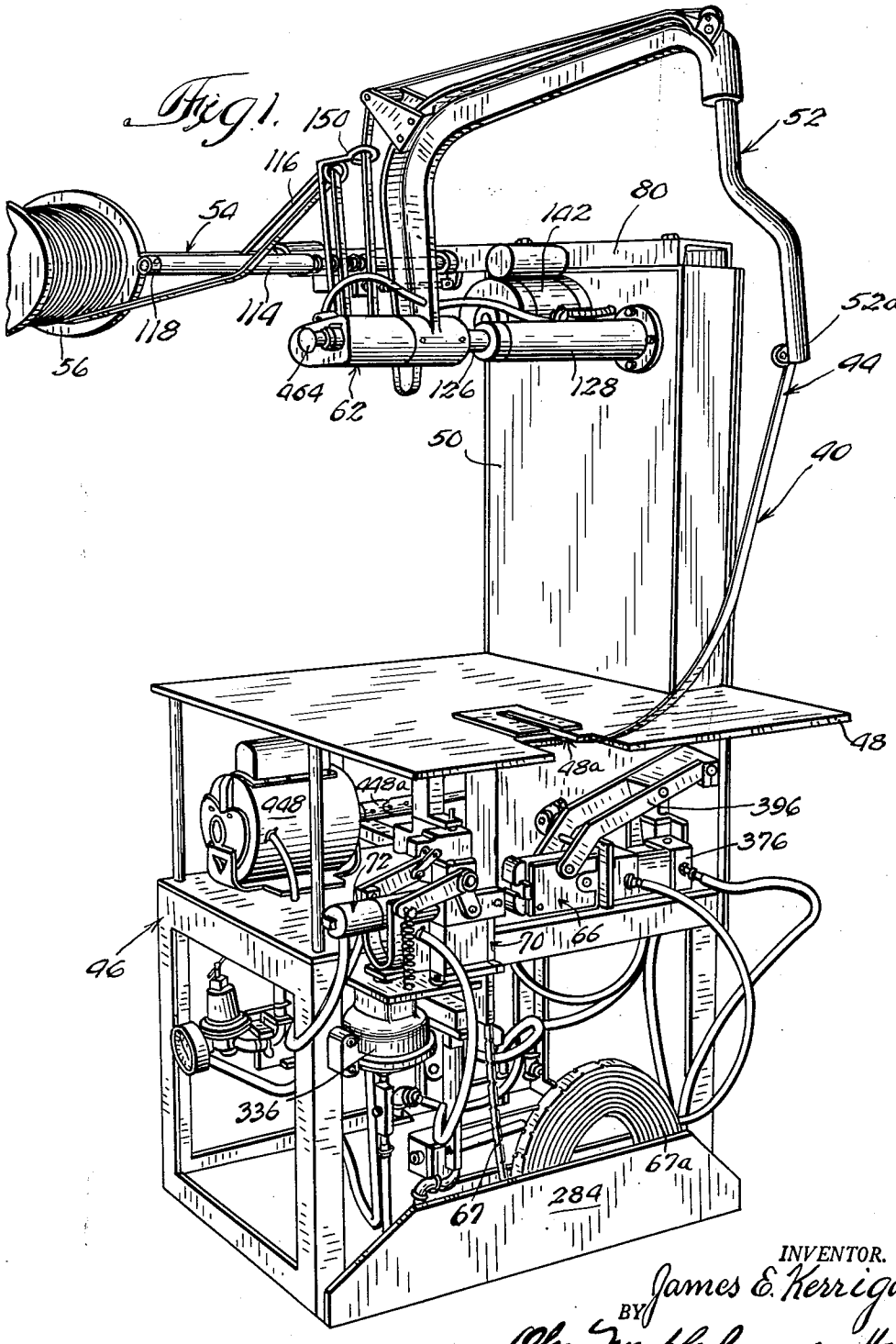
Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 1



INVENTOR.
James E. Kerrigan.
BY
Olson, Trexler, Wolters, Bosworth,
Pendleton & Nielsen.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 2

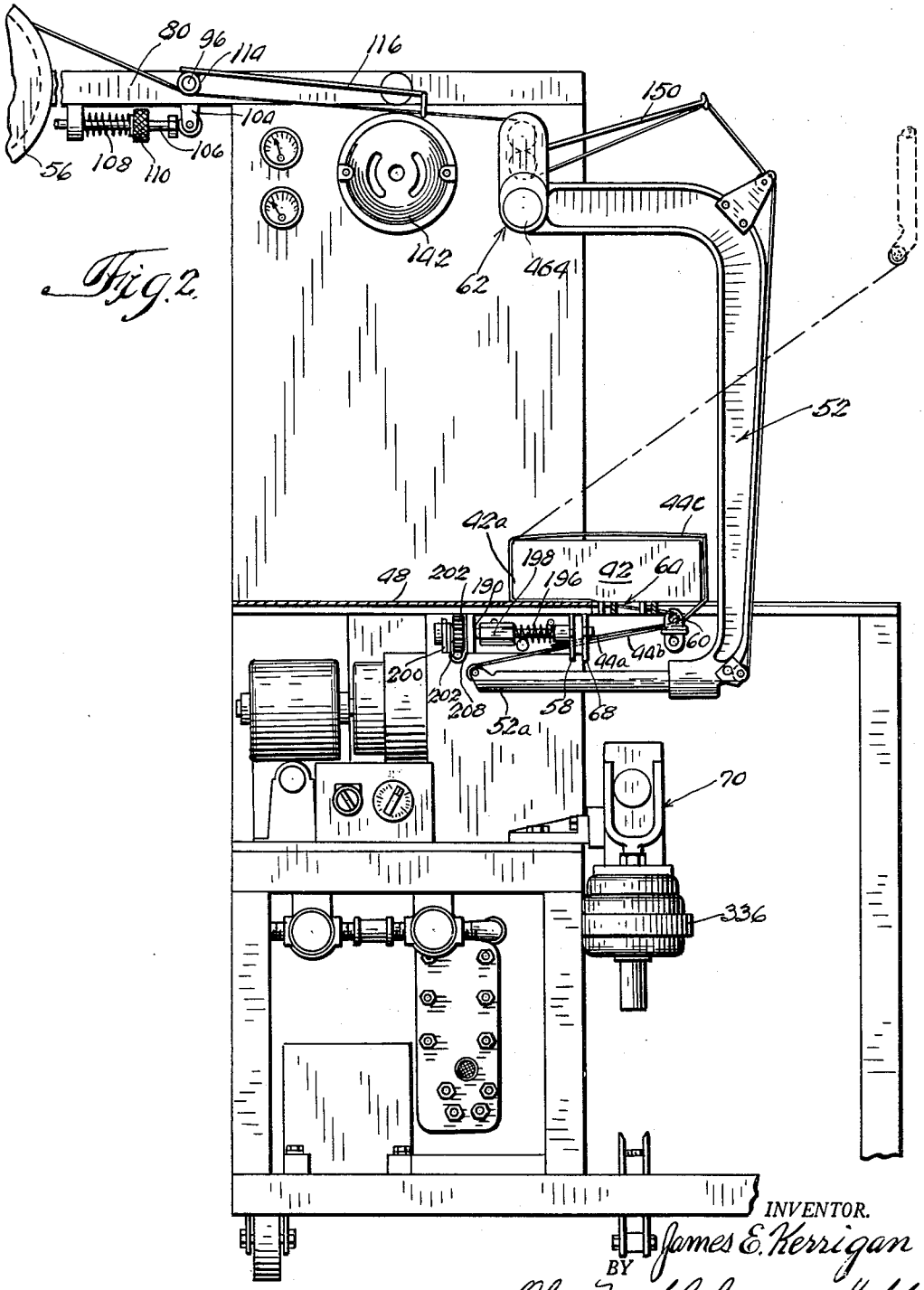


Fig. 2.

INVENTOR.
James E. Kerrigan
BY
Olson, Trexler, Wamsley, von Hoist, Pendleton & Kerkman. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 3

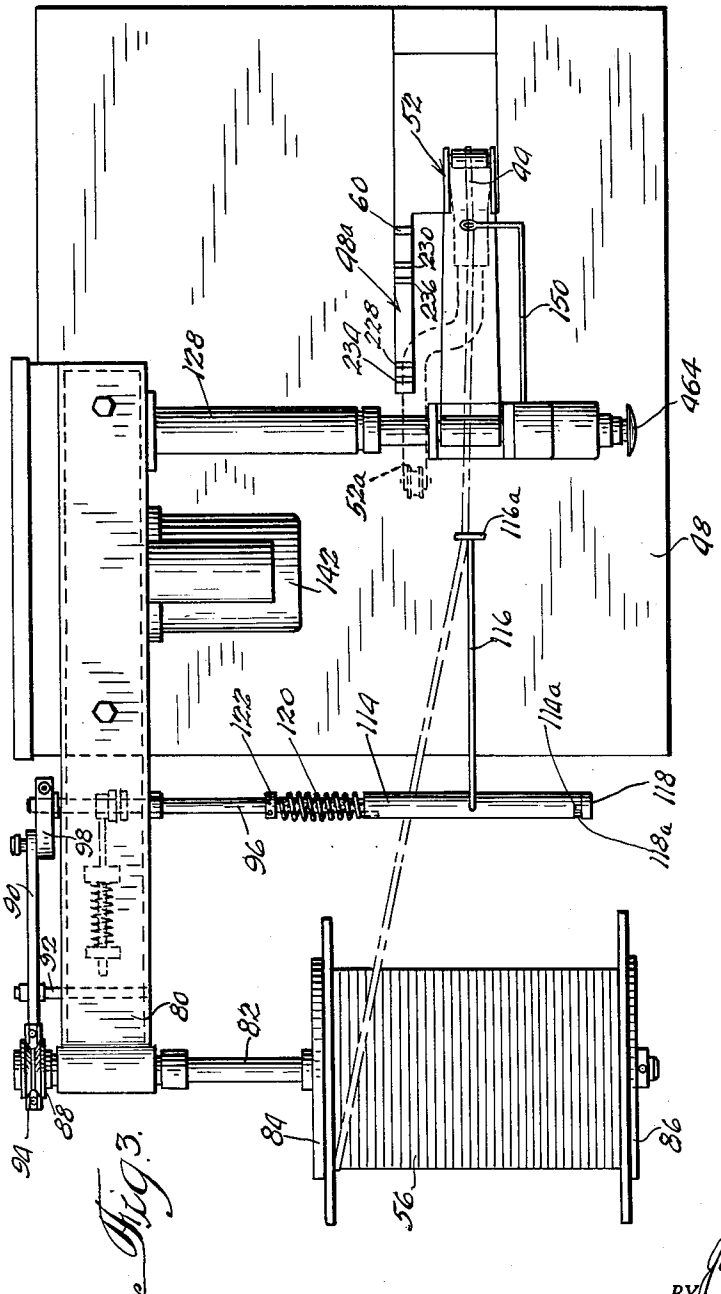


Fig. 3.

INVENTOR.
James E. Kerrigan
BY
Olson, Macklenburger, von Holst.
Pendleton & Newman Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 4

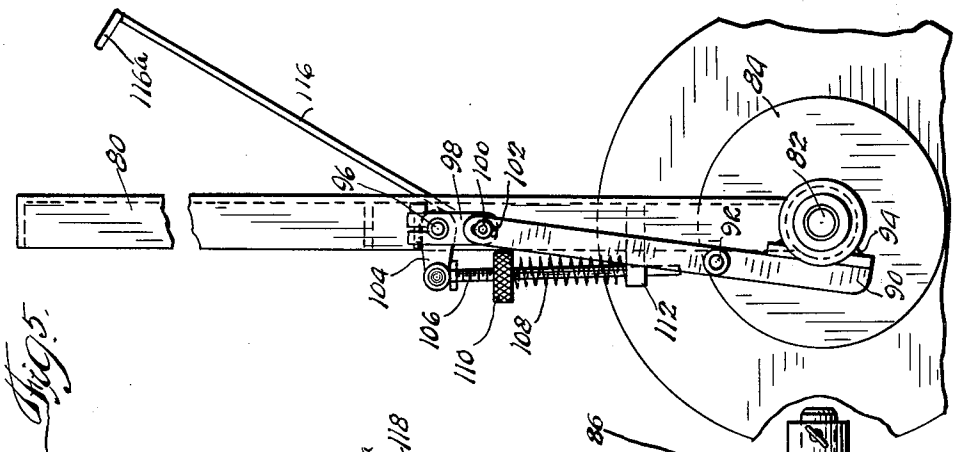


Fig. 5.

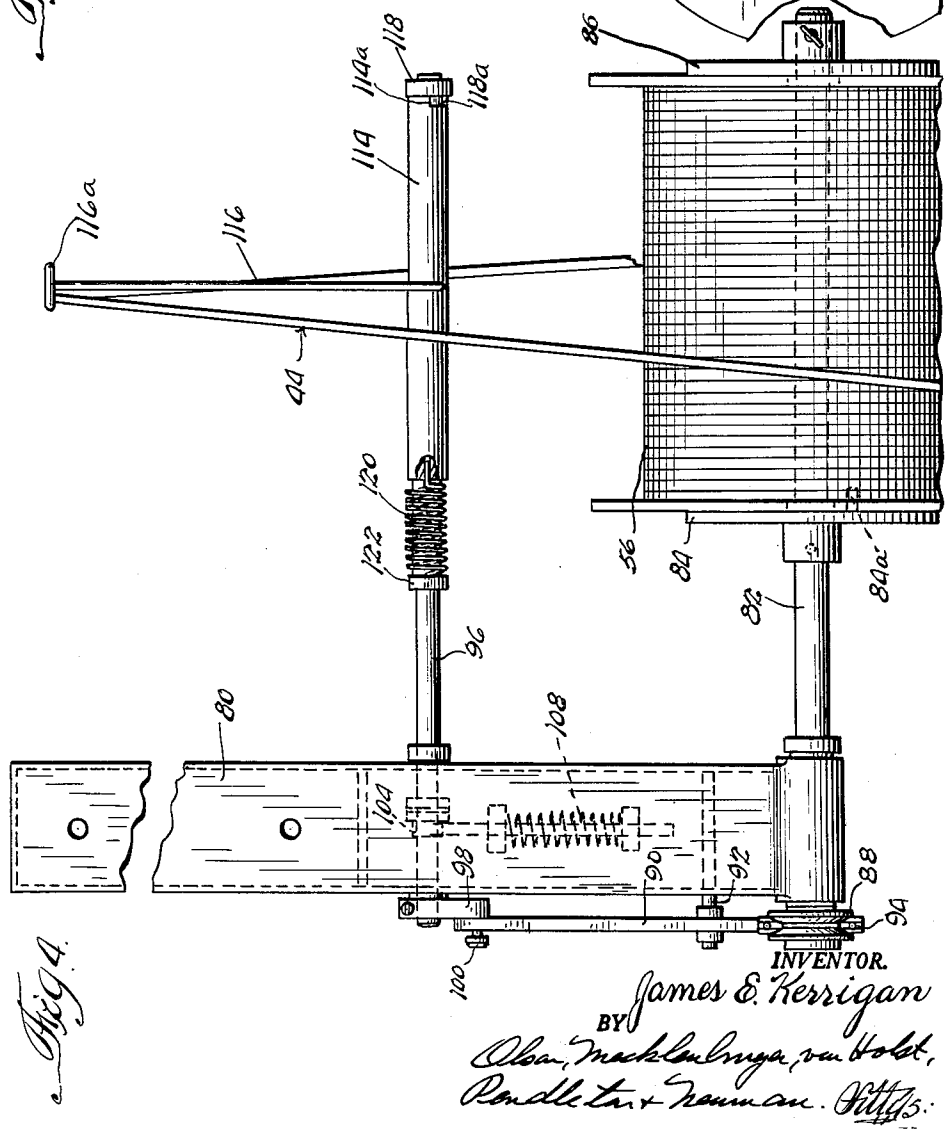


Fig. 4.

INVENTOR.
James E. Kerrigan
BY
Olson, Mackenzie, von Hoist, Pendleton & Norman. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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Fig. 6.

