Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 1

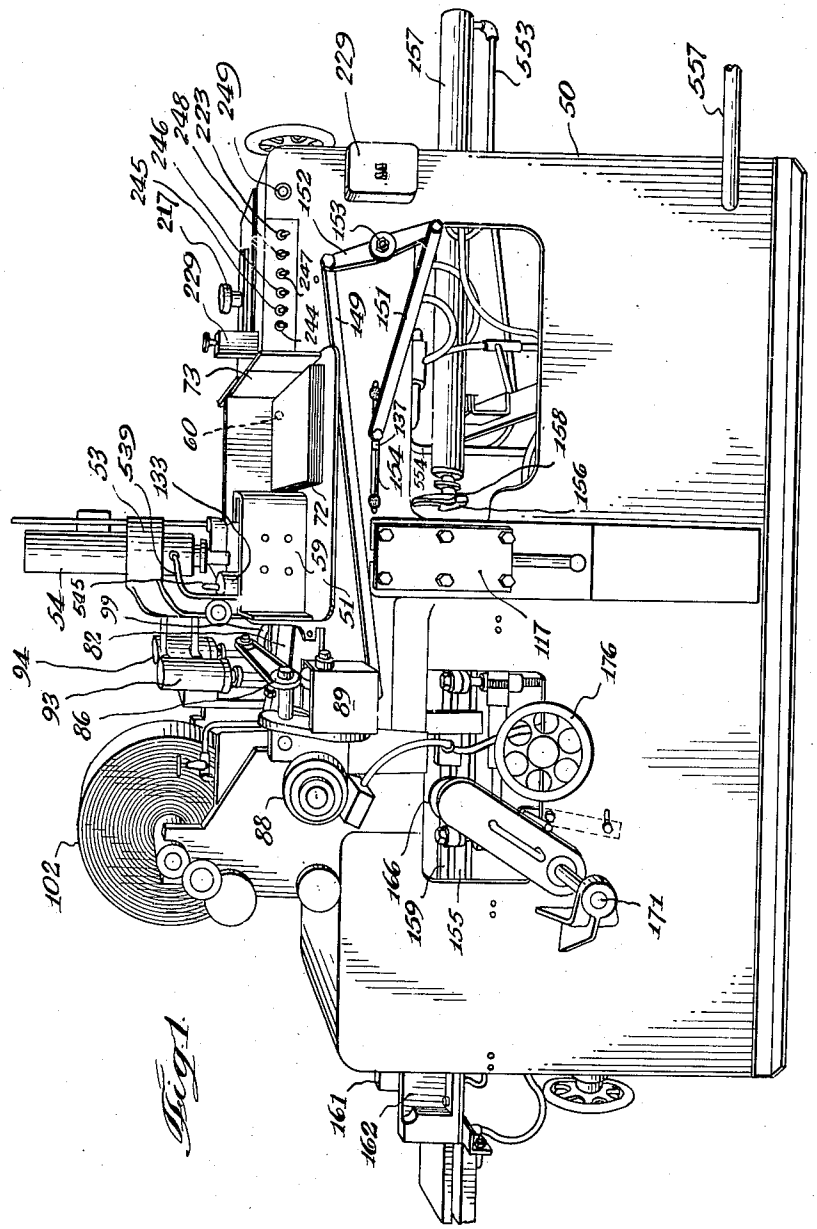


Fig. 1.

Inventors
Wallace A. Doepel
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Attorneys

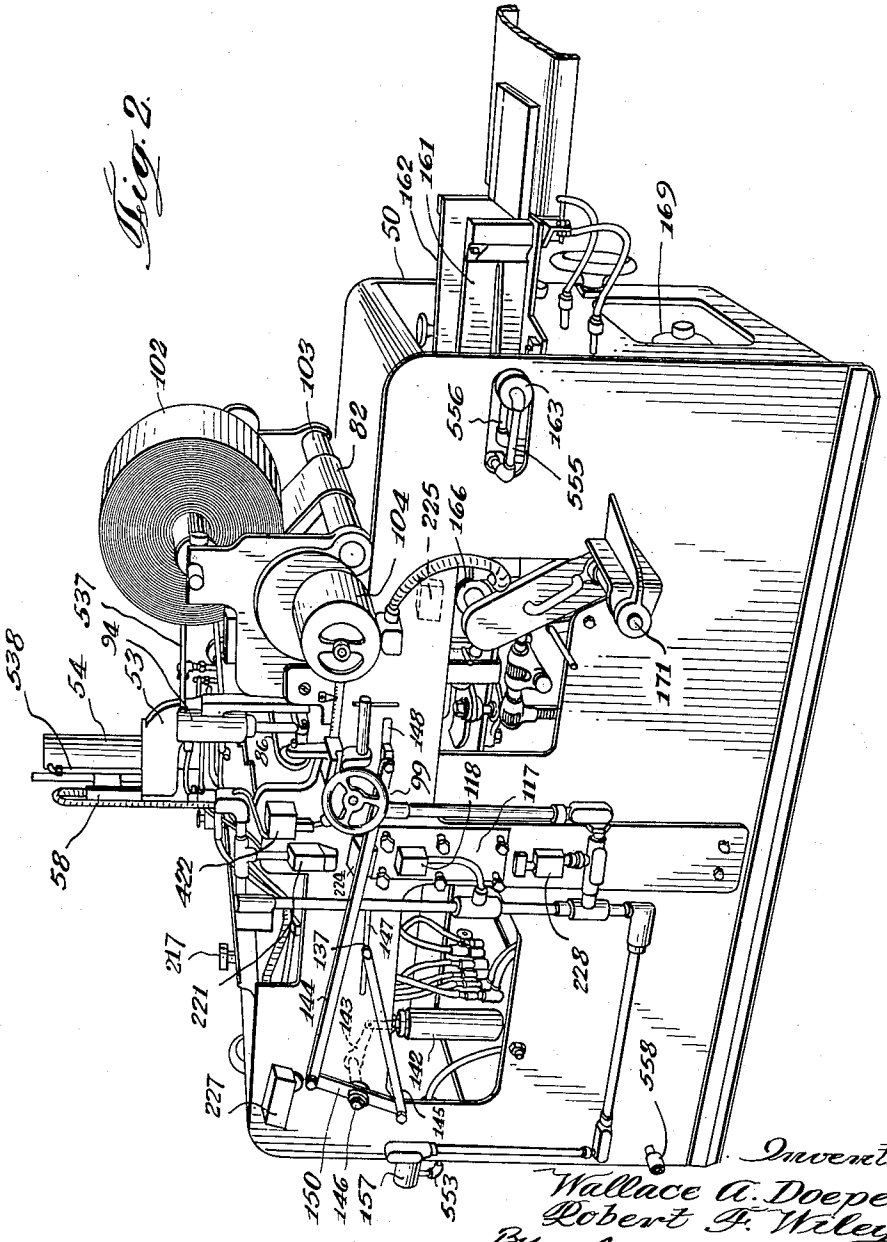
Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 2

