of the switch arms 40 required to close the switches 41 to accommodate the actuator 54 to pass by the arm 53 as the limit switches 41 are closed and an energizing circuit to the motor 12 is completed.

The ribbon 17 may be made from a thin gage heat sealable plastic material, such as, polyethylene film and is of a relatively limp or flaccid nature and carried on a spool 59. An individual ribbon is provided for each perforation in the stack of sheets 16, and the spools are rotatably carried in upwardly opening slotted portions 60 of parallel spaced dividers 61. The dividers 61 are mounted on a shelf 63 formed integral with a back wall 64 of the casing 10. The shelf 63 has an inner wall 65 extending angularly upwardly from its inner end, perpendicular to the support plates 35 and forming a support for the upper ends thereof.

The feed and guide means 36 includes a plate 67 extending parallel to the plate 35 and spaced thereabove a distance greater than the thickness of the ribbon 17. The plates 35 and 36 are suitably spaced apart along their outer sides and are supported at their discharge or lower end portions on a bar 69, mounted at its outer ends on the plates 26 and 27.

It may be seen from FIGURE 3 that the plate 67 terminates at the forward or advance face of the bar 69, and that a knife block 70 forms a forward continuation of the bottom surface of the plate 67. The knife block 70 may be secured to the bar 69 as by machine screws (not shown) and has a forward face 71, forming a surface along which cut-off knives 73 may move, to sever the ribbons threaded through the perforation 18 of the book or stack of sheets 16.

The feed and guide means for the ribbons 17 also includes a plurality of upper and lower pinch rolls 74 and 75 mounted on respective transverse shafts 76 and 77.

As shown in FIGURES 4 and 6 two feed and guide means 36 are provided and three ribbons are fed and guided by each feed and guide means. One set of pinch rolls 74 and 75 is shown as being provided for each ribbon, and three associated pinch rolls are integrally mounted on common hubs. The pinch rolls 74 and 75 extend through slotted portions of the plates 35 and 67 to engage opposite sides of the ribbons 17 and advance the ribbons step by step along the space between the inner sides of the plates 35 and 67.

The shaft 77 carrying the lower pinch rolls 75 is journalled in the plates 26 and 27 on bearing supports 78 and 79 respectively. The shaft 77 projects outwardly of the wall 27 and has a spur gear 80 mounted on the outer end thereof meshing with a spur gear 81 on the outer end of the shaft 76 for driving the shaft 76 at the speed of rotation of the shaft 77. The spur gear 80 is driven from a spur gear 83 on a shaft 84 mounted and projecting outwardly of the plate 27. The shaft 84 has a friction wheel 85 mounted thereon inwardly of the spur gear 83 and forming a drive member for said spur gear. The friction wheel 85 is rotated step by step by a friction drive member 86 mounted on the outer end of an arm 87 extending radially of a hub 88 mounted on the outer end of the cam shaft 13 and rotatably driven by said cam shaft. The friction drive member 86 is thus continuously driven with the shaft 13, as the shaft rotates and engages and drives the friction wheel 85, for a portion of a cycle of rotation thereof during each revolution of the shaft 13. The travel of friction wheel 85 is sufficient to feed ribbons 17 from the spools 59, the exact lengths required to pass through the perforations of a stack of sheets and to be folded downwardly over the back edge of the stack of sheets, to bind the stack of sheets.

The upper shaft 76 is journalled at its opposite ends in arms 89 extending angularly upwardly of the shaft 76 and pivotally mounted on the outsides of the plates 26 and 27 on pivot pins 90. The arms 89 extend beyond the shaft 76 toward the ribbon folder 23. A tension spring 91 is connected to the outer ends of the arms 89 to yieldably bias the pinch rolls 74 into engagement with the pinch rolls 75.

The ribbon guides 93 are provided to enter and pass through the perforations 18 in the stack of sheets 16 into engagement with the forward ends of the plates 36 and the blocks 70, to form continuations of the guide slots between the plates 35 and 67, and the undersurface of the blocks 70.