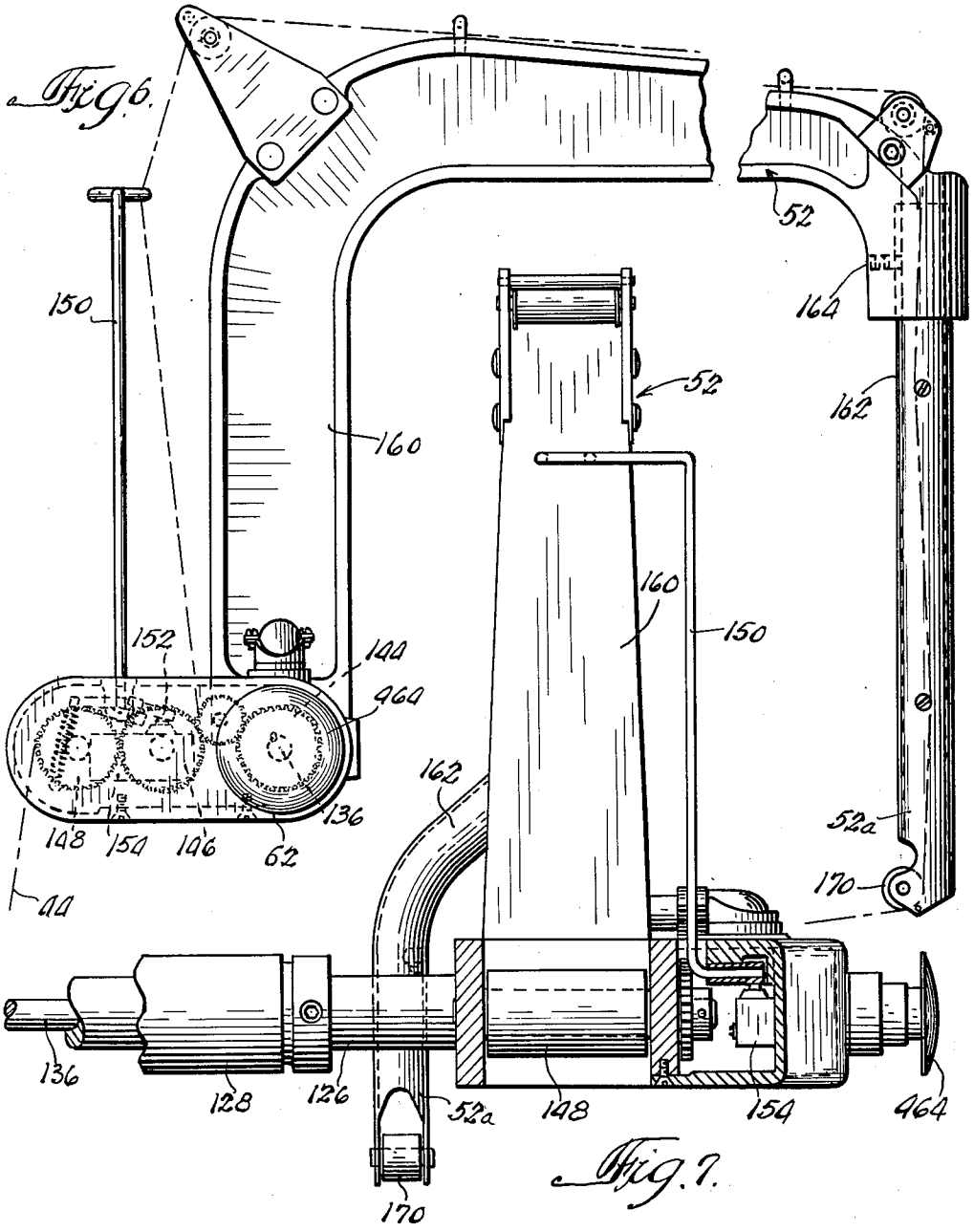


Fig. 7.

INVENTOR.
James E. Kerrigan
BY
Olson, Trexler, Wamsley, von Hoist,
Randleton & Neumann Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 6

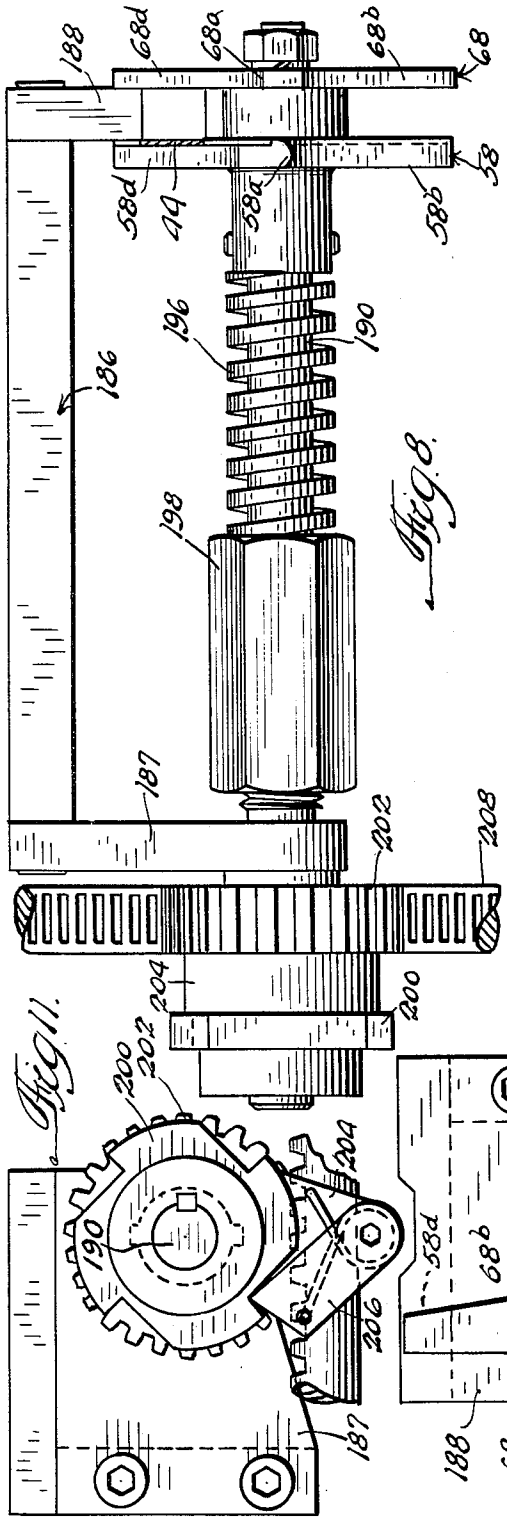


Fig. 8.

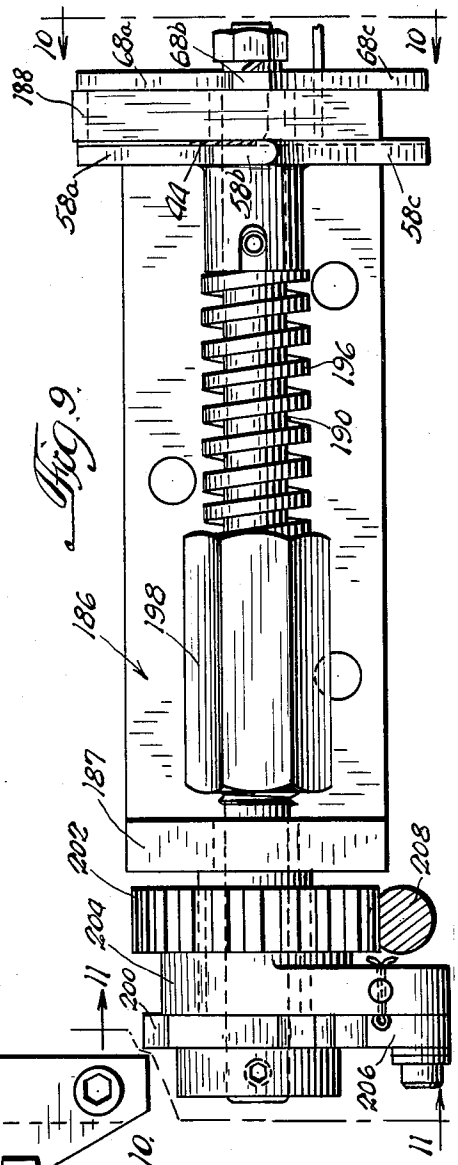


Fig. 9.

Fig. 11.

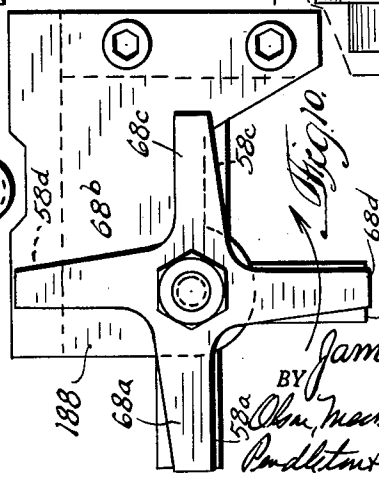


Fig. 10.

INVENTOR.
James E. Kerrigan
BY
Olson, Macklanburger, Van Hold, Pendleton & Newman. Attys

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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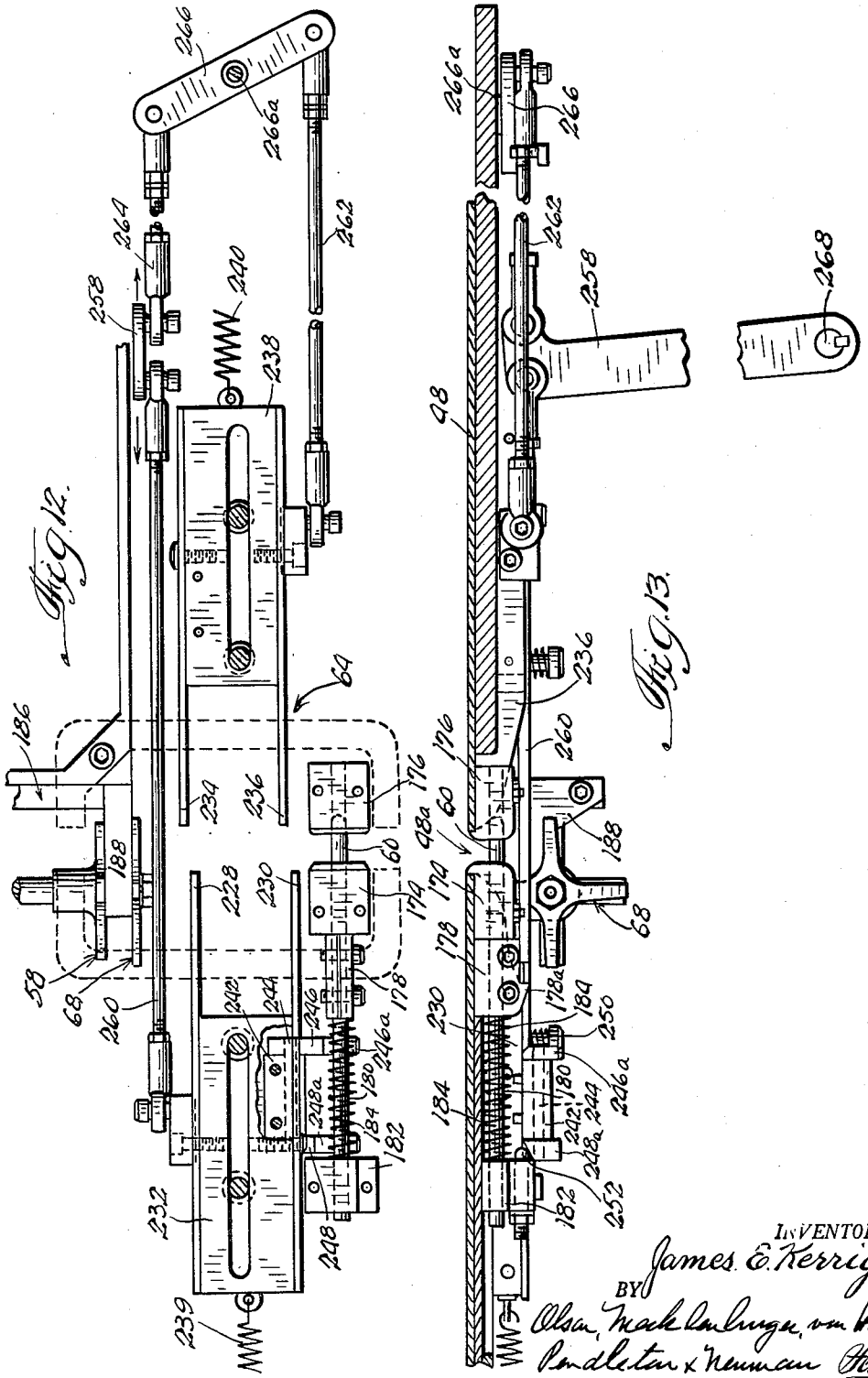


Fig. 12.

Fig. 13.

INVENTOR.
James E. Kerrigan
BY
Olson, Mackenzie, von Holst,
Pendleton & Neuman Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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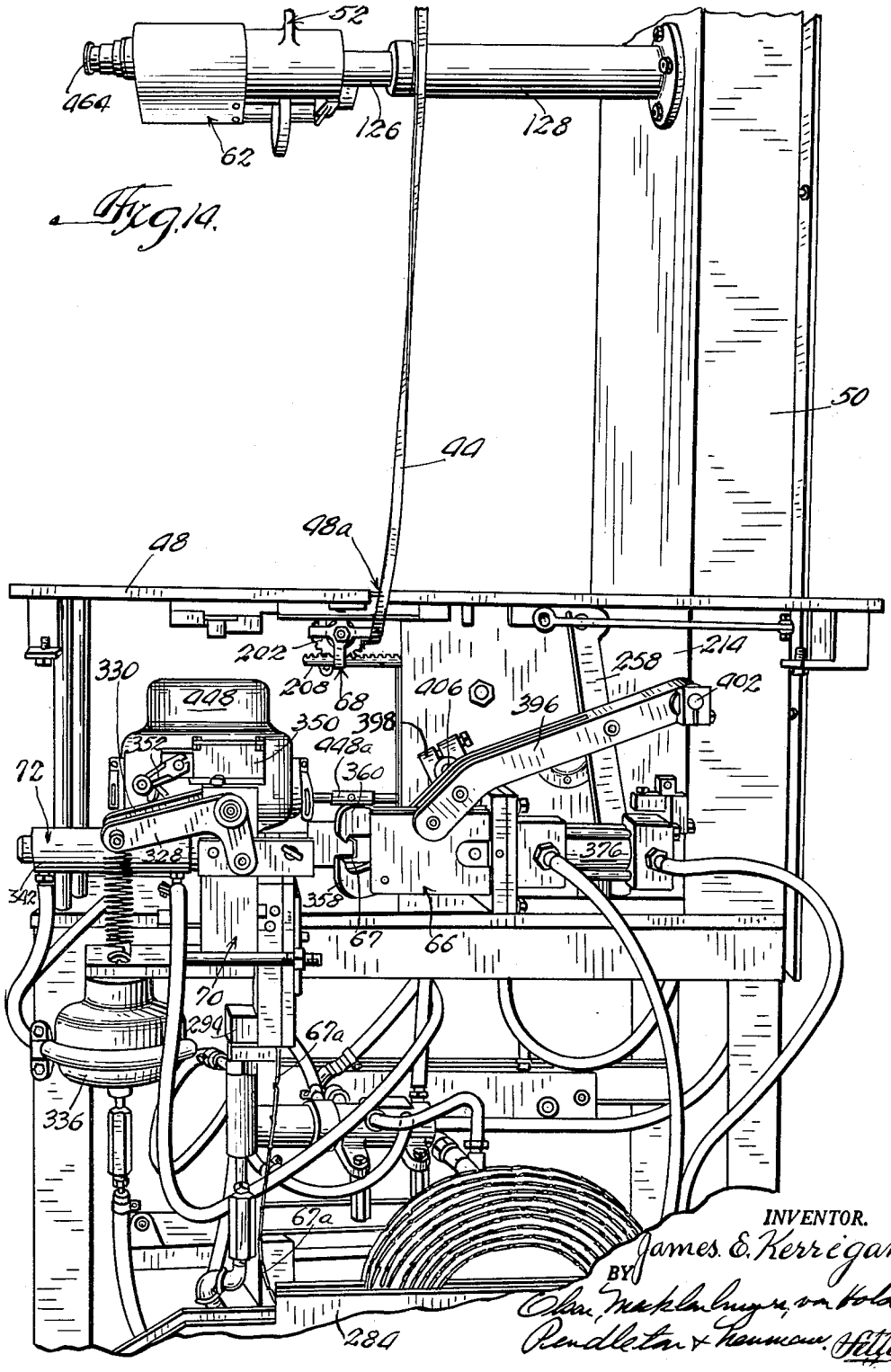


Fig. 14.