Fig. 2.



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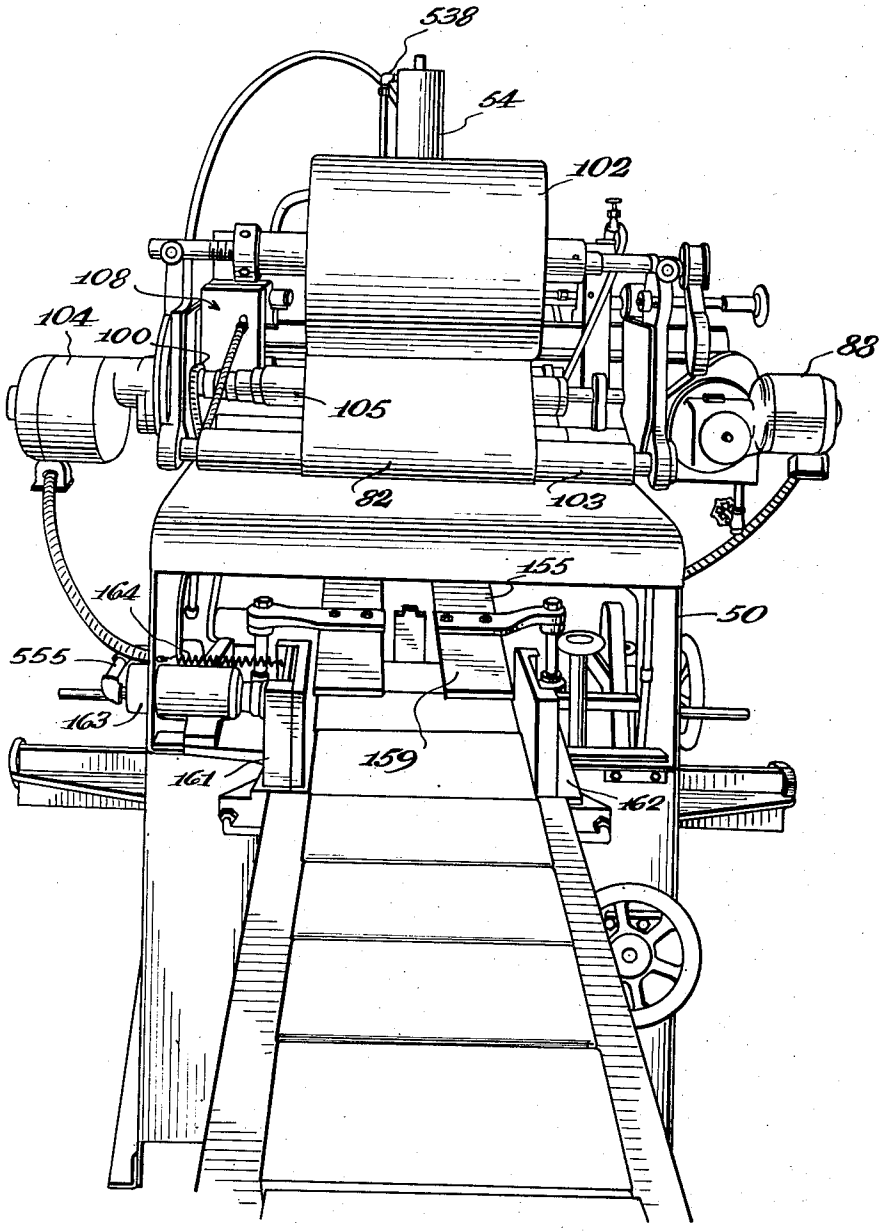
Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 3