As shown in FIGURES 3, 6 and 7 the ribbon guides 93 include two vertically spaced relatively thin plates 94 and 95 having aligned guide fingers 97 extending therefrom, conforming to the perforations 18 of the stack of sheets, one guide finger registering with each set of pinch rolls 74 and 75. The guide fingers 97 when inserted through the perforations 18 form in effect, extensions of the guides 35 and 37 and form a smooth channel supporting the ribbon to slide through the perforations in the book. The plates 94 and 95 are spaced apart a distance slightly greater than the thickness of a ribbon 17 and are mounted on the undersurface of a bar 99 slidably guided at its opposite ends in channels 100 extending along guide blocks 101, secured to the inner sides of the plates 26 and 27 and extending inwardly therefrom parallel to the plates 35 and 70 of the support and guide means 36 (FIGURE 6).

The bar 99 has two spaced generally T-shaped connectors 103, secured to the opposite side thereof from the fingers 97 and having links 104 pivotally connected thereto on pivot pins 105. The links 104 extend along opposite sides of a lever arm 106 and are pivotally connected thereto as by pivot pins 107 (FIGURES 3 and 6). The lever arm 106 is shown in FIGURE 3 as being one arm of a bell crank 109. The bell crank 109 is pivoted intermediate its ends on a shaft 110 parallel to the cam shaft 13 and positioned a substantial distance beneath the ribbon guides 93. The bell crank 109 has a second

lever arm **111** having a follower **112** on the end thereof engaging the face of a cam **113** mounted on the shaft **13** and rotatably driven thereby (FIGURE 4). The faces of the cams **113** are of the same contour and are so formed as to move the fingers **97** of the ribbon guides **93** through the perforations **18** of the stack of sheets **16**. The pinch rolls **74** and **75** are then operated to feed lengths of ribbon into the spaces between the fingers **97** through the perforations **18** in the book **16** and to be withdrawn from the perforations **18** after the ribbons have been advanced through said perforations, prior to operation of the cut-off knives **73**, to sever the ribbons threaded through the perforations **18**. A tension spring **115** is connected between the upper end of the lever **106** and a connector **116** on the bar **25**, to bias the follower **112** into engagement with the face of the cam **113** and to project the fingers **97** through the perforations **18**, as the followers **112** move to the low portions of said cams.

The cut-off knives **73** are shown in FIGURE 9 as being mounted on a bar **116** guided at its opposite ends in channels **117** formed in guide blocks **118**, mounted on the inner sides of the side plates **26** and **27** and extending parallel to the chute **19**. Connectors **119** are mounted on the bar **116** and depend therefrom and are pivotally connected to drive links **120** as by pivot pins **121**. As shown in FIGURE 3 each drive link **120** has a downwardly opening guide slot **123** formed therein extending parallel to the chute **19** and the direction of travel of the knives **73** and extending along opposite sides of the cam shaft **13**. Follower rollers **124** are rotatably mounted on the links **120** intermediate the ends of said links, and engage the faces of cams **125** mounted on and rotated by the cam shaft **13**. The knives **73** are thus moved upwardly along the ends of the plates **35** and blocks **70** as the follower roller **121** engages the high part of the cam. Tension springs **122** connected between the base of the casing **10** and the lower ends of the links **120** are provided to return the knives **73**.

The ribbon folder **23** moves downwardly along the stack of sheets, as the knives **73** move upwardly to sever the ribbons and first holds the ribbons taut, to be severed by the knives **73**, and then folds the severed ribbons along and beyond the edge of the stack of sheets in position for heat sealing the adjacent ends of the ribbons together.

The ribbon folder **23** comprises two parallel spaced plates **126** and **127** having outwardly flared upper end portions. The plates **126** and **127** extend the length of the chute **19** and are connected together at their outer ends in parallel spaced relation with respect to each other. The outer ends of the plates **126** and **127** are slidably guided in guide channels **129** formed in guide blocks **130** secured to inner sides of the walls **26** and **27** and extending inwardly therefrom (FIGURES 8 and 9). The guide channels **129** extend in the direction of travel of the stack of sheets as it is moved downwardly along the chute **19**, to guide the ribbon folder **23** for movement toward and from said chute from a position above the guide fingers **93** downwardly beneath said guide fingers.