INVENTOR.
James E. Kerrigan
BY
Olson, Trexler, Wamsley & von Hoist,
Pendleton & Hammon.
Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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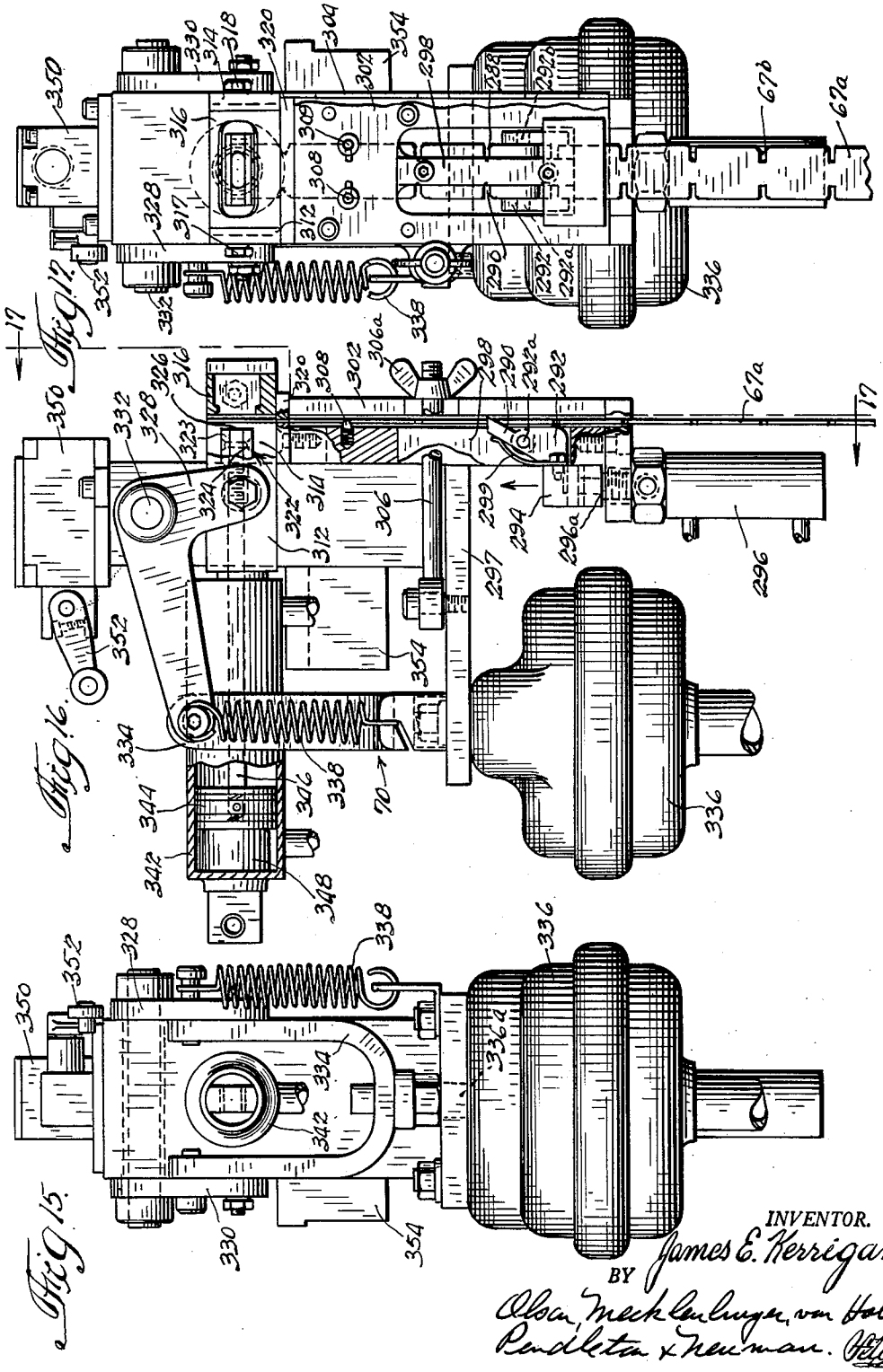


Fig. 17.

Fig. 16.

Fig. 15.

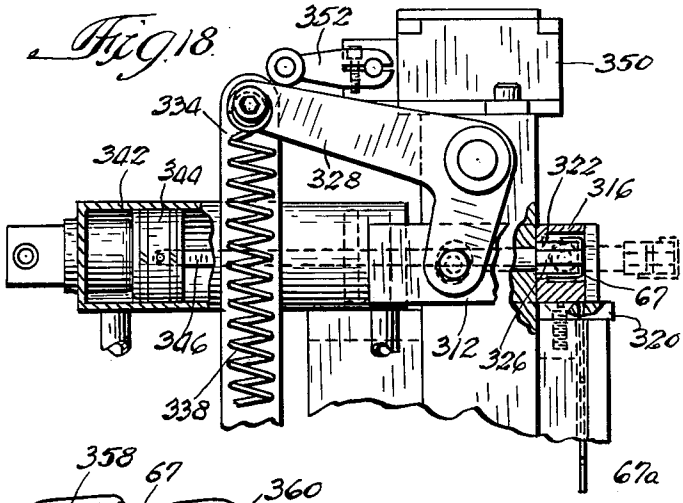
INVENTOR.
James E. Kerrigan
BY
Olson, Mecklenburger, von Holst, Pendleton & Newman. Pettys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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Fig. 18.



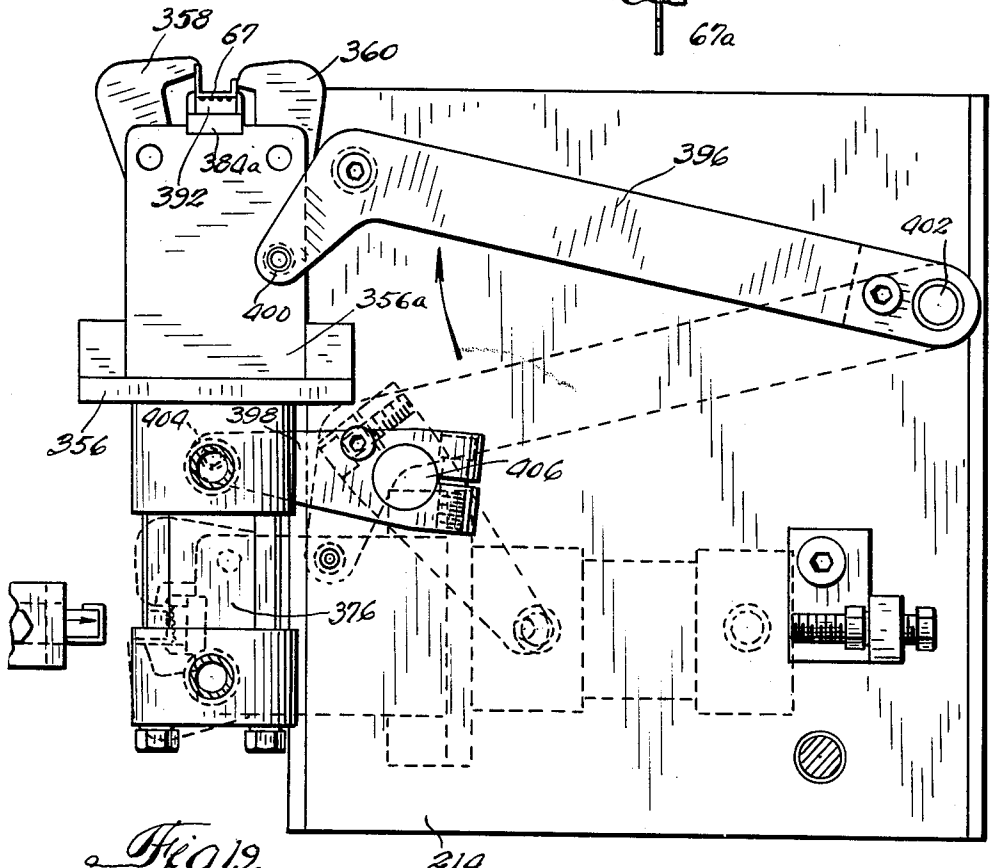


Fig. 19.

INVENTOR.
James E. Kerrigan
BY
Olson, Macklenburger, van Holst, Pendleton & Brennan. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 11

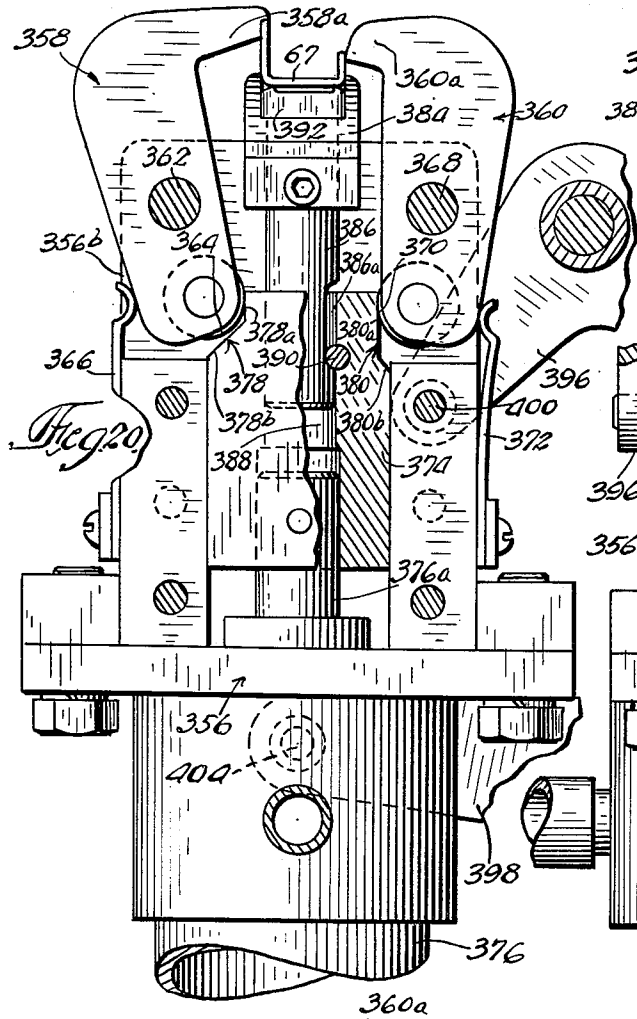


Fig. 20.

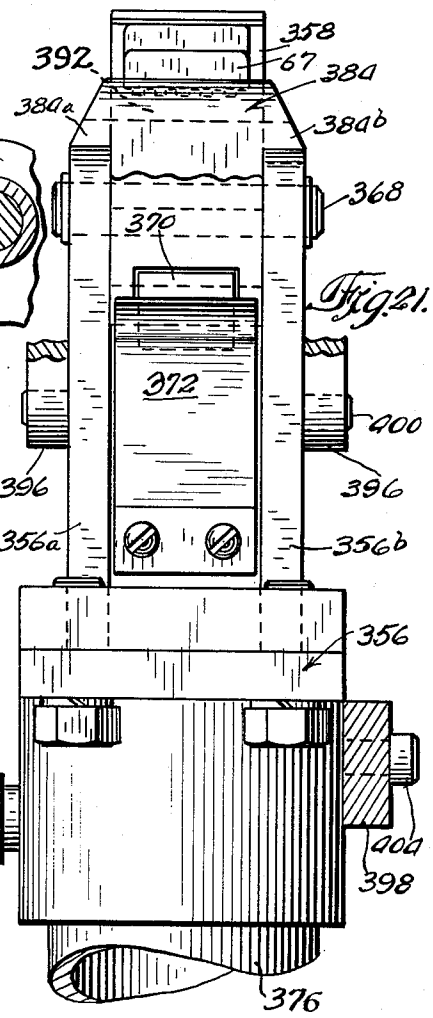


Fig. 21.

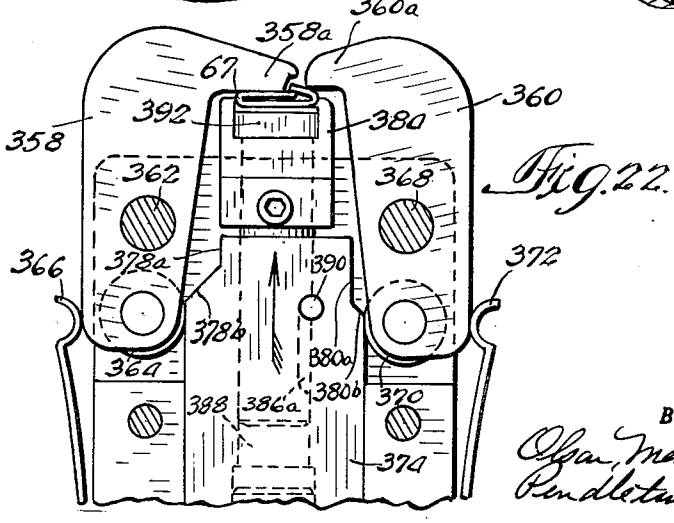


Fig. 22.

INVENTOR.
BY James E. Kerrigan
Olga, Markulenga, Van Dalet, Pendleton & Sherman. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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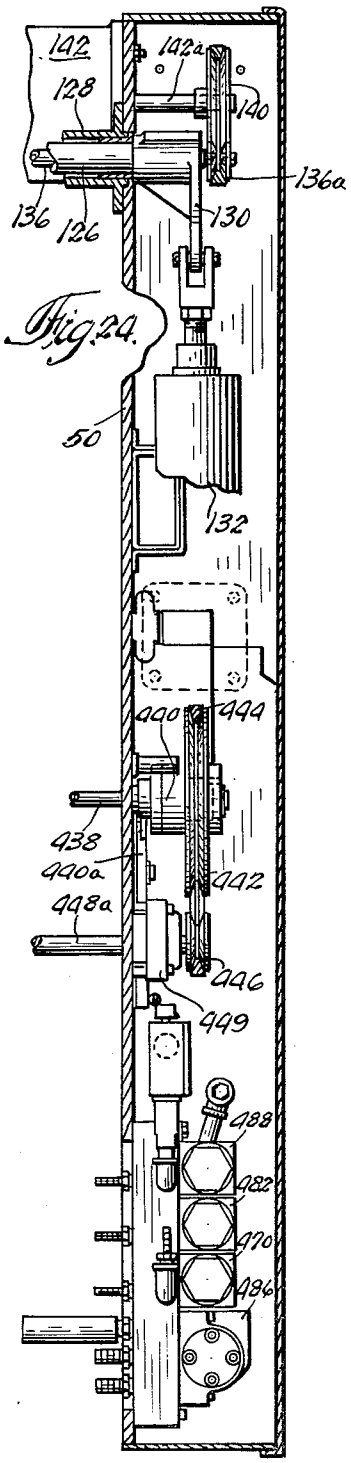


Fig. 24.

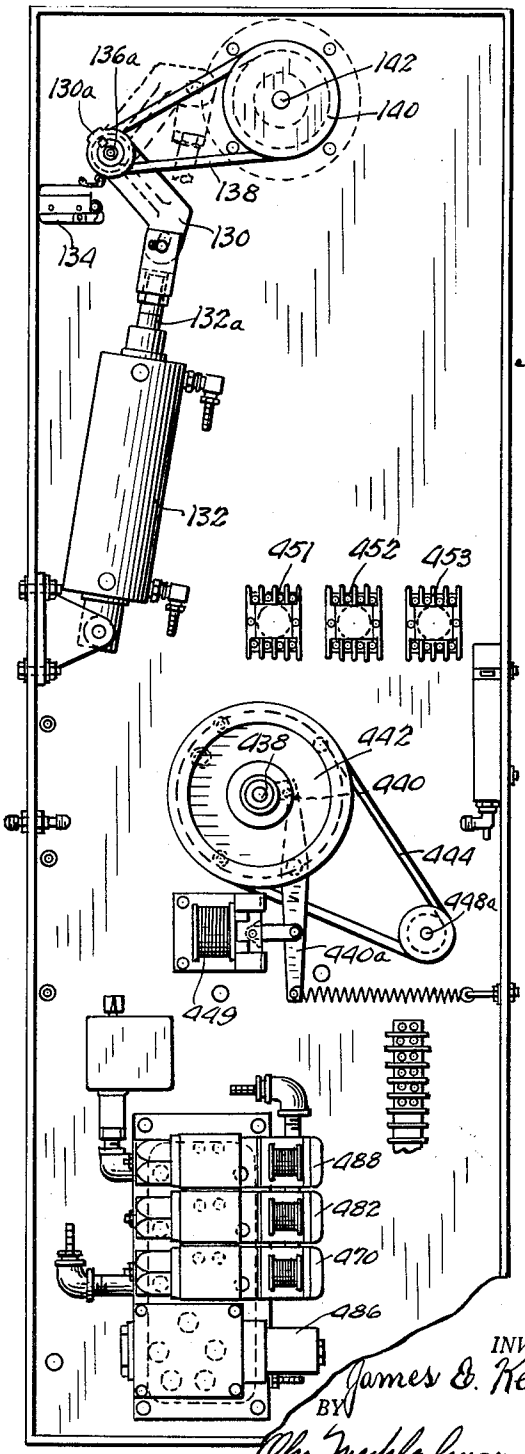


Fig. 23.

INVENTOR.
James E. Kerrigan
BY
Olson, Mackelmann, Van Halst,
Pendleton & Newman. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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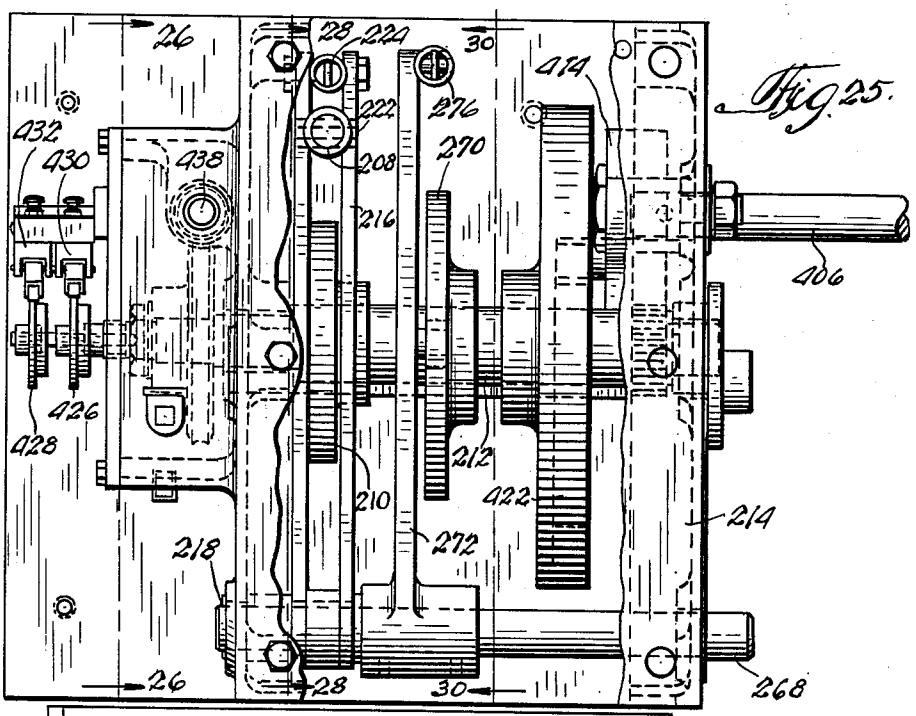


Fig. 25.