Fig. 3



Inventors
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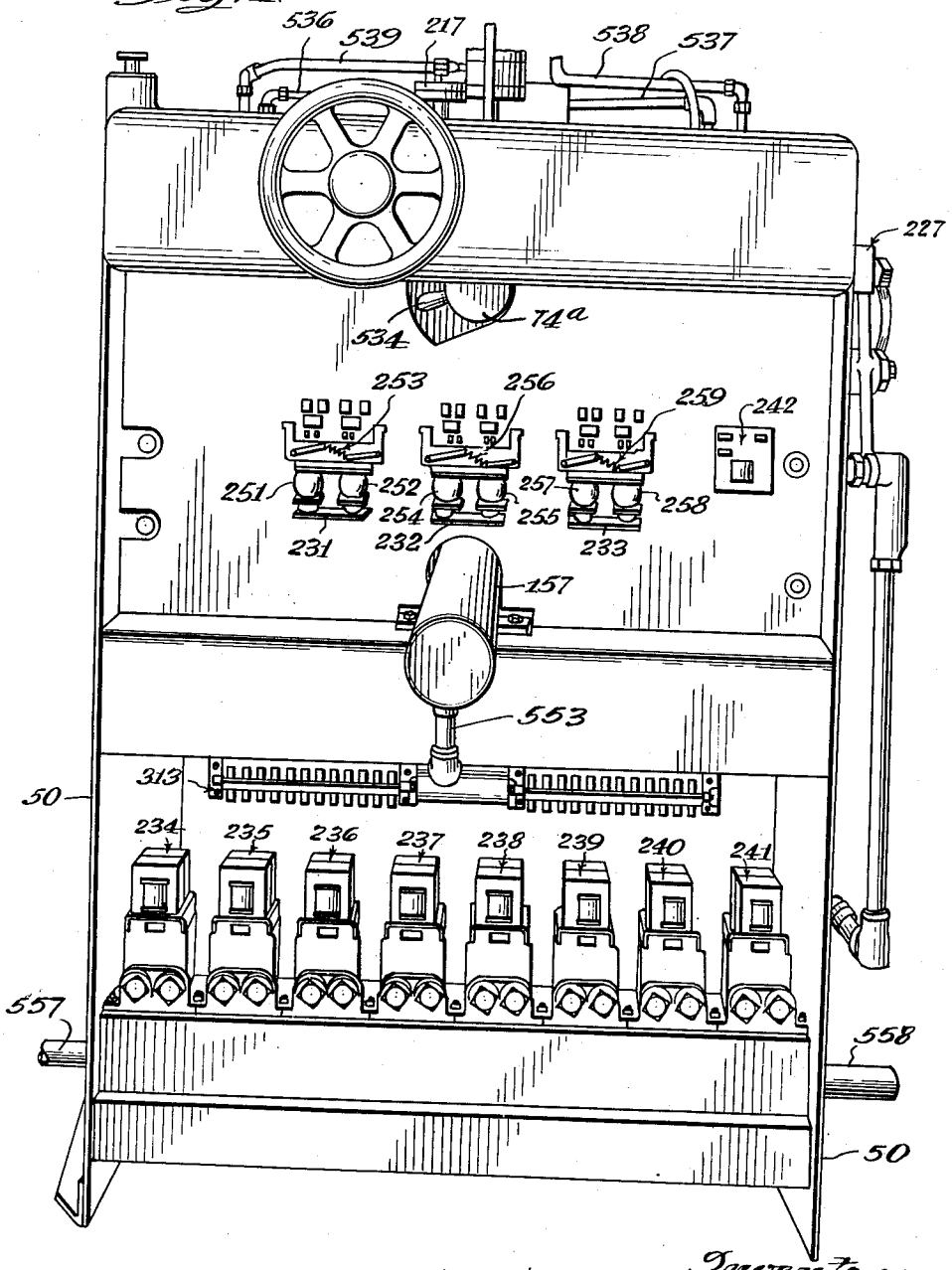
Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 4

Fig. 4.



Inventors
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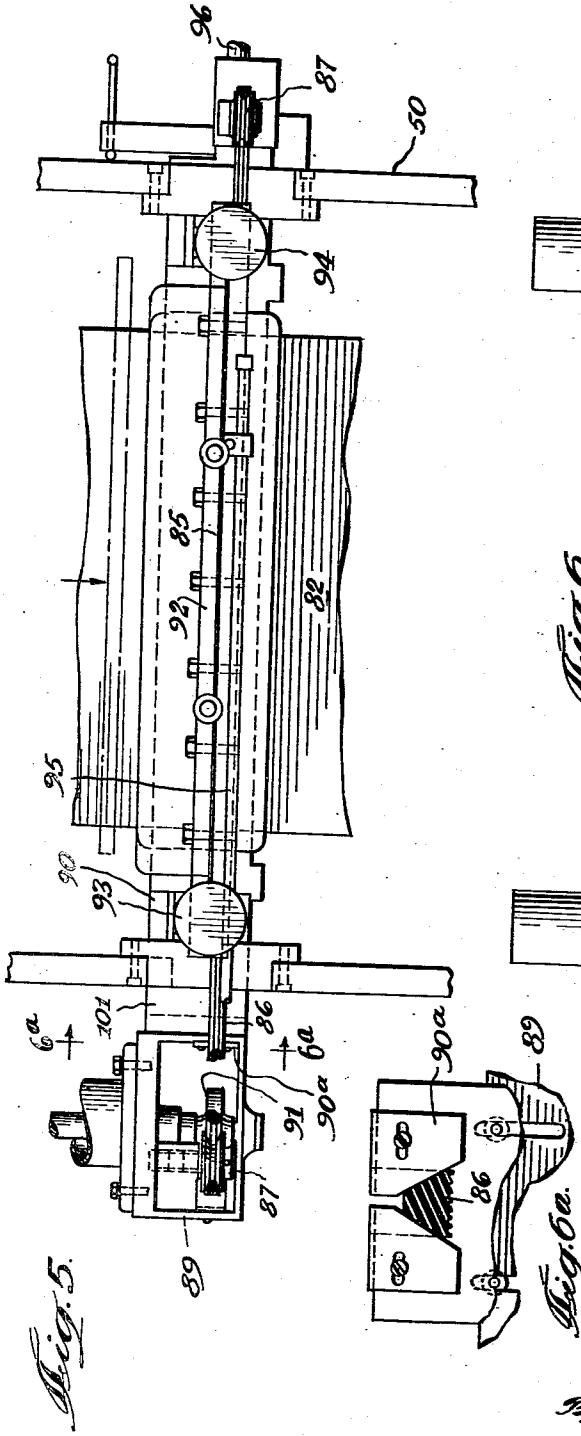


Fig. 5.