The plates **126** and **127** have folding tongues **131** and **132** respectively depending from the lower margins of said plates and forming downward continuations thereof. The folding tongues **131** and **132** are in alignment with each other and are in alignment with the guide fingers **97** and support plates **35**. The folding tongues **131** of the plate **126** extends downwardly a greater distance than the folding tongues **132** of the plate **127**, and come into engagement with the ribbons prior to engagement of the folding tongues **132** with the ribbons and prior to severing the ribbons by the knives **73**, to hold the ribbons taut during the severing operation.

Spaced cams **133** on the cam shaft **13**, and rotatably driven thereby, are provided to control movement of the ribbon folder **23**. As shown in FIGURE 9, the cams **133** engage follower rollers **135** mounted intermediate the ends of links **136** pivotally connected to the lower ends of connectors **137** secured to the plate **126** adjacent opposite ends thereof and depending therefrom. The links **136** are similar to the link **120** and are slidably guided at their lower end portions on the cam shaft **13** in slots (not shown) opening to the lower ends of said links.

The contours of the cams **133** are such that the ribbon folder **23** will move downwardly as soon as the fingers **97** move out of the path of travel of said ribbon folder. The folding tongues **131** will then engage the portion of the ribbons extending through the slots **18** prior to severing of the ribbons. The ribbon folder **23** may then remain in this position with the tongues **132** free from the ribbons as the knives **73** are moved upwardly along the block **70** to sever the ribbons. As the ribbons are severed, the ribbon folder **23** then moves downwardly for the full length of its travel under the control of the cams **133**, **133**.

As the ribbon folders **23** fold the ribbon downwardly along the edge of the book, the cutoff knives **73** retract, and heat sealing jaws **139** advance toward each other and clamp and heat seal the ribbons in the form of closed loops and thereby complete the binding operation.

The heat sealing jaws **139**, as shown in FIGURES 7 and 8, are mounted on transversely extending bars **140**, **140**, rockably movable toward and from each other to bring the jaws **139**, **139** into clamping engagement with the free end portions of the ribbons and to retractibly move said jaws. The heat sealing jaws may have resistor heaters **141** therein energized under the control of a normally open limit switch **142** as shown in FIGURE 1. The limit switch **142** has a switch arm **143** thereon and extending therefrom and having a follower roller **144** on the end thereof. The follower roller **144** is engaged by a cam plate **146** mounted on and projecting from the periphery of the disk **55**. The cam plate **145** has a sloping camming face **146** engaging the roller **144** and moving the switch arm **143** in a direction to close the limit switch **142**, once during each cycle of rotation of the disk **55**, and thereby energize the resistor heaters **141** as the heat sealing jaws **139** move toward each other to heat seal the ribbons in the forms of closed loops.

The bars **140**, **140** are mounted at their opposite ends on rocker arms **147**, **147**, as by machine screws **148**, **148** and spacers **149**, **149** spacing said bars above inturned ends **150**, **150** of said rocker arms (FIGURE 9).

The rocker arms **147**, **147** are pivotally mounted on the insides of the plates **26** and **27** on pivot pins **151**, **151**. A tension spring **153** is connected between the rocker arms **147**, **147**, intermediate the ends of said rocker arms, and serves to bias the heat sealing jaws **137** into engagement with each other.

The heat sealing jaws **139**, **139** are moved away from each other by operation of cams **155** on the cam shaft **13** and engaging follower rollers **156** on the ends of lever arms **157**. The lever arms **157** are pivotally mounted on an associated pivot pin **151** forming a pivotal support for the rocker arm **147**, shown in FIGURE 8 as being the upper or right hand rocker arm. A tension spring **159** connected between the base **11** and the lever arm **157**, adjacent its outer end portion, is provided to bias the follower roller **156** into engagement with the cam **155**.

The lever arm **157** has a widened base portion **160** pivotally mounted on the pivot pin **151**. The base portion **160** has diametrically opposed circumferentially extending slots **161**, **161** formed therein, through which extend headed adjustment screws **162**, **162** mounted on and extending outwardly of the upper or right hand rocker arm **147**, the heads of said adjustment screws engage the outer sides of the associated base portion **160** and retain the lever arm **157** in fixed relation with respect to the rocker arm **147**. The slots **161**, **161** and adjustment screws **162**, **162** enable the lever arms **157** to be centered with respect to the cams **155** and rocker arms **147**, and to retain said lever arms to fixed relation with re-

spect to the associated rocker arms **147**. The rocker arms **147**, **147** are connected together to effect simultaneous movement of said rocker arms in opposite directions, upon operation of the lever arm **157**, by meshing gear sectors **163**, **163**.