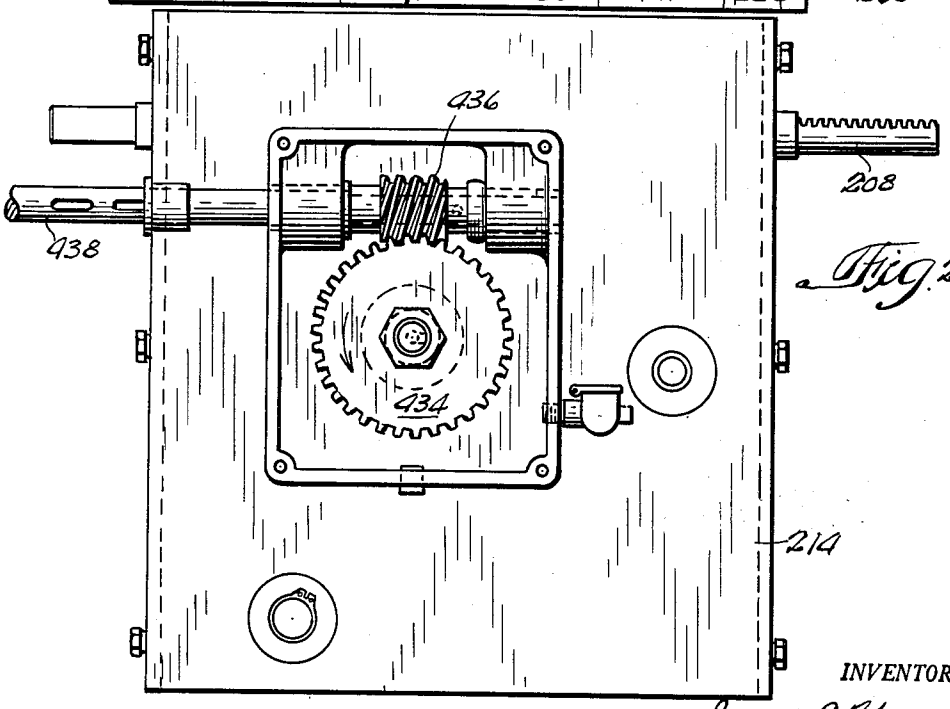


Fig. 26.

INVENTOR.

BY James E. Kerrigan

Olson, Macklanburger, Hubbell, Pendleton & Hamburg, Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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Fig. 28.

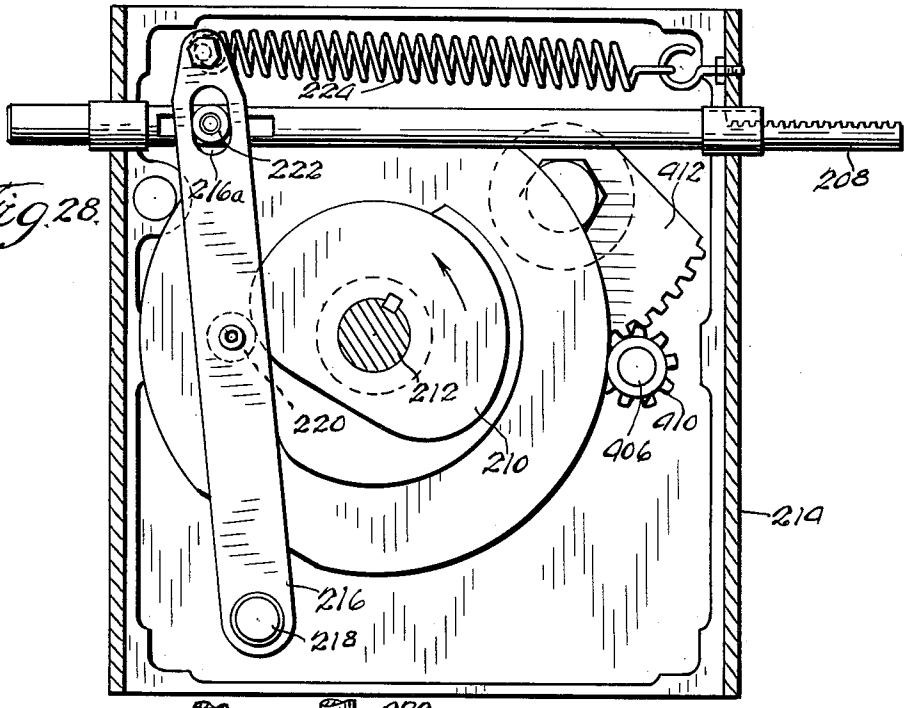
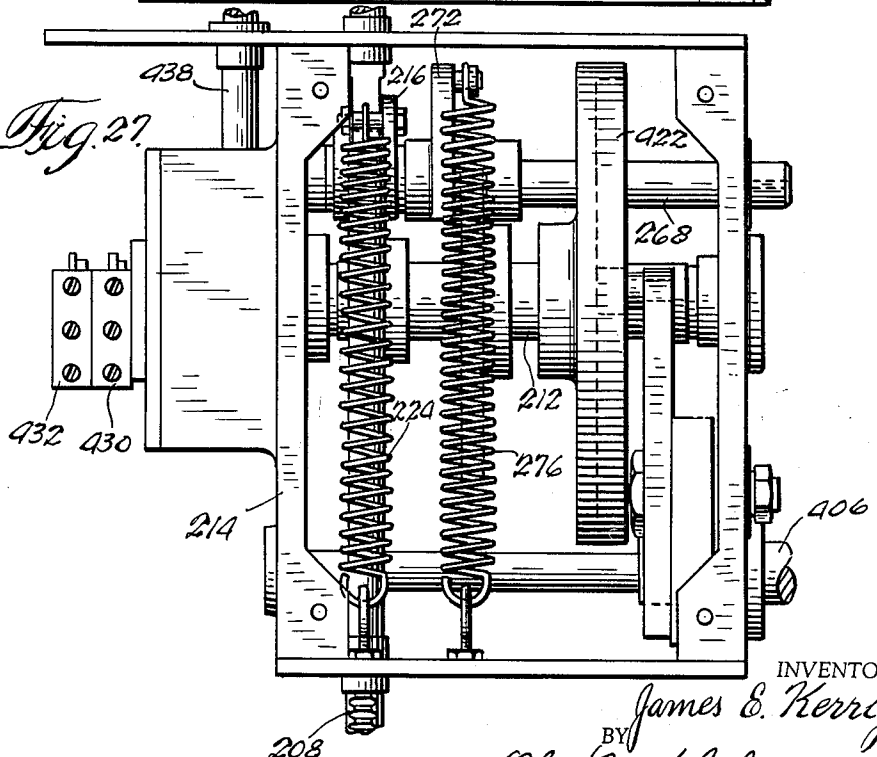


Fig. 27.



INVENTOR.
James E. Kerrigan
BY
Olson, Mack, Lorlinger, von Hoff, Pendleton & Newman. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

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Fig 29.

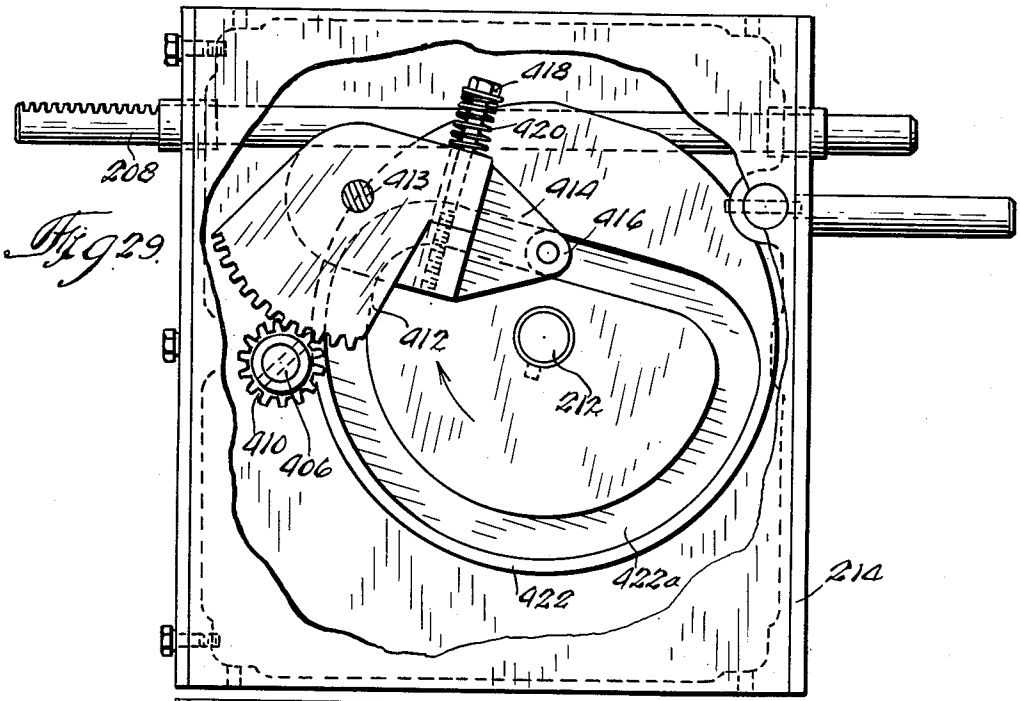
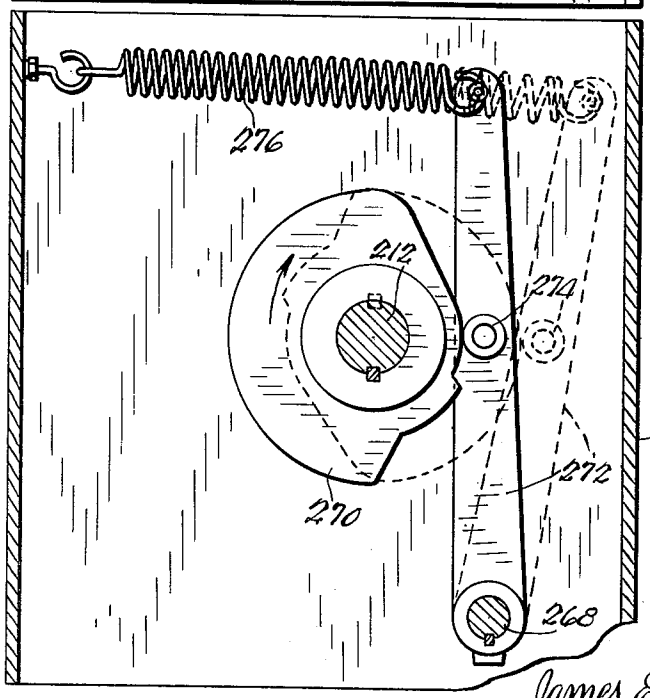


Fig 30.



INVENTOR.
James E. Kerrigan.
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Olson, Trecker, Lempert, van Hulst
Pendleton & Neuman. Attys.

Sept. 24, 1963 J. E. KERRIGAN 3,104,606

PACKAGE BINDING APPARATUS

Filed June 30, 1960 16 Sheets-Sheet 16

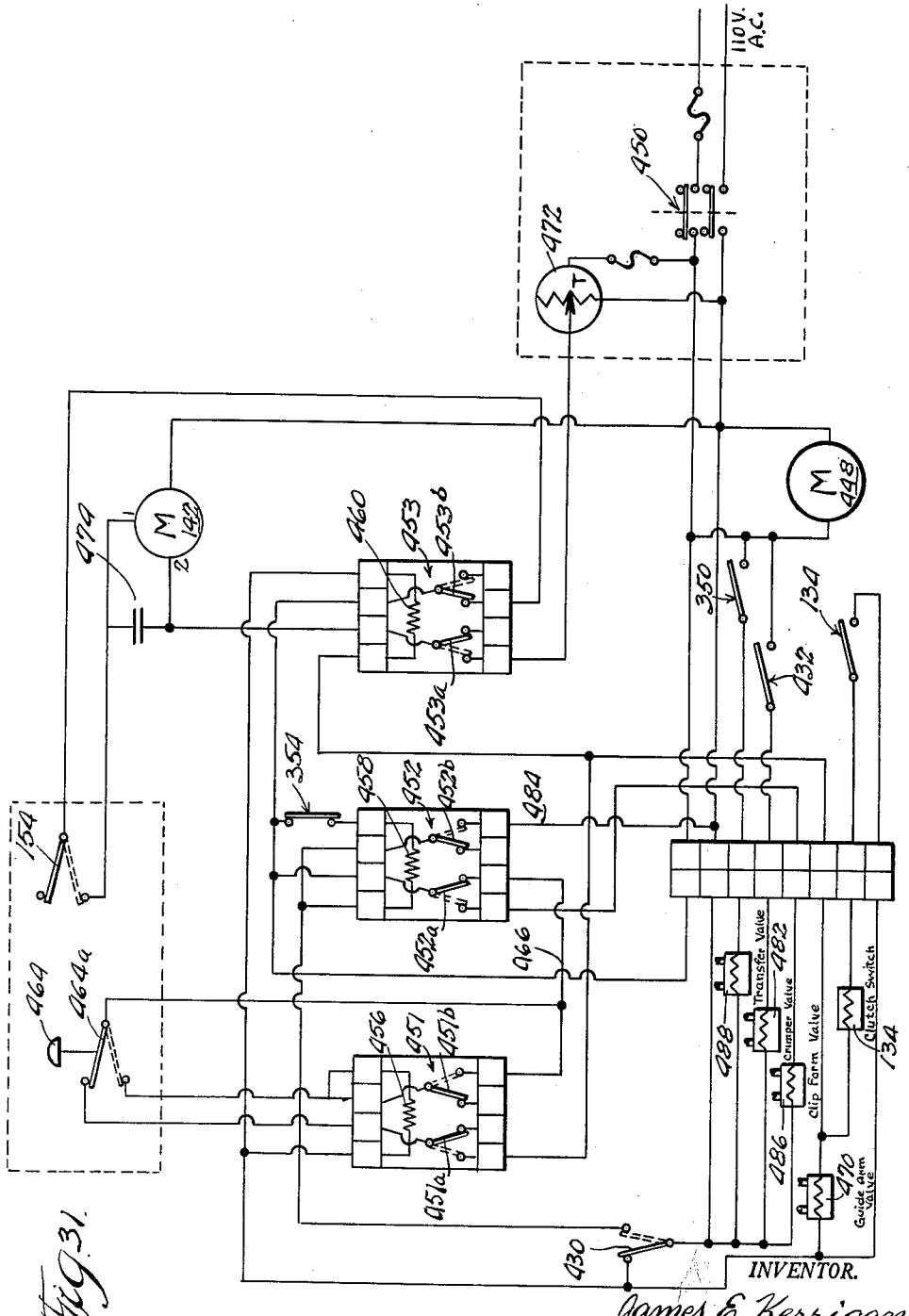


Fig. 31.

INVENTOR.

BY James E. Kerrigan

Olson, Mecklenburger, von Holst, Pendleton & Neumann. Attys.

United States Patent Office 3,104,606 Patented Sept. 24, 1963

3,104,606

PACKAGE BINDING APPARATUS

James E. Kerrigan, Arlington Heights, Ill., assignor to Chicago Printed String Company, Chicago, Ill., a corporation of Delaware

Filed June 30, 1960, Ser. No. 40,018
21 Claims. (Cl. 100—4)

This invention relates to an apparatus for binding packages with tape, and more particularly, to an apparatus for looping a package with soft flexible tape or ribbon and for joining the ends of this tape together to tightly bind the package.

This invention is particularly adapted for use with soft flexible tape, i.e., tape having no substantial stiffness, as distinguished from relatively stiff, hard metal banding material of limited flexibility. The flexible tape is preferably constructed of cloth fibers and has many distinct inherent advantages. For example, such tape will readily conform to the contour of any shape or size of package, and in general it is substantially cheaper than the metal banding material. In addition, the soft flexible tape may be easily severed to open the package.

An apparatus for binding packages should operate quickly and efficiently; it should be capable of applying the tape to the package firmly and accurately; and it should be capable of successively binding packages of various sizes automatically and without wasting any of the binding material. Immediately upon completing the binding of one package, the machine should be ready to accommodate and bind the next package.

In binding a package with soft flexible tape, however, special problems arise. Since the tape has no substantial stiffness, one problem is that of guiding this tape about the package, and another problem is that of firmly joining the ends of the tape. With stiff metal banding material these problems do not exist because the end of the material can be easily deflected about a package while being fed from a relatively remote point. Also, the ends of the stiff metal banding material can be easily deformed to lock them together in a tight joint. With soft tape, however, deflecting and remote feeding are not practical, and uniting of the ends of the material cannot be accomplished by mere deformation. Many machines which work quite satisfactorily with metal banding material would not operate at all with soft flexible tape.