Fig. 6a.

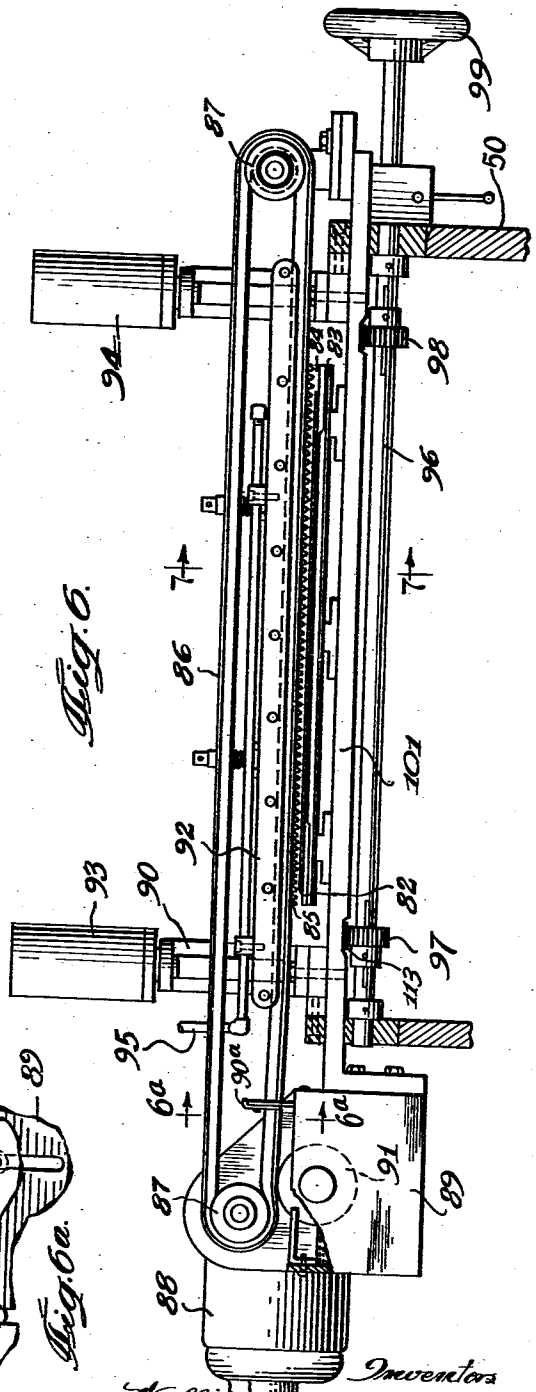


Fig. 6.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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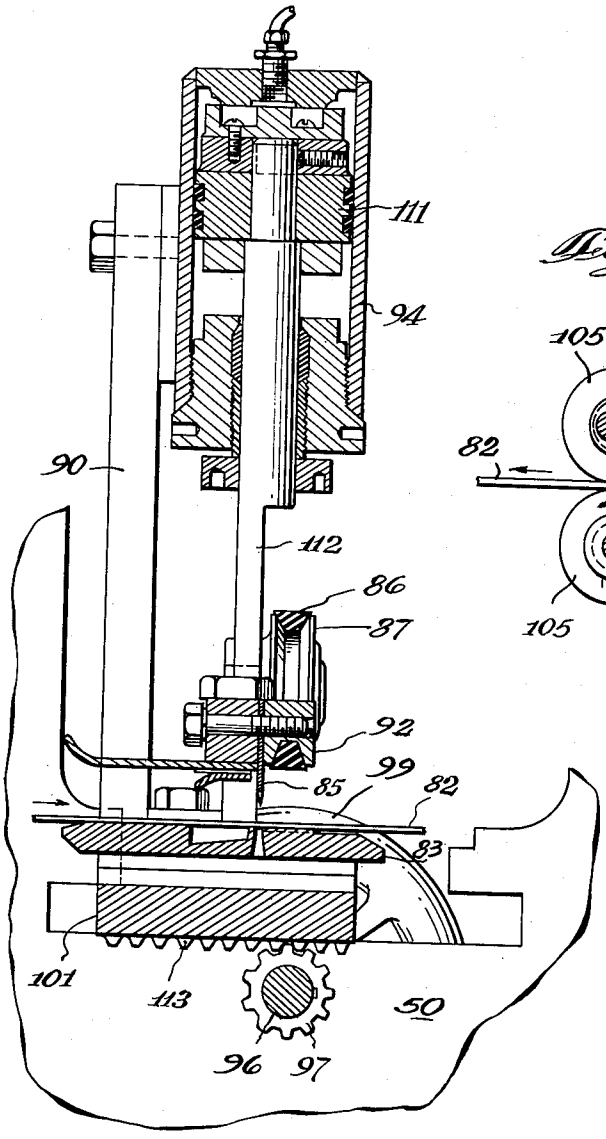


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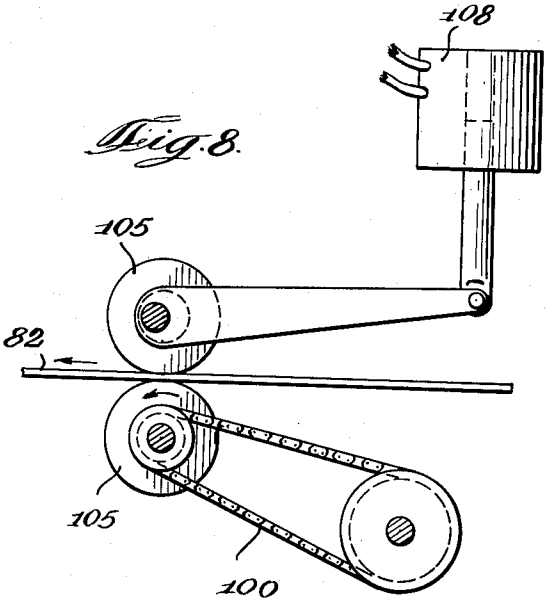