In operation of device, assuming the desired number of ribbon spools **59** are mounted between the dividers **61** and ribbons **17** are trained from said spools to the pinch rolls **74** and **75** and the spaces between the plates **35** and **67**, an unbound book or stack of sheets perforated along one edge thereof is inserted in the chute **19** with the perforated edge of the book in a lowermost position. The book is then fed along the chute **19** and ribbon folder **23** into engagement with the operating arms **40** for the limit switches **41** and into abutting engagement with the stops **32**, **32** and **33**. This will close the normally open limit switches **41**. Engagement of the book with the engaging end **46** of the arm **47**, will also slide the normally closed limit switch **49** along its guide **50** into position to bring the switch arm **53** in position to be engaged by the actuator **54**, at the termination of a binding operation. Closing the limit switches **41**, **41** will energize the motor **12** through a conductor **164**, and a conductor **165** connected with said motor through the limit switches **41**, **41** and **49**.

The binding cycle will then start and the fingers **97**, **97** of the ribbon guides **93**, **93** will advance through the perforated slots **18** in the book or stack of sheets **16**. The pinch rolls **74** and **75** will also be rotatably driven to feed the ribbons along spaces between the plates **35** and **67** and along the guide fingers **97**, **97** of the ribbon guides **93**. The ribbon guides **93**, **93** will then retractibly move with respect to the perforations **18**, **18** in the book **16** after the ribbons have advanced through the perforations **18**, **18** of the book. The cutoff knives **73**, **73** will then advance upwardly to sever the ribbons, and at the same time the ribbon folder **23** will start its downward travel and the tongues **131**, **131** of said ribbon folder will engage and clamp the leading end portions of the ribbons, holding the ribbons to the perforations **18**, **18** as the knives **73**, **73** sever the ribbons.

The knives **73**, **73** will then retractibly, move and the ribbon folder **23** will continue its downward movement along the book and fold the ribbons around the edge of the book.

The tension springs **153** will then move the heat sealing jaws **139**, **139** towards each other under control of the cams **155**, **155** into clamping engagement with the ribbons folded around the edge of the book. As the heat sealing jaws advance toward each other, the cam plate **145** will engage the follower roller **144** and close the normally open limit switch **142**, to energize the resistor heaters **141** in the heat sealing bars **139**. This will seal the ribbons in the forms of closed loops. The cams **155**, **155** will then operate the lever arms **157**, **157** to retractibly move the heat sealing bars **139**, **139**. The actuator plate **54** will then engage the switch arm **53** for the limit switch **49** and open said limit switch and deenergize the motor **12**. The binding operation will then stop and the bound book may be removed from the guide chute **19**.

It should be understood that the motor **12** is described as being a magnetic braking type of motor in which the brake is released as the motor is energized, and is applied as the motor is deenergized by opening of the normally closed limit switch **49**, by operation of the actuator **54** at termination of the binding operation. A one revolution clutch may be used instead of the magnetically braked motor and that various other conventional arrangements may be provided to stop rotation of the cam shaft **13** as soon as the binding operation is completed.

While I have herein shown and described one form in which my invention may be embodied, it may be readily understood that various variations and modifications in the invention may be attained without departing from the spirit and scope of the novel concepts thereof as defined by the claims appended hereto.

I claim as my invention:

1. In an apparatus for binding a stack of sheets having at least one perforation therein adjacent an edge thereof,
feed and guide means for a ribbon of heat sealable material,
a guide chute for a stack of sheets extending at right angles to said feed and guide means, stop means spaced from said guide chute and operable to align the perforation with the ribbon feed and guide means,
a ribbon guide extensibly movable through the perforation into juxtaposition with said ribbon feed and guide means, for guiding a ribbon to be threaded through said perforation,
said ribbon guide being retractible from said perforation after the ribbon has advanced therealong through the perforation to release the leading end of the ribbon and thereby complete the threading of the ribbon through the stack of sheets,
a cut-off knife movable along the discharge end of said feed and guide means for severing the ribbon,
a ribbon folder forming a continuation of said chute and spaced between the end of said chute and said feed and guide means and movable along the stack of sheets toward said stop to first clamp the ribbon for severing and to then fold the ribbon along opposite sides of the stack of sheets to extend beyond the edge thereof,
and heat sealing means disposed beneath said stop and clamping the adjacent ends of the ribbon together and sealing the ends of the ribbon by heat.