It is, therefore, one object of this invention to provide an apparatus for effectively binding a package with flexible tape.

It is another object of this invention to provide an apparatus for quickly looping flexible tape about a package and tightly uniting the ends thereof together to firmly bind the package.

It is another object of this invention to provide an apparatus which can rapidly bind successive packages with flexible tape.

It is still another object of this invention to provide an apparatus which will tightly bind a package with soft flexible tape in a very efficient and effective manner regardless of the size of the package.

It is an additional object of this invention to provide an apparatus which will effectively and firmly bind a package with flexible tape and will apply a clip to the tape to permanently unite the ends thereof.

It is still another object of this invention to provide an apparatus which will loop a package with flexible tape, will apply the desired degree of tension to the tape and will firmly join the ends of the tape together.

It is an additional object of this invention to provide a package binding apparatus which will form a clip and apply the clip to tape which has been looped about the package, whereby the ends of the tape may be firmly joined together.

Other objects will be seen, and a further understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings.

The apparatus constructed in accordance with this invention is particularly adapted to bind a package with soft flexible tape and includes a frame and means on the frame for supporting a tape supply spool and for regulating the rotation of the supply spool in accordance with the demand for the tape. Means is also provided on the frame for supporting the package with the bottom thereof in a predetermined, preferably horizontal, plane. A gripper disposed below the horizontal plane is adapted to grip a first portion of the tape extending to the free end thereof. A retractable guide spaced from the gripper and mounted below the horizontal plane adjacent the entrance side of the machine positions the free end or first portion of the tape substantially horizontally. A guide arm mounted on the frame is pivotally movable about a fixed axis disposed above the horizontal plane between a first position in which the free end of the arm is raised above the plane sufficiently to permit passage of a package thereunder and a second position in which the free end of the arm is below both the horizontal plane and the bottom of the package. The free end of the guide arm during movement between its first and second positions is disposed wtihin and defines a vertical looping plane, and those portions of the guide arm adjacent the free end are offset with respect to the free end. This facilitates the joining of the ends of the tape.

The tape extends from the spool, about the guide arm to the retractable guide and thence to the gripper. When the guide arm is in its raised or retracted position, the tape is stretched across the entrance of the apparatus between the retractable guide and the free end of the guide arm, and the apparatus is ready to receive a package. A reversible feed means feeds the tape from the supply spool when tension is applied to the tape in the guide arm by movement of a package into engagement with the tape extending between the free end of the movable guide arm and the retractable guide.

When in position for tying, the leading edge of the package is in engagement with the tape, and part of the tape extends at an oblique angle from the leading edge of the package which is disposed within or slightly above the predetermined horizontal plane, to the retractable guide disposed slightly below the plane. The guide arm in its second or lowered position is effective to position a second portion of the binding material extending to the supply spool in adjacent coextending relationship with respect to the first portion of the tape, which as previously described extends between the retractable guide and the gripper, and the intermediate potrion of the tape, i.e., the portion intermediate the first and second portions of material, is positioned about the package. The reversible feed means causes tension to be applied to the tape, and a pair of wedge-shaped positioning elements mounted on the frame for movement transverse to the looping plane enter between the package and the obliquely disposed tape to position this part of the tape away from the package and adjacent the first and second tape portions.

A clip applying mechanism which in its normal position is disposed remote from the path of the movable guide arm is then moved into position for the application of a clip to the three adjacent portions of the tape. The clip is applied in such a manner as to form a very tight joint between the three adjacent portions of the tape.

A tape cutter associated with the gripper severs at least the second portion of the tape after the clip has been applied thereto. The gripper moves simultaneously to

grip the severed end of the tape adjacent the free end of the guide arm so that when the arm is again raised, the tape will again be disposed across the entrance to the apparatus. Means is provided for operatively connecting the retractable guide to the wedge-shaped positioning elements, whereby when the positioning elements are retracted, the retractable guide will also be retracted to release the package. Means is provided for subsequently disconnecting the retractable guide and the positioning elements whereupon the retractable guide will return to its normal position. The guide arm is then moved to its raised position in preparation for binding the next package.

One of the features of this invention is the structure and operation of the movable guide arm which guides the tape about the package and positions the tape for the application of the clip thereto.

The clip applying mechanism is another feature of the invention. This mechanism is adapted to move from its retracted position into proximity with the adjacent portions of the tape to firmly affix a clip to these adjacent portions. Other features of the invention include the novel clip forming mechanism, the means for transferring a clip from the forming mechanism to the clip applying mechanism, the retractable guide and the tape positioning elements. These and many other features cooperate to provide an apparatus which is extremely efficient for binding packages.

In the drawings:

FIGURE 1 is a perspective view of an apparatus constructed in accordance with this invention;

FIG. 2 is a side elevation view of the apparatus partially in section showing the movement of the movable guide arm and illustrating the manner in which the tape is positioned about the package by the guide arm;

FIG. 3 is a top plan view of the apparatus with the guide arm in its lowered position;

FIG. 4 is a top plan view of the spool holder illustrating the means for regulating the rotation of the spool holder and for taking up slack during the tensioning;

FIG. 5 is a side elevation view of the spool holder, the regulating means and the slack take-up means;

FIG. 6 is an enlarged side elevation view of the guide arm and the reversible feed means;

FIG. 7 is a top plan view of the guide arm and the reversible feed means;

FIG. 8 is a top plan view of the gripper and the cutter showing the interrelation therebetween;

FIG. 9 is a side elevation view of the gripper and the cutter;

FIG. 10 is an end elevation view of the gripper and the cutter taken substantially along line **10**—**10** of FIG. 9;

FIG. 11 is an end elevation view taken substantially along line **11**—**11** of FIG. 9 showing the mechanism for operating the gripper and the cutter;

FIG. 12 is a top plan view of the material positioning means and the retractable guide means;

FIG. 13 is a side elevation view of the tape positioning means and the retractable guide means;

FIG. 14 is a perspective view of the lower portion of the machine illustrating the relationship of the clip forming and clip applying mechanisms;

FIG. 15 is an end elevation view of the clip forming mechanism and the clip transfer means;

FIG. 16 is a side elevation view of the clip forming mechanism and the clip transfer means;

FIG. 17 is a view of the clip forming mechanism and clip transfer means taken substantially along line **17**—**17** of FIG. 16;

FIG. 18 is a side elevation view of the clip forming mechanism and clip transfer means showing the operations thereof as the clip is being formed and after the clip has been formed;

FIG. 19 is an elevation view of the clip applying mechanism illustrating the movement of this mechanism from its retracted position to its clip applying position;

FIG. 20 is an enlarged side elevation view of the clip applying mechanism partially in section;

FIG. 21 is an end elevation view of the clip applying mechanism illustrated in FIG. 20;

FIG. 22 is a side elevation view of a portion of the clip applying mechanism illustrated in FIG. 20 showing the operation of the mechanism to effect closing of the clip;

FIG. 23 is an end elevation view of the mechanism for operating the guide arm, the reversible feed means and the timing mechanism for the apparatus;

FIG. 24 is an elevation view partially in section of the mechanism illustrated in FIG. 23;

FIG. 25 is an elevation view of the mechanical and electrical timing mechanism for the apparatus;

FIG. 26 is a sectional elevation view taken substantially along line **26**—**26** of FIG. 25 and illustrating the drive for the electrical and mechanical timing mechanisms;

FIG. 27 is a top plan view of the mechanical timing mechanism with the cover plate thereof removed;

FIG. 28 is a sectional view of the mechanism for operating the cutter and gripper taken substantially along line **28**—**28** of FIG. 25;

FIG. 29 is an elevation view of the mechanism for effecting movement of the clip applying mechanism between its retracted and its clip applying positions;

FIG. 30 is a sectional elevation view taken substantially along line **30**—**30** of FIG. 25 and illustrating the mechanism for operating the tape positioning means; and

FIG. 31 is a diagram of the electrical circuit employed in accordance with this invention.

The apparatus **40** constructed in accordance with this invention is adapted to bind a package **42** with soft flexible tape **44**. The tape is preferably of fabric and may be either woven or of the weftless variety. Such tape has no substantial stiffness and is thus distinguishable from wire and from metal banding material which can also be used to bind packages.

The apparatus **40** includes a frame **46** having a package support plate **48** which is adapted to support the bottom of the package **42** in a predetermined horizontal plane. Plate **48** has a slot **48***a* extending inwardly from one side thereof, which may be conveniently termed the "entrance" side of the apparatus. Extending vertically upward from the package support plate **48** is a cabinet upright **50**, and a guide arm **52** is pivotally connected to this upright **50** for movement between a raised or retracted position illustrated in FIG. 1 and a lowered position illustrated in FIG. 2. Also connected to upright **50** is a device **54** for holding a supply spool **56** of the flexible tape.

As best illustrated in FIG. 2, spaced below the package support plate **48** and adjacent the inner end of slot **48***a*, is a gripper **58** for gripping the free end of the tape. Spaced laterally from the gripper **58** adjacent the entrance side of the apparatus is a retractable guide **60** which is adapted to traverse slot **48***a*. The flexible tape **44** thus extends from the spool **56** about the guide arm **52** and the guide **60** to the gripper **58**. The package **42** when moved into position for binding, as illustrated in FIG. 2 of the drawings, will initially come into engagement with the tape **44** extending vertically across the entrance of the machine between the guide arm **52** and the guide **60**. A reversible feed mechanism **62** responsive to tension applied to the tape **44** by the movement of the package into engagement therewith is effective to feed the tape from the supply spool onto the guide arm **52** until the package is at rest in the position illustrated in FIG. 2, and the tension on the tape **44** is thus relaxed. Arm **52** is actuated downwardly from the position illustrated in FIG. 1 to the position illustrated in FIG. 2, causing a second portion **44***b* of the tape to be disposed in adjacent coextending relationship with the first portion **44***a* of the tape between the gripper **58** and the guide **60** and causing the intermediate portions **44***c* of the tape **44** to be positioned about package **42**.

The reversible feed mechanism 62 when reversed is effective to apply a tension to the tape extending about the package 42 and to gripper 58. Tape positioning elements 64 mounted just below plate 48 for transverse horizontal movement effectively wedge the tape extending along the bottom of the package downwardly to a position spaced from the package and adjacent the first and second tape portions 44*a* and 44*b*.

At this point, a clip applying mechanism 66 (see FIG. 1) which had been previously positioned remote from the path of the free end of guide arm 52 is moved upwardly into position in proximity with the three adjacent portions of the tape, and this mechanism is effective to apply a metal clip 67 to these adjacent portions to thus firmly interconnect them. After the adjacent portions of the tape have been thus clipped together, a cutter 68 operatively connected to the gripper 58 and disposed between the gripper and the clipped joint severs the second portion 44*b* of the tape extending over the guide arm 52 to the supply spool 56. The gripper 58 and the cutter 68 operate simultaneously and, thus the tape extending from the free end of the guide arm 52 is gripped by gripper 58 as the cutter 68 severs it from the joint and as the gripper releases the previously held free end portion 44*a* of the tape. The positioning elements 64 are retracted and effect the momentary simultaneous retraction of the guide 60 to release the package and the tape extending thereabout. Since the free end of the material 44 has been gripped by the gripper 58, when guide arm 52 is raised the tape will again be positioned horizontally between the gripper 58 and guide 60 and vertically across the entrance of the apparatus. The clip 67 which is applied to the adjacent portions of the material to firmly unite them is substantially U-shaped and is formed in a mechanism 70 disposed below slotted support plate 48. The clip 67 is transferred from the clip forming mechanism 70 to the crimper or clip applying mechanism 66 by means of a clip transfer device 72.

The device for holding the supply spool 56 is best illustrated in FIGS. 4 and 5. Attached to upright 50 is a horizontal cantilever channel brace 80, and journalled for pivotal movement at the end of this channel brace is a transversely disposed, horizontal shaft 82. Two transverse disks 84 and 86 are mounted on the shaft 82 by means of setscrews, and the supply spool 56 of the tape 44 is adapted to be positioned on the shaft 82 between these disks. Inner disk 84 has an eccentric pin 84*a* which extends axially outward toward outer disk 86, and is adapted to engage a corresponding hole in one of the side disks of the supply spool 56 to fix the supply spool in position on the shaft 82. The outside disk 86 may be conveniently removed from the shaft for the replacement of the supply spool 56.

A brake drum 88 is keyed to the end of shaft 82 on the opposite side of channel support 80. A lever member 90 pivotally mounted on a fixed pin 92 carries a brake shoe 94 adjacent one end thereof for engagement with the brake drum 88. The lever 90 is pivotally movable about the fixed pin 92 to alternatively release and engage the brake and thus regulate the rotation of the shaft 82 and the supply spool 56 mounted thereon.

Also journalled in the channel support 80 adjacent the upright 50 is a second shaft 96. The shaft 96 is disposed parallel to the shaft 82, and a link 98 is affixed to the one end thereof. A pin 100 carried on the link 98 is disposed within a slot 102 in the end of the brake lever 90. A second link 104 also connected to the shaft 96 within the channel support 80 has a threaded rod pivotally connected to its free end, and a spring 108 coiled about the rod 106 acts between a threaded nut 110 on the rod 106 and a stop 112 fixed to the channel support 80. Thus, the spring 108 urges link 104 and the shaft 96 in a clockwise direction, as viewed in FIG. 5, and it also urges brake shoe 94 into engagement with the brake drum 88 by virtue of the operative interconnection of the shaft 96 to the lever 90 through the link 98.

A sleeve 114 is disposed on the shaft 96 substantially in line with the supply spool 56, and a lead arm 116 having a loop 116*a* at its free end is fixed to the shaft 114 in such a manner that the tape from the supply spool 56 may be led through the looped end 116*a* of this lead arm. Sleeve 114 has a recess or slot 114*a* in its outer end, and a collar 118 mounted in fixed position on the outer end of the shaft 96 has a transverse pin 118*a* which is disposed within recess 114*a* of the sleeve to restrict the relative rotative movement of the sleeve 114 with respect to shaft 96. A spring 120 coiled about the shaft 96 has one of its ends fixed to a second collar 122 on the shaft 96, and the opposite end of the coil spring 120 is fixed to the sleeve 114. The coil spring 120 thus is effective to urge the sleeve 114 and the lead arm 116 about the shaft 96 in the clockwise direction, as viewed in FIG. 5.

The spring 120 is not strong enough to effect rotation of the shaft 96 in the counterclockwise direction against the resistance of the spring 108 when arm 116 is moved in the counterclockwise direction, but spring 120 is strong enough to cause the upward (clockwise) movement of lead arm 116 to take up slack between the supply spool 56 and the feed means 62 when the feed means 62 has been reversed to apply tension to the tape. When the feed means 62 is actuated to feed material from the supply spool 56, the lead arm 116 is drawn downwardly against the resistance of the spring 120 by the pull on the tape extending therethrough. When the pin 118*a* engages the end of the slot 114*a* in the sleeve 114, further rotation of the arm 116 and the sleeve 114 causes counterclockwise rotation of the shaft 96 against the resistance of the spring 108, and the lever 90 is rotated in the clocwise direction about its pivot pin 92 to disengage the brake shoe 94 from the brake drum 88, thus permitting the shaft 82 with the supply spool 56 affixed thereto to freely rotate. This free rotation is permitted until the feed means 62 no longer is applying a pull to the tape 44 extending through the lead arm 116, whereupon the spring 108 will return shaft 96 and brake lever 90 to their normal positions, and the brake shoe 94 will thus engage the brake drum 88 to prevent the further rotation of the supply spool 56 and to eliminate the backlash effect. When the feed means 62 is reversed, spring 120 causes further clockwise rotation of arm 116 and sleeve 114 to take up slack in the tape.

The guide arm 52 and the feed mechanism 62 are connected together, as best illustrated in FIGS. 6 and 7, and both are mounted on a horizontally disposed hollow shaft 126 which is journalled in a sleeve bracket 128 mounted on the cabinet upright 50. The shaft 126 extends through the bracket 128 and into the interior of the cabinet upright 50 (see FIGS. 23 and 24), and an operating lever 130 is keyed thereto. The operating lever 130 is connected to the piston rod 132*a* of a hydraulic cylinder 132. The reciprocal movement of piston rod 132*a* is governed by the application of hydraulic pressure to cylinder 132, and this movement effects movement of the guide arm 52 between its raised position illustrated in FIG. 1 and its lowered position illustrated in FIG. 2. A protuberance 130*a* on lever 130 operates a switch 134, the function of which will be hereinafter more fully described.