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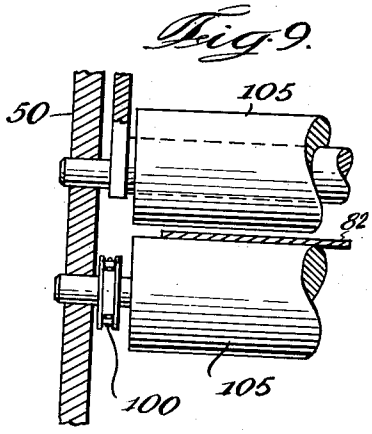


Fig. 9.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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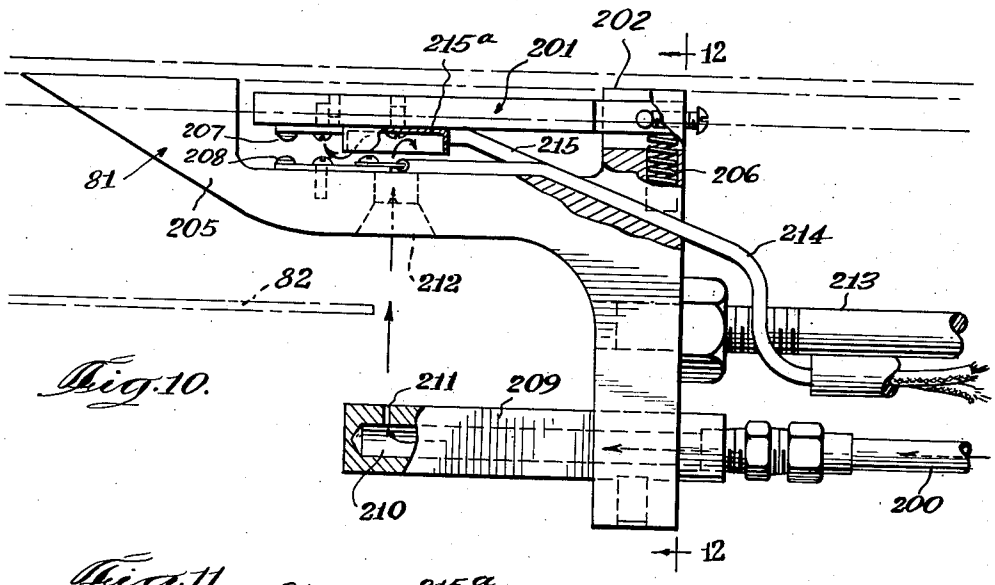


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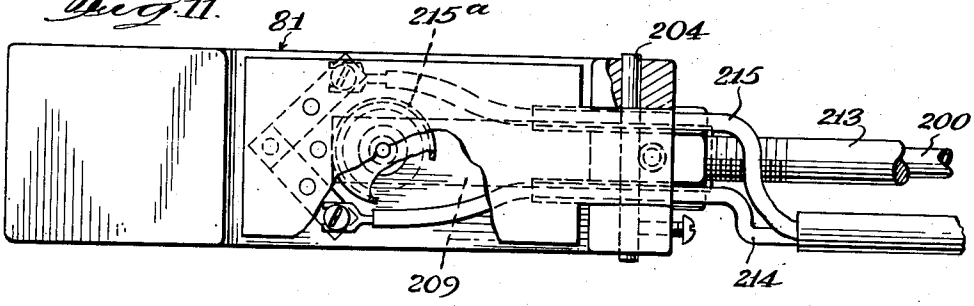


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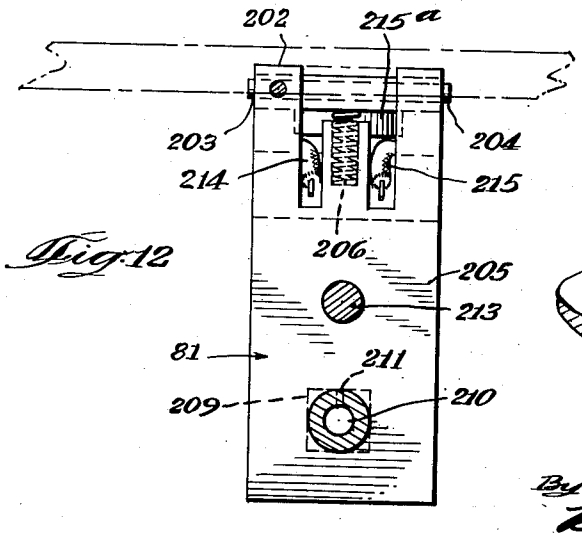


Fig. 12

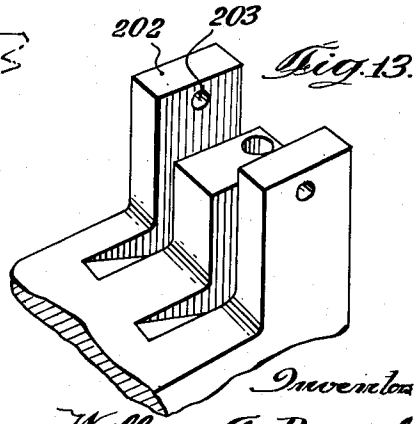


Fig. 13.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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Fig. 14.