2. In an apparatus for binding a stack of sheets having at least one perforation therein, adjacent an edge thereof,
a generally vertically extending guide chute for a stack of sheets,
a pair of pinch rolls spaced beneath said chute and guide means leading therefrom,
a stop spaced beneath said guide means and limiting movement of the stack of sheets to register the perforation in the stack of sheets with said guide means,
a ribbon guide on the opposite side of the chute from said pinch rolls and guide means and in alignment with the perforation in the stack of sheets upon engagement of the stack of sheets with said stop,
means for rotatably driving said pinch rolls, means for projecting said ribbon guide through the perforation in the stack of sheets to a position adjacent said guide means for guiding a ribbon fed by said pinch rolls through said perforation,
said means also retractibly moving said ribbon guide with respect to the perforation and releasing the portion of the ribbon threaded through the perforation,
a cut-off on the same side of said chute as said pinch rolls,
means for vertically moving said cut-off to effect severing of the ribbon to length,
a ribbon folder spaced beneath said chute and in alignment therewith and movable downwardly along the stack of sheets beneath said ribbon guide and pinch rolls to first clamp the ribbon during the cut-off operation and to then fold the ribbon around the edge of the stack of sheets,
heat sealing jaws mounted for movement into engagement with the free ends of the ribbon folded around the edge of the stack of sheets for clamping the free ends of the ribbon together and sealing the ribbon in the form of a closed loop,
and means for moving said heat sealing jaws in clamping and release directions.

3. In an apparatus for binding a stack of sheets having at least one perforation therein, adjacent an edge thereof,
a generally vertically extending guide chute for a stack of sheets,
a ribbon guide spaced beneath said guide chute and on one side thereof and mounted for movement toward and from the stack of sheets,

a stop spaced beneath said ribbon guide and locating the perforation in the stack of sheets in alignment with said ribbon guide and accommodating the projection of said ribbon guide through the perforation,

pinch rolls and guide means leading therefrom on the opposite side of the stack of sheets from said ribbon guide and feeding a ribbon along said guide means and ribbon guide through the perforation in the stack of sheets,

a ribbon folder in alignment with said guide chute and extending along opposite sides of the stack of sheets and disposed above said ribbon guide and movable along the stack of sheets beneath said ribbon guide for folding the ribbon around the edge of the stack of sheets,

a cut-off knife movable to sever the ribbon held to the stack of sheets by said ribbon folder,

heat sealing jaws clamping the free ends of the ribbon together and sealing the ribbon in the form of a closed loop, a motor,

a shaft driven by said motor,

a plurality of cams on said shaft,

individual drive connections from said cams to said ribbon guide,

said ribbon folder,

said cut-off knife and said heat sealing jaws for effecting operation thereof in a preselected sequence and a cyclic step up drive connection from said shaft to said pinch rolls for driving said pinch rolls distances sufficient to thread the ribbon through said ribbon guide during each cycle of rotation of said shaft.

4. In an apparatus for binding a stack of sheets having at least one perforation therein, adjacent an edge thereof,

a generally vertically extending guide chute for a stack of sheets,

a ribbon guide spaced beneath said guide chute on one side thereof and mounted for extensible movement toward and beyond a stack of sheets in said guide chute,

a pinch rolls and guide means leading therefrom on the opposite side of the stack of sheets from said ribbon guide and in alignment therewith,

a stop spaced beneath said ribbon guide and pinch rolls and registering the perforation with said ribbon guide to accommodate the projection of said ribbon guide through the perforation to guide a ribbon fed by said pinch rolls through the perforation,