Disposed coaxially within the hollow shaft 126 is a drive shaft 136, one end of which extends through the operating lever 130 within the upright 50 and has a drive pulley 136*a* keyed thereto. Drive pulley 136*a* is connected by means of a flexible drive belt 138 to a larger drive pulley 140 keyed to the shaft 142*a* of a bidirectional A. C. motor 142. Keyed to the opposite end of shaft 136 is a spur gear 144, best illustrated in FIG. 6, which drives a pair of rubber tape-engaging rolls 146 and 148 through suitable gearing. Rolls 146 and 148 are disposed close together with their surfaces abutting, and the tape 44 extends over roll 148 and between the rolls 146 and 148. Rolls 146 and 148 frictionally engage the tape, and depending upon the direction of rotation of these rolls the tape may be alternatively fed out over the guide arm 52

or tensioned. The motor 142 may be reversed to drive the shaft 136 and the rolls 146 and 148 alternatively in opposite directions. From the rolls 146 and 148 the tape extends through a lead arm 150 and thence over the guide arm 52. The lead arm 150 is connected to and operates a switch 154, and switch 154 in turn operates the motor 142 to effect feed out of the tape, as will be hereinafter more fully described.

When moving from its raised position, as illustrated in FIG. 1, to its lowered position, as illustrated in FIGS. 2, 6 and 7, the free end 52*a* of the arm moves within and defines a vertical looping plane, that is, a plane within which the tape is to be looped about the package. The remainder of the guide arm 52 or at least the portion of the guide arm adjacent the free end 52*a* is laterally offset, i. e., disposed to one side of the looping plane. This offset arrangement of the guide arm 52 permits the clip applying mechanism 66 to be moved into proper position when the guide arm is in its lowered position.

It has been found convenient to form guide arm 52 in two separate sections. The first section 160 is a substantially J-shaped casting or forging, and the second section 162 of the guide arm is tubular. The tubular second section 162 is disposed within a hole drilled in the end of the J-shaped first section 160, the two sections being held in place by means of screws 164. This tubular construction of the second section 162 of the guide arm permits the free end 52*a* of the guide arm to be easily bent or offset with respect to the remainder of the arm. The tape 44 extends from the feed mechanism 62 over suitable guide rolls on the first section 160 of the guide arm and thence through the tubular second section 162 to the free end 52*a*; and a guide roll 170 is provided at the free end 52*a* of the arm to properly guide the tape.

The guide 60 is preferably a pin which is spaced below the support plate 48 and is axially movable transverse to the looping plane from its normal position, best illustrated in FIGS. 3, 12 and 13, wherein it traverses the slot 48*a* in the package support plate to a retracted position wherein it is substantially removed from and disposed to one side of slot 48*a*. The guide pin 60 is slidably mounted in a guide block 174 mounted on the underside of plate 48, and when in its operative or normal position this pin 60 has one of its ends disposed within an apertured block 176 aligned with and corresponding to the block 174 but disposed on the opposite side of the slot 48*a* therefrom. The opposite end of guide pin 60 is connected to a slide member 178 slidably mounted on a guide rod 180 which is fixed to the package support plate 48 by means of a bracket 182. A spring 184 coiled about the fixed rod 180 urges the slide member 178 and the guide pin 60, to the right in FIGS. 12 and 13, toward their operative or normal positions, wherein the pin traverses the slot 48*a* in the package support plate. Slide member 178 has a depending keeper portion 178*a* which facilitates retraction of guide pin 60 after the clip 67 has been applied to the adjacent portions of the tape, as will be hereinafter more fully described.

The mechanism for gripping the free end of the tape and for severing the tape after the joint has been formed is best illustrated in FIGS. 8, 9, 10 and 11. Mounted below the package support plate 48 near the inner end of the slot 48*a* is a substantially U-shaped bracket 186 having transverse parallel arms 187 and 188. Journalled between arms 187 and 188 of the bracket is a shaft 190, and keyed to the shaft 190 on the inside of the arm 188 of the bracket is the gripper 58. The gripper 58 is star-shaped having four equally spaced, radially extending gripping elements 58*a*, 58*b*, 58*c* and 58*d*. The leading edge of each of the gripping elements is rounded, so that when the gripper 58 is rotated in the counterclockwise direction, as indicated by the arrow in FIG. 10, the free end of the tape 44 will be wedged between one of the gripping elements and the arm 188 of the bracket 186. Also keyed to shaft 190 but disposed on the opposite side of the bracket arm 188 from the gripper 58 is the cutter 68. The cutter 68 is also substantially star-shaped and includes four radially extending cutting elements 68*a*, 68*b*, 68*c* and 68*d*, the leading edges of which are sharp, so that when the cutter 68 is rotated in the counterclockwise direction indicated by the arrow in FIG. 10 to move one of the cutting elements into engagement with the tape, the tape will be cut between one of these elements and arm 188 of the bracket. A spring 196 coiled about the shaft 190 acts between a threadedly adjustable nut 198 on shaft 190 and the sleeve of the gripper 58. Thus, in effect spring 196 urges both the gripper 58 and the cutter 68 into tight engagement with the bracket arm 188 disposed therebetween.

Keyed to the opposite end of the shaft 190 is a ratchet wheel 200, and a pinion 202 is mounted on the shaft 190 for relative rotation in respect thereto and with respect to wheel 200. A lever bracket 204 fixed to the pinion 202 carries a pawl 206 adjacent its end, and pawl 206 is urged by a spring 207 into engagement with the ratchet wheel 200. Pawl 206 is thus adapted to effect rotation of the ratchet wheel and of the shaft 190 with the gripper 58 of the cutter 68 keyed thereto. The ratchet wheel 200 has four ratchet stops, and during each of its clockwise movements, as viewed in FIG. 11, the pawl 206 is adapted to rotate the ratchet wheel 200 and the shaft 190 through 90°.

Pinion 202 is driven by means of a rack 208, and rack 208 in turn is reciprocally moved by means of a cam 210 which is mounted on the cam shaft 212 within the cam box 214, as best illustrated in FIGS. 25 and 28. A double or split lever 216 mounted on a fixed pivot pin 218 has a follower wheel 220 for engaging cam 210, and the opposite end of the lever 216 is slotted to accommodate a transverse pin 222 carried by rack 208. A spring 224 acting between the free end of the double lever 216 and the cam box 214 urges the slotted end of the lever 216 and the rack 208 to the right in FIG. 28 and urges the follower 220 into engagement with cam 210. When the slotted lever 216 is moved to the left, i.e., when the lever is moved in the counterclockwise direction by cam 210 against the resistance of spring 224, rack 208 is also moved to the left in FIG. 28 and in the direction of the arrows in FIGS. 8 and 11. This causes clockwise movement of the pawl 206 and corresponding clockwise movement of the ratchet wheel 200, the shaft 190, the gripper 58 and the cutter 68. Thus, each time cam 210 is rotated through 360°, the gripper 58 and the cutter 68 are simultaneously moved through 90°. It will be remembered that the free end portion 44*a* of the tape is gripped by the gripper 58. After the second portion 44*b* of the tape has been placed across the gripper 58 and the cutter 68 by the guide arm 52, and after the clip has been applied to the tape to join the ends thereof together, the cutter 68 and the gripper 58 are simultaneously rotated, as previously described. The cutter 68 will cut both portions 44*a* and 44*b* of the tape, and the gripper 58 will grip the severed end of portion 44*b* which extends through guide arm 52 to the supply spool at the same time the small fragment of tape at the end of portion 44*a* which had been previously gripped is released by the gripper 58. As a practical matter it is only necessary to sever the second portion 44*b* of the tape, but it has been found substantially more convenient to sever both portions of the tape. This also trims the tape ends equally.

As previously stated, after the package 42 has been positioned in the apparatus, the guide arm 52 has been moved to its lower position to position the tape about the package and the tape has been tensioned, the portion of the tape disposed adjacent the bottom of the package 42 is wedged away from the package and is positioned adjacent the first and second tape portions 44*a* and 44*b*, so that the clip may be applied to these three portions of the tape. The positioning means 64 for wedging the tape away from the package to facilitate the application of the clip thereto is best illustrated in FIGS. 12 and 13. For this purpose, two pairs of substantially wedge-shaped

positioning elements are provided. Elements 228 and 230 which constitute one pair of the positioning elements are interconnected by means of a slotted web 232, and wedge-shaped elements 234 and 236 which constitute the second pair of positioning elements are interconnected by means of a similar slotted web 238. The spacing between the elements in each pair is identical, and the pairs are slightly staggered horizontally so that when they are moved from their retracted position on their respective sides of slot 48*a*, as illustrated in FIGS. 12 and 13, to their operative or slot traversing positions illustrated in FIG. 3, they will pass close to each other but will not engage each other. The space between element 228 and element 236 is sufficiently wide to accommodate the crimper or clip applying mechanism 66.

The spacing of the guide pin 60 below the support plate 48, as previously described, causes the tape which extends between the leading edge of the package 42 and this pin to be disposed at an oblique angle with respect to the plane of the plate 48. This angle is sufficient to permit the forward tips of the wedge-shaped positioning elements to enter between the package and the tape, and the further movement of these positioning elements causes the tape to be fully wedged away from the package as described.

The slotted connecting webs 232 and 238 with the respective pairs of positioning elements carried thereon are movable horizontally toward and away from each other and are guided in this reciprocal movement by means of pins which extend downwardly from the package support plate 48 through the slots in the webs. Springs 239 and 240 effectively urge the positioning element pairs toward their retracted positions.

Means is provided for temporarily and operatively interconnecting the guide pin 60 to one of the pairs of the positioning elements so that this pin may be retracted momentarily with the positioning elements to release the package and the tape extending thereabout. For this purpose, connected to web 232 is a bracket 242 in which a pin 244 is journalled. Keyed to one end of pin 244 is a lever member 246 carrying a latch or hook 246*a* adjacent its outermost end. Keyed to the opposite end of pin 244 is a second lever member 248 carrying a cam block 248*a* at its outermost end. A spring 250 acting against lever member 246 urges the free ends of the lever members 246 and 248 upwardly. When the connecting webs 232 and 238 and their respective positioning elements are moved toward each other to traverse the slot 48*a* in the supporting plate 48, the latch 246*a* will engage the depending keeper portion 178*a* on the slide member 178 which is attached to the guide pin 60. When the positioning elements are returned to their normal or retracted position, as illustrated in FIGS. 12 and 13, the guide pin 60 will be simultaneously retracted by virtue of this interconnection between the latch 246*a* and the keeper portion 178*a*. This connection, however, is temporary, for at the end of the retracting stroke or movement the cam block 248*a* engages a pin 252 which is fixed to the package support plate 48, and this causes the cam block 248*a* and the latch 246*a*, both of which are keyed to the same shaft to be cammed downwardly, and the latch 246*a* will thus release the keeper 178*a*. The guide pin 60 will, therefore, be returned under the influence of the spring 184 to its normal position traversing the slot 48*a* in the package support plate 48.

To accomplish the simultaneous reciprocal movement of the positioning elements, as described, the pairs of elements are both operatively and effectively connected to a single operating lever 258. The slotted web 232 carrying the positioning elements 228 and 230 is directly connected to the operating lever 258 by means of a connecting rod 260. The slotted web 238 carrying the positioning elements 234 and 236 is connected to the operating lever 258 by means of the connecting rods 262 and 264 through a lever 266 which is pivotally mounted on a pin 266*a* fixed to the package support plate 48. The operating lever 258 is adapted to move alternatively in the two directions illustrated by the arrows in FIGS. 12 and 13. When the end of the operating lever 258 is moved to the left in FIGS. 12 and 13, the positioning elements will be moved to their illustrated position; that is, they will be separated or retracted. When, on the other hand, the operating lever 258 is moved to the right, the pairs of positioning elements will be moved toward each other into the slot traversing position illustrated in FIG. 3, wherein they are effective to wedge the tape away from the bottom of the package 42.

The operating lever 258 is keyed to a shaft 268, and this shaft and the operating lever are caused to oscillate by means of a cam 270 mounted on the cam shaft 212 within the cam box 214, as best illustrated in FIG. 30. A follower arm 272 keyed to the end of shaft 268 has a follower roller 274 carried centrally thereon which engages the cam 270, and a spring 276 acting between the free end of the follower arm 272 and the cam box 214 urges the follower arm 272 in the counterclockwise direction, as viewed in FIG. 30, into engagement with the cam 270 and urges the shaft 268 and the operating lever 258 in the counterclockwise direction, as illustrated in FIGS. 13 and 30. The extreme positions of the cam 270 and of the lever arm 272 are illustrated by full lines and dotted lines, respectively, in FIG. 30. The follower is reciprocated from its full line position to its dotted line position and then back into its full line position each time the cam shaft 212 and the cam 270 are rotated 360°, and each time the cam shaft 212 and the cam 270 are rotated 360°, the positioning elements are moved toward and away from each other in the cycle of the machine.

The clip forming mechanism 70, the clip applying mechanism 66 and the clip transfer device 72 are illustrated in FIG. 14. The clip forming mechanism 70 is adapted to form the substantially U-shaped metal clip 67 from severed sections of a strip 67*a* of metal clip material, a supply roll of which may be held within a receptacle 284 at the base of the apparatus 40. As best illustrated in FIGS. 16 and 17, the clip stock strip 67*a* is partially divided into clip sections by means of slots 67*b* which are cut in the opposite sides of the clip stock and extend inwardly toward each other.

The slotted clip stock strip 67*a* is fed vertically upward in the clip forming mechanism 70 by means of two pawls 288 and 290 which engage opposing slots 67*b* in the clip stock. Pauls 288 and 290 are mounted on a substantially U-shaped carriage 292 which is connected to a block 294 carried on the end of the operating piston rod 296*a* of a hydraulic cylinder 296. The hydraulic cylinder 296 is fixed to the frame 297 of the clip forming mechanism 70. The pawls 288 and 290 are pivotally mounted on coaxial protuberant pin formations 292*a* and 292*b*, respectively, extending inwardly from the arms of the U-shaped carriage 292, and the pawls 288 and 290 and the pins upon which they are mounted straddle a vertical guide bar 298 fixed to the frame 297. The bar 298 thus serves to guide the pawls 288 and 290 and the carriage 292 in their vertical reciprocal movement, and springs 299 acting between the carriage 292 and the pawls 288 and 290 urge these pawls into engagement with the slots 67*b* in the clip stock strip. The stroke of the piston rod 296*a* of the hydraulic cylinder 296 is just long enough to move the clip stock upwardly in the clip forming mechanism 70 the length of one section.

An access door 302 is connected to the frame 297 by means of a hinge 304, and a swing bolt 306 carrying a wing nut 306*a* adjacent its free end is adapted to lock the access door 302 in its closed position. In order to maintain the clip stock strip 67*a* in proper position during the return stroke of the piston 296*a* and of the pawls 288 and 290, two spring-actuated, clip stock engaging detent balls 308 and 309 are provided. These balls engage in the opposing slots 67*b* of the clip stock at the end of the upward or feeding stroke of the piston 296*a* and of the

pawls 288 and 290. Thus, when the piston and the pawls are returned, i.e., moved downwardly, the clip stock strip 67*a* will be resiliently held in place.

Mounted for horizontal sliding movement in the sides of frame 297 are two parallel flanged plates 312 and 314. Spaced in parallel relationship, and mounted between these plates is a die 316 which is held in place by means of screws 317 and 318, and by means of the flanges at the ends of these slide plates which serve to reinforce the screws. A slotted cutter plate 320 is fixed to the frame 297 below the slide plates 312 and 314, and the clip stock material extends therethrough into position behind the die 316. It will be noted that the top edge of the cutter plate 320 is in alignment with the opposing slots 67*b* below the uppermost section of the clip stock strip.

Spaced rearwardly, to the left in FIG. 16, from the die 316 is a punch 322 formed of two brass plates 323 and 324 and a centrally disposed alnico magnet 326. The slide plates 312 and 314 and the die 316 connected therebetween are movable rearwardly, i.e., to the left in FIG. 16, with respect to punch 322, as best illustrated in FIG. 18. To accomplish this movement of the slide plates and of the die, two bell cranks 328 and 330 are provided. These bell cranks are pivotally mounted adjacent the top of the frame 297 on a horizontal pin 332 which extends through and protrudes on opposite sides of the frame. One end of the bell crank 328 is pivotally connected to the slide plate 312 and the corresponding one end of the bell crank 330 is pivotally connected to the slide plate 314. The opposite ends of the bell cranks 328 and 330 are connected to a yoke 334, and the yoke 334 is mounted on the end of the operating piston 336*a* of a hydraulic cylinder 336 fixed to the frame 297. A spring 338 acting between the frame 297 and the end of the bell crank 328 urges the operatively interconnected bell cranks 328 and 330 in a counterclockwise direction toward the position illustrated in FIG. 16. The counterclockwise rotation of the bell cranks 338 and 330 is restricted by the abutment of yoke 334 with frame 297.

It will be noted that when the yoke 334 is moved upwardly by hydraulic cylinder 336, as illustrated in FIG. 18, to cause clockwise rotation of bell cranks 328 and 330, the slide blocks 312 and 314 and the die 316 will be moved to the left or rearwardly into engagement with the top section of the clip stock strip 67*a* to sever the top section from the remainder of the strip between the die 316 and the cutter plate 320. As the die 316 is moved further rearwardly, the severed section of the clip stock is carried into engagement with the punch 322, and the continued movement of the die with respect to the punch 322 causes this severed portion of the clip stock to be formed about the punch 322. The result is a substantially U-shaped clip disposed about the punch 322 within the die 316, as best illustrated in FIG. 18.