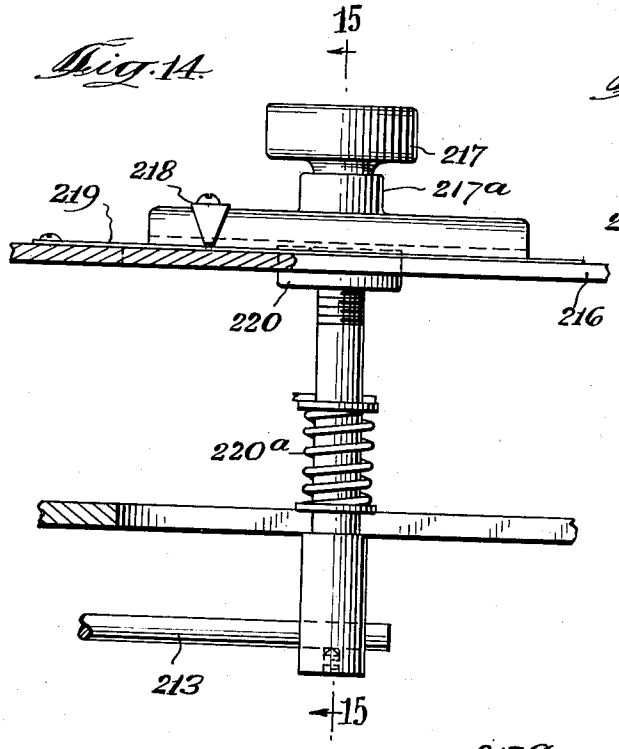
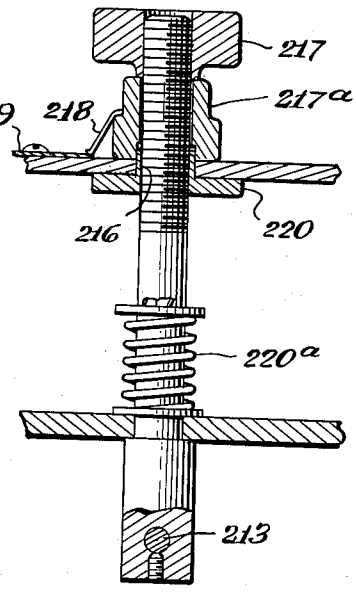


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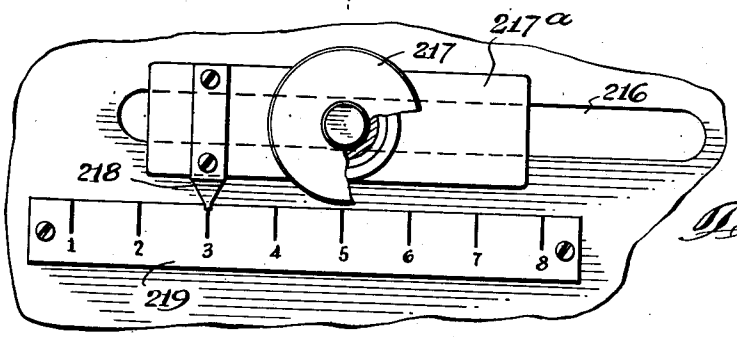


Fig. 16.

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Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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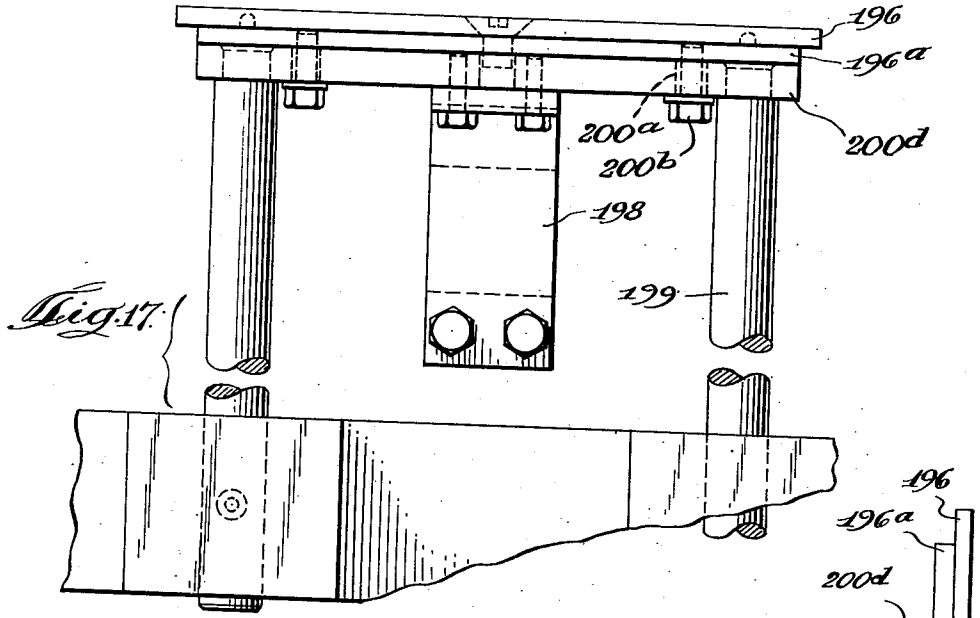