a ribbon folder in alignment with said chute between the bottom of said chute and said ribbon guide and slidable along the stack of sheets beneath the path of travel of said ribbon guide to first hold the ribbon taut for severing and then fold the ribbon along the stack of sheets to project from the edge thereof,

a cut-off knife spaced beneath said ribbon guide and movable vertically to sever the ribbon held to the stack of sheets by said ribbon folder,

heat sealing jaws spaced beneath said ribbon guide and ribbon folder,

clamping the free ends of the ribbon together and heat sealing the ribbon in the form of a closed loop,

a motor,

a shaft driven by said motor,

a plurality of cams on said shaft,

and individual drive connections from said cams to said ribbon guide,

said ribbon folder,

said cut-off knife and said heat sealing jaws to effect the sequential operation thereof in the order named,

a cyclic step up drive connection from said shaft to said pinch rolls for driving said pinch rolls distances sufficient to thread the ribbon through said ribbon guide during each cycle of rotation of said shaft,

and a normally open switch in association with said stop and engaged by the stack of sheets upon the engagement of the stack of sheets with said stop for

effecting energization of said motor and the initiation of a binding operation.

5. In an apparatus for binding a stack of sheets having at least one perforation, a motor, a shaft driven by said motor,

a guide chute guiding a stack of sheets for binding,

a stop spaced beneath said guide chute and limiting movement of the stack of sheets into a binding position,

mechanism driven by said shaft for threading a ribbon through said perforation,

holding the ribbon taut for severing,

severing the ribbon and heat sealing the ends of the ribbon,

a normally open limit switch having a switch arm in association wtih said stop means and extending from said stop means toward said chute,

to be engaged by the stack of sheets and effect energization of said motor and the initiation of a binding operation when the stack of sheets is in a binding position in engagement with said stop means,

a normally closed limit switch beneath said chute and mounted for slidable movement toward and from said chute, spring means biasing said switch toward said stop,

a switch actuator on said shaft and rotatable therewith,

movement of the stack of sheets into engagement with said stop moving said normally closed limit switch into operative association with said actuator to be actuated thereby and open the circuit to said motor at the completion of a binding cycle.

6. An apparatus for binding a stack of sheets each perforated at a multiplicity of spaced points along one edge thereof,

comprising a casing,

a guide chute mounted on a wall of said casing and extending within said casing perpendicular to said wall,

means limiting movement of the stack of sheets along said guide chute in a binding position,

ribbon feed and guide means on one side of said chute,

extending parallel to said wall and spaced inwardly from said wall in centered relation with respect to the perforations in the stack of sheets when in a binding position in said chute in engagement with said limiting means,

a ribbon guide on the opposite side of said chute from said feed and guide means and including spaced guide fingers projectable in a direction parallel to said wall through the perforations in the stack of sheets into juxtaposition with said feed and guide means for guiding ribbons through the perforations in the stack of sheets,

means engaging the ribbon and holding the ribbon taut for cut-off upon withdrawal of said guide fingers from the perforations in the stack of sheets,

a ribbon cut-off cutting off the taut ribbon to length, and means heat sealing the ends of the ribbon.

7. An apparatus for binding a stack of sheets each perforated at a multiplicity of spaced points along one edge thereof,

comprising a casing,

a guide chute mounted on a wall of said casing and extending within said casing perpendicular to said wall,

means limiting movement of stack of sheets along said guide chute in a binding position,

ribbon feed and guide means on one side of said chute,

extending parallel to said wall and spaced inwardly from said wall in centered relation with respect to the perforations in the stack of sheets when in a binding position in said chute in engagement with said limiting means,

a ribbon guide on the opposite side of said chute from said feed and guide means and including spaced guide

fingers projectable in a direction parallel to said wall through the perforations in the stack of sheets into juxtaposition with said feed and guide means for guiding ribbons through the perforations in the stack of sheets,

a ribbon cut-off cutting off the threaded ribbons,

a ribbon folder movable along the stack of sheets for first engaging the ribbons and maintaining the ribbons taut during the cut-off operation and then folding the ribbons to depend from the edge of the stack of sheets,

and heat sealing jaws beneath said ribbon folder engaging opposite sides of the depending end portions of the ribbons and clamping the depending end portions of the ribbons together and sealing the ribbons in the form of closed loops.

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