It is to be noted that the aperture of the die 316 is slightly offset toward the top thereof, and the punch which is aligned with this aperture in the die is thus also slightly offset upwardly. This causes the clip to be formed with the lower leg thereof slightly longer than the top leg. It is also to be noted that the rear portion of the aperture of the die 316 is somewhat restricted, and the remainder of the die aperture is somewhat enlarged. The clip is formed about the punch 322 by the restricted rear portion of the die aperture, and the spring back tendencies of the clip prevent any possibility of the clip being returned rearwardly out of the die once it has been moved through the restricted portion of the die aperture.

The clip transfer device 72 which effects transfer of the U-shaped clip to the clip applying mechanism 66 is best illustrated in FIGS. 16 and 18 and includes a hydraulic cylinder 342, a piston 344 disposed for reciprocal movement within the cylinder 342 and a piston rod 346 connected to piston 344. The punch 322 is connected to the end of the piston rod 346, and an abutment 348 at the rear of the cylinder 342 reinforces and supports the rod 346 and the punch 322 in their rearward position as the die 316 is drawn rearwardly about the punch 322 for the formation of the clip, as illustrated in FIG. 18.

Mounted atop frame 297 is a control switch 350 having an actuating lever 352 which is disposed in the path of bell crank 328. When the bell cranks 328 and 330 are moved by the piston of the hydraulic cylinder 336 through the connecting yoke 334 in the clockwise direction to pull the die 316 rearwardly about the punch 322, the actuating arm 352 of the switch 350 is engaged. Switch 350 controls the valve which operates the hydraulic cylinder 342 in the clip transfer device 72, and when the actuating arm 352 of this switch is engaged, hydraulic pressure is applied to the cylinder 346 in a direction which will effect movement of the piston 344 to the right in FIGS. 16 and 18 carrying with it the piston rod 346 and the punch 322. Since the clip 67 has been formed about the punch 322, it too is forced to the right completely through die 316 to the position illustrated in dotted lines in FIG. 18. The length of the stroke of piston 344 is sufficient to move the clip from the position illustrated in solid lines in FIG. 18 within die 316 into the clip applying mechanism 66, and the alnico magnet 326 in the punch 322 maintains the clip on the punch during this transfer. At the end of the transfer stroke a switch 354 is opened for purposes which will be further described.

The movement of the clip applying mechanism 66 is illustrated in FIG. 19, and the structural and operational details of this mechanism are best illustrated in FIGS. 20, 21 and 22. This mechanism includes a hollow frame 356 having cover plates 356*a* and 356*b* between which are mounted two pivotal jaws 358 and 360. Jaw 358 is mounted on a pin 362 and carries cam follower wheel 364 adjacent the inner end thereof. At the outer end of the jaw 358 is a transverse notched tip portion 358*a*. A leaf spring 366 mounted on the frame 356 resiliently urges the jaw 358 in the counterclockwise direction into the "open" position illustrated in FIG. 20. The jaw 360 is pivotally mounted on a pin 368 and is similar in construction to the jaw 358, having a follower roller 370 mounted at its end and having a transverse tip portion 360*a* at the outer end. The transverse tip portion 360*a* of this jaw, however, is not notched and is not as long as the corresponding tip portion 358*a* of the jaw 358. A spring 372 resiliently urges the jaw 360 in the clockwise direction into the "open" position illustrated in FIG. 20.

A cam plate 374 is slidably mounted for reciprocal movement within the hollow of frame 356 between the inner ends of the jaws 358 and 360, and this cam plate is fixed to the piston rod 376*a* of hydraulic cylinder 376. At the outer end of the cam plate 374 are cam surfaces 378 and 380, each of the cam surfaces having a flat or parallel surface section 378*a* and 380*a*, respectively, and an angular surface section 378*b* and 380*b*, respectively. The flat surface sections 378*a* and 380*a* are parallel, and the angular surface sections 378*b* and 380*b* are longitudinally staggered in such a manner that all portions of the angular surface section 378*b* are disposed outwardly or above the angular surface section 380*b*. The roller 364 on the inner end of the jaw 358 is in engagement with and rolls upon cam surface 378, and the corresponding roller 370 on the inner end of the jaw 360 is in engagement with and rolls upon the cam surface 380, the rollers being urged into engagement with their cam surfaces by springs 366 and 372, respectively.

With the cam plate 374 retracted, as illustrated in FIG. 20, the rollers 364 and 370 are in engagement with sections 378*a* and 380*a* of their respective cam surfaces and are in their closest proximity to one another. This results in the jaws 358 and 360 being completely open to accommodate an open clip 67. The notch in the transverse tip 358*a* of jaw 358 serves to lock the open clip 67 in position in the crimper 66, as illustrated in FIG. 20.

A clip seat 384 is fixed to a stub shaft 386 which is

adapted to slide axially within an axial aperture 388 in the cam plate 374. The stub shaft 386 has a longitudinal recess 386*a* spaced inwardly from its inner end, and a pin 390 extending through the cam plate 374 partially traverses the aperture 388 in the cam plate 374 and is disposed within the recess 386*a* of shaft 386. Thus, the axial movement of stub shaft 386 with respect to the cam plate 374 is limited by the length of the recess 386*a* in the stub shaft. Clip seat 384 has two shoulder portions 384*a* and 384*b* which are adapted to engage cover plates 356*a* and 356*b*, respectively, of the frame to restrict the inward (downward) movement of the clip seat. The outer end of the clip seat 384 is recessed, and an anvil block 392 is disposed therein. The anvil block 392 preferably has an undulated clip engaging surface.

As illustrated in FIG. 20, the cam plate 374 is in its retracted position, and the jaws 358 and 360 are open to accommodate the open clip 67. The bottom of the clip rests on the anvil block 392 and partially within the recessed clip seat 384, and the clip seat 384 is maintained in this position by virtue of the engagement of the shoulder portions 384*a* and 384*b* thereof with the side plates of the frame 356. The longest leg of the clip 67 is disposed in the notch in the transverse tip 358*a* of the jaw 358. At the proper time in the cycle of the machine hydraulic pressure is applied to cylinder 376 forcing the piston rod 376*a* and the cam plate 374 mounted thereon outwardly (upwardly) from the retracted position illustrated in FIG. 20 to the extended position illustrated in FIG. 22. As the cam plate 374 is moved outwardly, the cam rollers 364 and 370 roll on cam surface sections 378*a* and 380*b*, respectively. The first camming movement occurs when angular surface section 378*b* of the cam surface 378 moves into engagement with the follower wheel 364 mounted on the jaw 358. Further outward movement of the cam plate 374 results in the clockwise movement of the jaw 358 which causes the long leg of the clip 67 to be folded inwardly (downwardly). After this folding has been completed, the follower wheel 370 mounted on the jaw 360 is engaged by the surface section 380*b* of the cam surface 380. This jaw is rotated in the counterclockwise direction to effect inward (downward) folding of the short leg of the clip 67 over the already folded longer leg. Thus, the staggered relationship between the angular sections of cam surfaces 378 and 380 results in the sequential closing of the legs of the clip 67.

After the clip has been thus closed by the movement of the jaws 358 and 360 to their "closed" position illustrated in FIG. 22, further outward movement of the cam plate 374 causes the pin 390 to engage the end of the recess 386*a* in the stub shaft 386. The clip seat 384 with the anvil block 392 therein is thus hammered upwardly against the transverse tips 358*a* and 360*a* of the closed jaws, and the clip is hammered together with the bottom portion being undulated by the undulated surface portion of the anvil block 392. During the return stroke of the piston 376*a*, the jaws 360 and 358 are sequentially returned to their open position under the influences of springs 372 and 366, respectively, as permitted by the cam surfaces 378 and 380, and toward the end of this return stroke pin 390 engages the opposite end of the recess 386*a* in the stub shaft 386 causing this shaft and the clip seat 384 attached thereto to move inwardly (downwardly) until the shoulder portions 384*a* and 384*b* thereof again engage and rest upon the side plates of the frame 356.

The crimper or clip applying mechanism 66 is normally in a retracted position remote from the path of the guide arm 52, as illustrated in FIGS. 1 and 14 and as illustrated in dotted lines in FIG. 19. This mechanism is moved to its clip applying position, as illustrated in solid lines in FIG. 19 after the tape 44 has been positioned and tensioned about the package. To accomplish this movement two lever arms 396 and 398 are provided. One end of arm 396 is connected to a pin 400 extending outwardly from the side plates 356*a* and 356*b* toward the forward end of the clincher frame 356. The opposite end of arm 396 is pivotally connected to a fixed pin 402 mounted on the exterior of the cam box 214. One end of the arm 396 is pivotally connected to a pin 404 on the rearward end of the clincher frame 356, as best illustrated in FIGS. 19, 20 and 21. The opposite end of arm 398 is connected to an operating shaft 406 which extends into the cam box 214. Shaft 406 when rotated in a clockwise direction, as illustrated in FIG. 19, is effective to move the crimper 66 from its retracted position illustrated in dotted lines 19 to its operative or clip applying position, as illustrated in full lines in FIG. 19. In pivoting about its fixed pivot pin 402 the arm 396 serves to guide and properly orient the crimper 66 as the crimper is moved by the arm 398 mounted on the shaft 406.

The means for effecting movement of rod 406 is best illustrated in FIG. 29. A spur gear 410 is connected on the end of shaft 406 within the cam box 214, and a segment gear 412 mounted on a fixed pin 413 is in engagement with the spur gear 410. A follower member 414 having a roller 416 mounted adjacent its free end is also pivotally mounted on the fixed pin 413 and is connected to segment gear 412 by means of a bolt 418. A spring 420 acting between the head of bolt 418 and the segment gear 412 makes the interconnection between the segment gear 410 and the follower member 414 somewhat resilient. A cam 422 having a cam track 422*a* therein is mounted on the cam shaft 212 within the cam box 214, and the roller 416 of the follower member 414 is disposed for rolling movement within the cam track 422*a*. The cam 422 and the shaft 212 revolve in the clockwise direction as indicated by the arrow. As this cam rotates, the segment gear 412 is caused to move in a counterclockwise direction about pin 413, as illustrated in FIG. 29, and the spur gear 410 on the end of shaft 406 is rotated in the opposite or clockwise direction. As previously indicated, the clockwise movement of shaft 406 results in the movement of the crimper 66 from its retracted position to its clip applying position. The segment gear 412 and the crimper are maintained in their positions for a substantial part of the rotation of cam 422 after which time the follower 414 and the segment gear 412 are returned by the cam to their normal position; that is, they are rotated clockwise, as illustrated in FIG. 29, resulting in the movement of shaft 406 in counterclockwise direction and the return of crimper 66 to its retracted position illustrated in the dotted lines in FIG. 19.

Mounted on the end of shaft 212 are two cams 426 and 428 which operate electrical switches 430 and 432, respectively, as best illustrated in FIG. 25. A pinion 434 is also keyed to shaft 212 between the electrical cams 426 and 428 and the mechanical cams 210, 270 and 422, and a worm gear 436 is in operative engagement with the pinion 434. The pinion 434 is mounted on a shaft 438 which is connected through a clutch mechanism 440 to a drive pulley 442 disposed within the cabinet upright 50. (See FIGS. 23 and 24.) A drive belt 444 extends about drive pulley 442 and about another pulley 446 mounted on the end of the shaft 448*a* of a motor 448. The clutch mechanism 440 is operated by means of a lever 440*a*, the movement of which is controlled by a solenoid 449.

Motor 448 is the main motor for the apparatus 40, and this motor is connected in the main line through a main switch 450, as best illustrated in the wiring diagram of FIG. 31. It will also be noted that three relays 451, 452 and 453 are provided in the electrical circuit, each relay operating two switches. The switches 451*a* and 451*b* in relay 451 are moved from their normal position, as illustrated in solid lines, to their dotted line position when the operating coil 456 is energized. Similarly, in relay 452 switches 452*a* and 452*b* are movable from their

normal position illustrated in full lines to their dotted line position when coil 458 is energized, and in relay 453 switches 453*a* and 453*b* are movable from their solid line position to their dotted line position when coil 460 is energized. The reversible or bidirectional motor 142 which operates the reversible feed mechanism 62 to alternatively feed and tension the tape is connected across the main line through the switch 154 and relay switch 453*b* when the relay 453 is in its normal or de-energized position. Switch 154 which, as previously described, is operated by the lead arm 150 (see FIGS. 6 and 7) closes when tension is applied to the tape 44, and the lead arm 150 is pivoted in the clockwise direction. When this switch is closed, the motor 142 is energized, and the motor 142 continues to operate to feed tape onto the guide arm 52 until there is no longer any tension on the tape at which point switch 154 will open. The package 42 is then in position ready for tying, as illustrated in FIG. 2.

The next portion of the cycle is begun by depressing the button 464 on the start switch 464*a*. This 464 button is located conveniently at the pivotal axis of the guide arm 52 and the feed mechanism 62, as best illustrated in FIGS. 6 and 7. The depressing of button 464 will effect movement of switch 464*a* to its dotted line position and will thereby immediately energize the coil 456 in the relay 451 by completing the circuit across the main 110 volt A.C. line through the switch 452*a*, through a "hold" line 466, through the solenoid 456 and through the switch 430. The energizing of the relay coil 456 causes the switches in the relay 451 to move to their dotted line position, and when the start button 464 is released and the switch 464*a* again assumes its solid line position, the relay coil 456 will remain energized through switch 451*b* to the hold line 466. With the relay 451 energized and the start switch 464*a* returned to its normal position as illustrated, the coil 460 in relay 453 will also be energized through the switch 451*a* and the switch 430. As previously described, the switch 430 is operated by the cam 426 on the cam shaft 212.

With the relay 451 energized, the solenoid valve 470 which operates the hydraulic cylinder 132, and thus controls the movement of the guide arm 52, is energized through switch 464*a* and 451*a* from the hold line 466. The energizing of this solenoid valve 470 causes hydraulic pressure to be applied to the cylinder 132 in a direction which will effect the downward movement of guide arm 52. Simultaneously, the energizing of relay 453 causes the motor 142 to reverse and a voltage will be applied to terminal 2 of this motor through a variable autotransformer 472 and through switch 453*a*. The condenser 474 connected across terminals 1 and 2 of the motor 142 causes the necessary voltage lag for directional starting. The variable auto-transformer 472 permits the voltage to the motor 142 to be regulated and, thus the tension applied to the tape may be regulated. It will be noted, however, that the variable transformer is connected in the line to the motor 142 only when relay 453 has been energized and the motor has been reversed to apply tension to the tape.

When the guide arm 52 has been moved to its lowermost position, as illustrated in FIG. 2, the switch 134 will be tripped by the protuberant cam formation 130*a* on operating arm 130 (see FIG. 23). Switch 134 operates the solenoid 449 within the upright 50, and this solenoid, as previously described, operates the clutch control lever 440*a* to actuate the clutch mechanism 440 (see FIG. 23). Thus, the mechanical and electrical timing cams in cam box 214 are set in motion. The normally "open" switch 432 is closed by the cam 428 mounted on cam shaft 212 to actuate a solenoid valve 482 controlling the application of hydraulic pressure to the hydraulic cylinder 376 in the clip applying mechanism 66.

When the cam operated switch 430 is moved from its normal full line position to its dotted position, the relays 451 and 453 are de-energized and the switches in these relays thus return to their full line positions. Simultaneously, the coil 458 in relay 452 is energized and remains energized by the connection of the switch 452*b* to a "hold" line 484. The actuation or relay 452 causes the "clip form" valve 486 to be energized and this valve controls the application of hydraulic pressure to the hydraulic cylinder 336 in the clip forming mechanism 70 (see FIGS. 15, 16 and 17). When valve 486 is energized the operating piston rod 336*a* of the hydraulic cylinder 336 is moved upwardly which, as previously described, pulls the die 316 rearward about the punch 322 to form the clip 67. Near the end of the stroke of the piston rod 336*a* the bell crank 328 engages the operating arm 352 on switch 350 (see FIG. 18), and as illustrated in FIG. 31, when switch 350 is closed the solenoid valve 488 is energized which controls the application of hydraulic pressure to the transfer cylinder 342 (see FIG. 18). This causes the punch 322 to be moved through the die 316, and the clip 67 is thus deposited between the jaws of the crimper 66.

At the end of the stroke of the transfer piston 344, the switch 354 is opened to de-energize the relay 452 permitting the valve 488 to return to its closed position and permitting the piston 344 in the transfer cylinder 342 to its normal position as illustrated in FIG. 16. Switch 354 is a safety switch, and if for any reason the piston 344 in the transfer cylinder is prevented from completing its stroke, the switch 354 will not be opened and the relay 452 will remain energized to prevent further any operation of the apparatus.

The operation of the apparatus 40 is as follows:

The tape 44 is initially threaded from the supply spool 56 through the lead arm 116 between the rubber rolls in the reversible feed mechanism 62 through the lead arm 150 over and through the guide arm 52 and across the entrance side of the machine, over the retractable guide pin 60, below the package support plate 48 and across the cutter 68 to the gripper 58.