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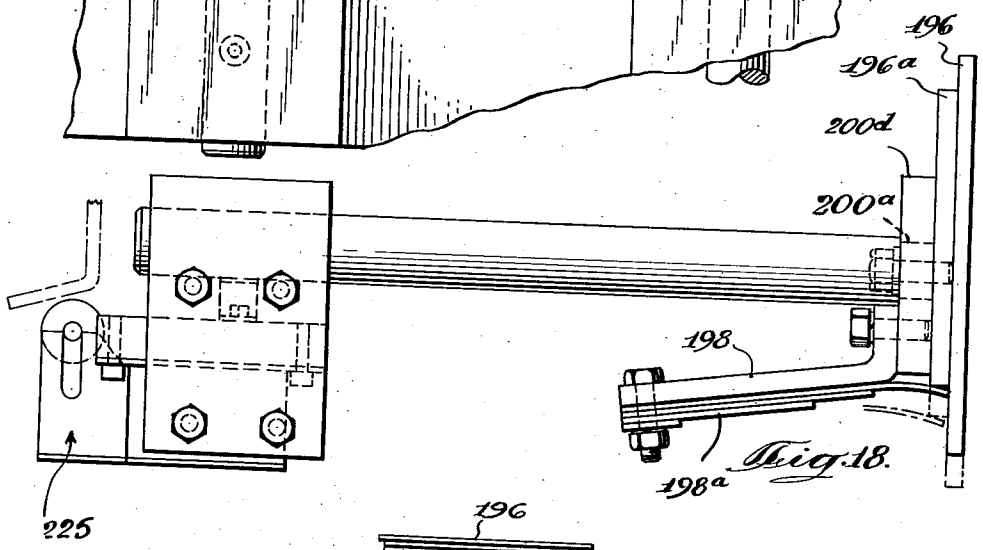


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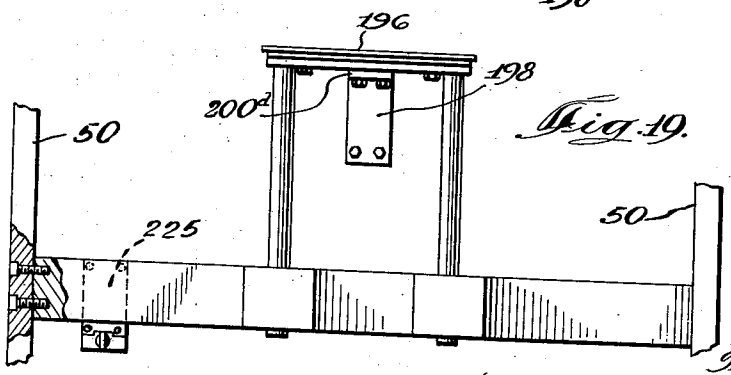


Fig. 19.

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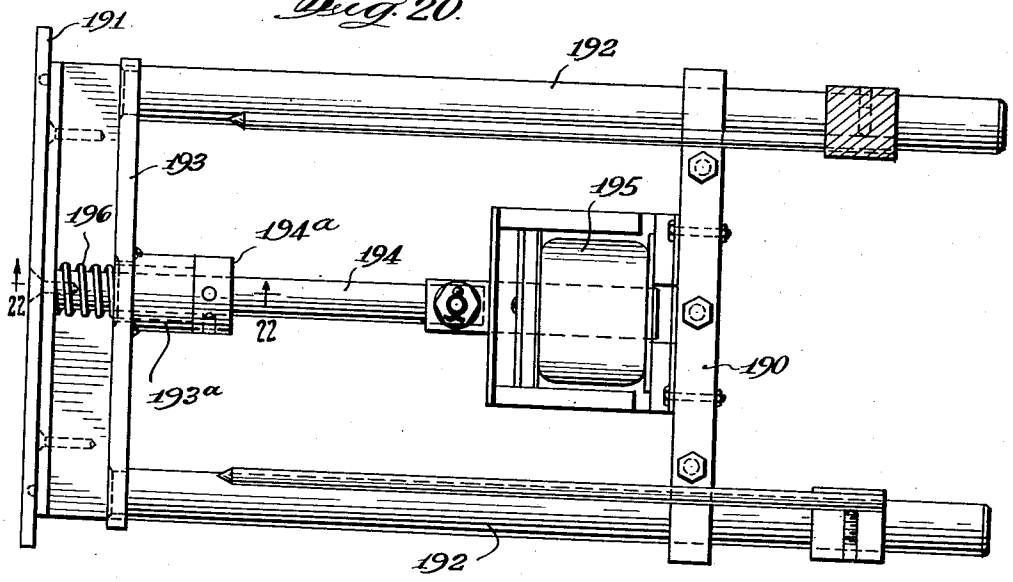
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Fig. 20.



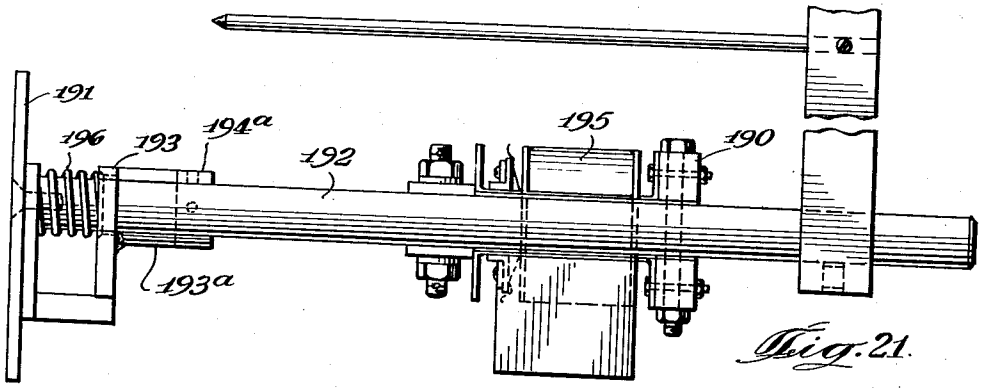


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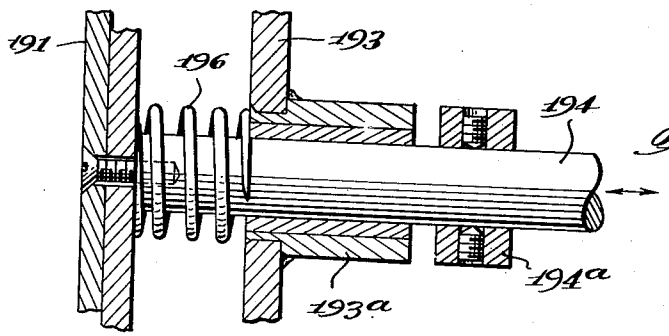