When the package 42 is first moved into engagement with tape 44 below the raised guide arm 52, the slight tension caused by this engagement is sufficient to move the switch operating arm 150 to close the switch 154. The bidirectional A.C. motor 142 is caused to operate in a direction which will effect movement of the tape from the supply spool 56 onto the tape arm 52. The pull on the tape 44 extending to the supply spool by the feed mechanism 62 causes the brake to release so that the supply spool 56 may freely rotate. When the package has been properly positioned on the support plate 48, as illustrated in FIG. 2, and the feed mechanism 62 has fed enough tape over the guide arm 52 to overcome the tension caused by the engagement of the package with the tape, the arm 150 is returned to its normal position, and the switch 154 turns off the feed mechanism 62. The brake is again applied to the supply spool 56 to prevent backlash. At this point the operator must press the start button 144 at the axis of the tape arm, if and when the cycle is to continue.

When the button 144 is pressed, two relays 451 and 453 are energized. The relay 453 when energized causes the motor 142 to reverse to apply tension to the tape extending between the reversible feed mechanism 62 and the gripper 58. The relay 451 when energized operates a valve which causes the guide arm 52 to move downwardly to the position illustrated in FIG. 2. At the end of the downward stroke of guide arm 52 the switch 134 is tripped to operate the clutch mechanism 440 and to clutch in the mechanical and electrical operating and timing cams in the cam box 214.

The wedge-shaped positioning element pairs are moved to their slot traversing position through the operation of the cam 270 (see FIG. 30), and the clip crimper 66 is moved into its clip applying position by means of the cam 422 (see FIG. 29). The switch 432 is next closed by the

cam 428 to actuate the valve 482 which causes the crimper 66 to close the clip 67 about the adjacent portions of the tape 44. When the switch 432 is again opened by cam 428, the crimper 66 is again opened to release the closed clip, and the holder 58 and the cutter 68 are operated by the cam 210 to simultaneously cut the tape and grip the portion of the tape which extends over the guide arm 52 to the supply spool. The cam 270 then moves the tape positioning elements to their open or retracted position and causes the guide pin 60 to also retract momentarily due to the temporary interconnection between the positioning elements and this fixed guide. Cam 422 then returns the crimper 66 to its position remote from the path of the guide arm 52, and at this point in the cycle the switch 430 is opened by cam 426 to de-energize the two relays 451 and 453 and to energize the relay 452.

The energizing of relay 452 in turn energizes the clip form valve 486 which causes the die 316 to be pulled rearwardly about the punch 323 and the clip form mechanism 70. As previously described, at the end of this forming stroke the switch 350 is energized and causes the clip to be transferred through the die 316 on the punch 326 to the crimper 66, and at the end of this transfer stroke the switch 354 is opened to de-energize relay 452 and return the machine to its normal position for receipt of the next package.

It may be seen that the apparatus constructed in accordance with this invention operates very efficiently to bind packages of various sizes with soft flexible tape. Although the invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that many modifications and changes in various details may be resorted to without departing from the spirit and scope of the invention, as hereinafter claimed.

What is claimed is:

1. In an apparatus for binding a package with flexible tape fed from a supply, means for gripping a first portion of the tape, movable guide means for positioning a second portion of the tape extending to said supply in adjacent coextending relationship with respect to the first portion thereof and for guiding an intermediate portion of the tape about the package, a clip applying mechanism including a pair of jaws mounted for pivotal movement between a normal open position for accommodating an open clip and a closed position for closing the clip, a jaw-engaging cam element movable in one direction between said jaws to effect movement of said jaws to their closed position, means for effecting movement of said jaws toward their open position when said cam element is moved in the opposite direction, an impact member connected to said cam element for limited reciprocal movement relative thereto between said jaws, whereby said impact member may be driven in one direction by said cam and may be withdrawn in the opposite direction by said cam, power means for effecting movement of said cam element to close said jaws and for subsequently effecting movement of said impact member toward impact engagement with said jaws, whereby the clip may be first closed and then tightly compressed between said jaws and said impact member, means for effecting movement of said mechanism from a normal retracted position remote from the path of said movable guide means to a clipping position in which the adjacent portions of the tape are disposed between the jaws of said mechanism, whereby the clip in said mechanism may be closed about and tightly compressed on the adjacent portions of the tape to securely fasten them together, and means severing the second portion of the tape intermediate the clipped joint and the supply.

2. The structure of claim 1 wherein said movable impact member has a corrugated clip-contacting surface with the corrugations extending transverse to the pivotal axis of said mechanism jaws whereby the closed clip will be compressed and at least one side thereof will be transversely corrugated to tightly grip and hold the adjacent portions of the tape.

3. In an apparatus for binding a package with flexible tape fed from a supply, means for gripping a first portion of the tape, movable guide means for positioning a second portion of the tape extending to said supply in adjacent coextending relationship with respect to the first portion thereof and for guiding an intermediate portion of the tape about the package, a clip applying mechanism including a pair of jaws, each jaw having a transverse clip engaging tip and being mounted for pivotal movement between a normal open position for accommodating an open clip and a closed position for closing the clip, a jaw-engaging cam element movable in one direction between said jaws and having cam faces thereon for effecting sequential closing of said jaws, means for effecting movement of said jaws toward their open position when said cam element is moved in the opposite direction, an impact member connected to said cam element for limited reciprocal movement relative thereto between said jaws, whereby said impact member may be driven in one direction by said cam element and may be withdrawn in the opposite direction by said cam element, power means for effecting movement of said cam element from a normal position to first close said jaws and to subsequently move the impact member toward impact engagement with the transverse tips of said jaws, whereby the clip may be first closed and then tightly compressed between the tips of said jaws and said impact member, means for effecting movement of said mechanism from a normal retracted position remote from the path of said movable guide means to a clipping position in which the adjacent portions of the tape are disposed between the jaws of said mechanism, whereby the clip in said mechanism may be closed about and tightly compressed on the adjacent portions of the tape to securely fasten them together, and means severing the second portion of the tape intermediate the clipped joint and the supply.

4. The structure of claim 3 including stop means for maintaining said impact member in position for support of the clip after said cam element has been returned to its normal retracted position by said power means.

5. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a clip, a mechanism for sequentially forming clips from a prepunched strip of malleable clip material, said forming mechanism including a guide for the strip, a punch, an open die movable across said guide to sever a section from the strip and movable over said punch to form the severed section into a substantially U-shaped clip, a clip applying mechanism for accommodating the channel-shaped clip and for closing the clip about the adjacent portions of the tape, and means for moving said punch through said die into said clip forming mechanism, whereby the clip may be transferred from said clip forming mechanism to said clip applying mechanism.

6. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a clip, means for conveying a strip of malleable clip material along a predetermined path, a punch and an open die relatively movable with respect to each other for severing a section of the clip material from the strip thereof and for forming the severed portion into a substantially channel-shaped clip, a clip applying mechanism for accommodating the channel-shaped clip and for closing the clip about the adjacent portions of the tape, and means for moving said punch through said die into said clip forming mechanism, whereby the clip may be transferred from said clip forming mechanism to said clip applying mechanism.

7. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of

tape with a clip, a mechanism for sequentially forming clips from a prepunched strip of malleable clip material, said mechanism including a punch and an open die relatively movable with respect to each other for severing a section of the clip material from the strip and for forming the severed section into a substantially U-shaped clip, and means for positively engaging the punched portions of the strip and for moving a precise length of the strip into position for severing and forming by said punch and die, a clip applying mechanism for accommodating the channel-shaped clip and for closing the clip about the adjacent portions of the tape, and means for moving said punch through said die into said clip forming mechanism, whereby the clip may be transferred from said clip forming mechanism to said clip applying mechanism.

8. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a clip, a clip applying mechanism including a pair of jaws, each jaw having a transverse clip engaging tip and being mounted for movement between a normal position for accommodating an open clip and a closed position for closing the clip, a cam element movable along a path toward said jaw tips and having cam faces thereon for engaging and effecting sequential closing of said jaws, an impact member connected to said cam element for limited reciprocal movement relative thereto between said jaws, whereby said impact member may be driven in one direction by said cam element and may be withdrawn in the opposite direction by said cam element, power means for effecting movement of said cam element from a normal position to first close said jaws and to subsequently move the impact member toward impact engagement with the transverse tips of said jaws, whereby the clip may be first closed and then tightly compressed between the tips of said jaws and said impact member.

9. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a clip, a clip applying mechanism including a pair of jaws, each jaw having a transverse clip engaging tip and being mounted for movement between a normal position for accommodating an open clip and a closed position for closing the clip, a cam element movable along a path toward said jaw tips and having cam faces thereon for engaging and effecting sequential closing of said jaws, a movable impact member disposed between said jaws for supporting the clip in proper position between said jaws prior to and during the closing thereof by said jaws, said impact member being operatively connected to said cam element for limited reciprocal movement relative thereto between said jaws, whereby said impact member may be driven in one direction by said cam element and may be withdrawn in the opposite direction by said cam element, power means for effecting movement of said cam element from a normal position to first close said jaws and to subsequently move the impact member toward impact engagement with the transverse tips of said jaws, whereby the clip may be first closed and then tightly compressed between the tips of said jaws and said impact member, and stop means for maintaining said impact member in position for support of a clip after said cam element has been returned to its normal retracted position.

10. The structure recited in claim 7 wherein said clip transfer means includes a magnetized clip contacting element for maintaining the clip in proper position as it is being transferred from said clip forming mechanism to said clip applying mechanism.

11. In an apparatus for binding a package with flexible tape fed from a supply, means for gripping a first portion of the tape, a first guide spaced from said gripping means, a second guide intermediate said first guide and said supply movable between a normal position in which the tape is presented between said guides for engagement by the package and a second position in which a second portion of the tape is positioned in adjacent coextending relationship with respect to the first portion thereof, and an intermediate portion of the tape is positioned about the package, tension sensing means for detecting the application of tension to the tape by the movement of the package into engagement therewith when said second guide is in its normal position, feed means operative in one direction to feed tape from the supply to said second guide and operative in the opposite direction to apply tension to the tape, power drive means responsive to said sensing means for effecting movement of said feed means in said one direction when the package is moved into engagement with the material and adapted to reverse to apply tension to the tape extending about the package, means for joining the adjacent portions of the tape, and means for severing the second portion of the tape intermediate the joint and said gripping means.

12. The structure of claim 11 and including control means for causing movement of said second guide toward its second position and simultaneous reversal of said feed means, whereby tension is applied to the tape as it is being positioned about the package.

13. In an apparatus for binding a package with flexible tape, means for supporting a supply spool of the tape for free axial rotation, means for gripping a first portion of the tape extending to the free end, movable guide means for positioning a second portion of the tape adjacent said first portion and for guiding the portion of the tape intermediate said first and second portions about the passage, reversible feed means operative in one direction for feeding the tape from the supply spool to said movable guide means and subsequently operative in the opposite direction to apply a tension to the tape extending about the package, a brake normally resisting the free axial rotation of the supply spool, means positioned for engagement by the tape intermediate said reversible feed means and said spool supporting means and operative to effect release of said brake and permit free rotation of said supply spool during the feeding of the tape by said reversible feed means, means for joining the adjacent portions of the tape, and means for severing the second portion of the tape intermediate the joint and said gripping means.

14. The structure of claim 13 wherein said supply spool support means includes a rotatable shaft having means thereon for affixing a spool thereto; said brake includes a brake element movable into and out of engagement with the rotatable shaft of said spool support means to control the rotation thereof; said tape engaging and brake releasing means includes a lead arm for the tape extending between the spool and said reversible feed means, said lead arm being operatively connected to said brake element and being movable in one direction under the application of tension to the tape during feeding by said feed means to effect movement of said brake element out of engagement with said rotatable shaft; and means is provided for urging said lead arm and said brake element in the opposite direction to effect braking of said rotatable shaft and to effect slack take-up by said lead arm.

15. An apparatus for binding a package with a flexible tape fed from a supply which comprises, means for supporting the package as it is being tied with the bottom thereof in a predetermined plane, means on one side of said plane for gripping a first portion of the tape extending to the free end, a first guide spaced from said gripping means on the one side of said plane, second guide movable between a first position in which a part thereof is disposed on the opposite side of said plane and a second position in which the said part is disposed on said one side of said plane, said second guide when in said first position being effective to position the tape between said guides in the path of the package entering the apparatus, whereby when the leading edge of the package is moved into engagement with the tape, the tape will extend at an oblique angle with respect to said plane between said first guide and the leading edge of the package, and said second guide when in its second position being effective

to position a second portion of the tape extending to the supply in adjacent coextending relationship with respect to the first portion thereof and to guide the intermediate portions of the tape about the package and about said first guide, two cooperating pairs of wedge-shaped positioning elements disposed adjacent said plane and movable toward each other between the package and the tape extending between said first guide and the leading edge of the package to position that portion of the tape away from the package and adjacent the first and second portions thereof, means operatively linking said positioning elements together and drive means connected to said linkage means to effect operative movement of said elements toward and away from each other, means for applying a clip to the three adjacent portions of the tape intermediate the positioning elements in each of said pairs, and means for severing the second portion of the tape from the supply after the portions have been joined.

16. In an apparatus for binding a package with flexible tape fed from a supply, means for gripping the tape adjacent the free end thereof, a retractable guide element spaced from said gripping means for engaging and positioning a first portion of tape extending to said gripping means, movable guide means for positioning a second portion of the tape in adjacent coextending relationship with respect to said first portion and for guiding an intermediate portion of the tape about the package and about said retractible guide element, tape positioning means operable in sequence with said movable guide means and movable between a retracted position and an operative position for placing a part of the intermediate portion of tape in spaced relationship with respect to the package and adjacent the first and second portions of the tape, means for applying a clip to the three adjacent portions of the tape whereby these portions may be firmly joined together, latching means for releasably interconnecting said retractable guide element and said tape positioning means whereby said guide element will be retracted with said positioning means after the clip has been applied to the adjacent portions of the tape, means for severing the second portion of the tape intermediate the clipped joint and said gripping means, and means for subsequently disconnecting said fixed guide element and said tape positioning means, whereby said retractable guide element may be returned to its tape engaging position.

17. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a clip, a clip applying mechanism including a pair of jaws, each jaw having a transverse clip engaging tip and being mounted for movement between a normal position for accommodating an open clip and a closed position for closing the clip, means resiliently urging said jaws toward their open position, a jaw-engaging cam element movable between said jaws in one direction to effect movement of said jaws to their closed position and movable in the opposite direction to permit return movement of said jaws to their normal position, said cam element having faces thereon for effecting sequential closing of said jaws as said cam element is moved in said one direction, power means for effecting movement of said cam element, an impact member, means connecting said impact member to said cam element for limited reciprocal movement relative thereto between said jaws, whereby as said cam element is moved in said one direction said jaws may be closed and said impact member may be subsequently moved toward impact engagement with the transverse tips of said jaws, and as said cam element is moved in said opposite direction said jaws may be opened and said impact member may be forcibly withdrawn.

18. The structure of claim 17 wherein said impact member is partially recessed whereby it may accommodate the central portion of a substantially U-shaped clip, and the transverse clip-engaging tip of at least one of said jaws is slightly recessed to accommodate a protruding portion of the clip, whereby said clip may be maintained in position within said mechanism.

19. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a clip, a clip applying mechanism including a pair of jaws, each jaw having a transverse clip engaging tip and being mounted for movement between a normal position for accommodating an open clip and a closed position for closing the clip, power means having an operating member movable toward and away from said jaws, a cam element mounted on said operating member and having a central aperture therein, said cam element having a pair of cam faces thereon which are relatively offset for engaging and effecting sequential closing of said jaws as said cam is moved toward said jaws on the operating member of said power means, means for effecting movement of said jaws toward their open position when said cam element is moved in the opposite direction away from said jaws, an impact member having a depending shaft, said shaft having an elongated longitudinally extending recessed portion and being mounted with said recessed portion disposed within the aperture of said cam element, a pin at least partially traversing the aperture in said cam element and the recessed portion of said shaft, whereby said impact member may be moved toward impact engagement with the transverse clip engaging tips of said jaws subsequent to the closing of said jaws and said impact member may be forcibly withdrawn when said cam element is returned to its normal position.

20. In an apparatus for looping packages with a length of flexible tape and for joining the ends of the length of tape with a substantially U-shaped clip, the combined lengths of the legs of the clip being greater than the central portion interconnecting the legs, a novel clip applying mechanism, said mechanism including a pair of jaws, each jaw being mounted for movement between a normal position for accommodating an open clip and a closed position for closing the clip, a cam element reciprocally movable along a path between said jaws toward and away from said jaw tips, said cam element having a pair of angular cam faces disposed in relative staggered relationship along the axis of movement and sequentially engageable with said jaws for effecting sequential closing of said jaws as said cam element is moved in one direction, whereby one of the legs of the clip may be folded over the other, means for effecting movement of said jaws toward their open position when said cam element is moved in the opposite direction, and power means for moving said cam element in a direction to effect closing of said jaws.

21. The structure of claim 16 wherein said latching means includes a keeper portion mounted on said retractable guide element and a bolt portion mounted on said tape positioning means, means resiliently urging said bolt portion toward latching position, whereby when said tape positioning means is in its operative position said bolt portion will releasably engage said keeper portion, and a fixed abutment positioned for engagement by said bolt portion when said tape positioning means and said bolt portion have been moved to their retracted position, whereby said bolt portion may be moved to effect disengagement of said keeper portion, and spring means urging said retractable guide element toward its tape engaging position.

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