Fig. 22.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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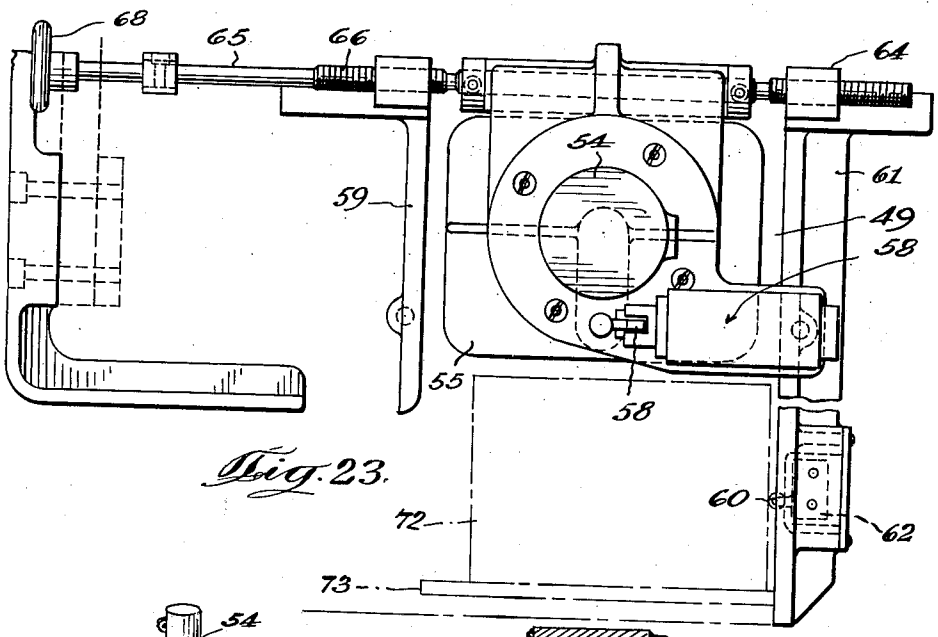


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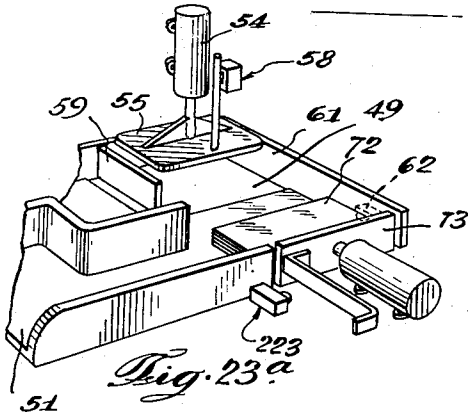


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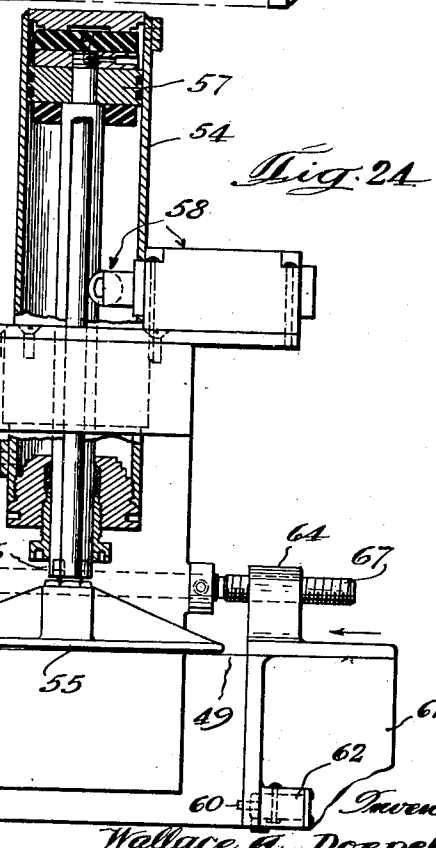
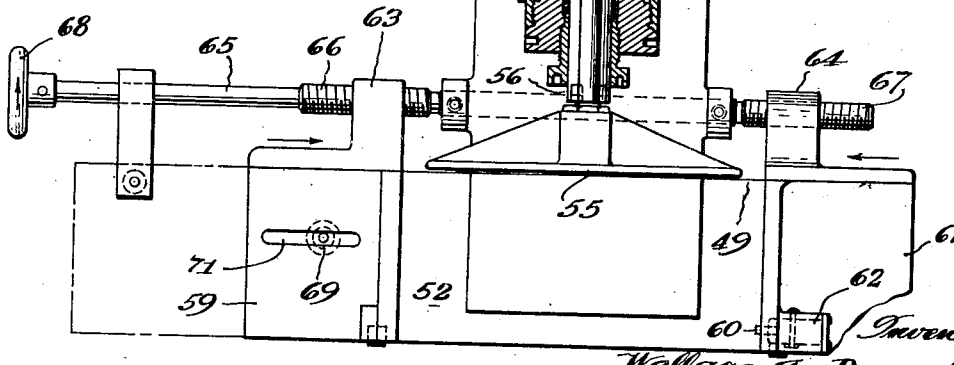


Fig. 24.



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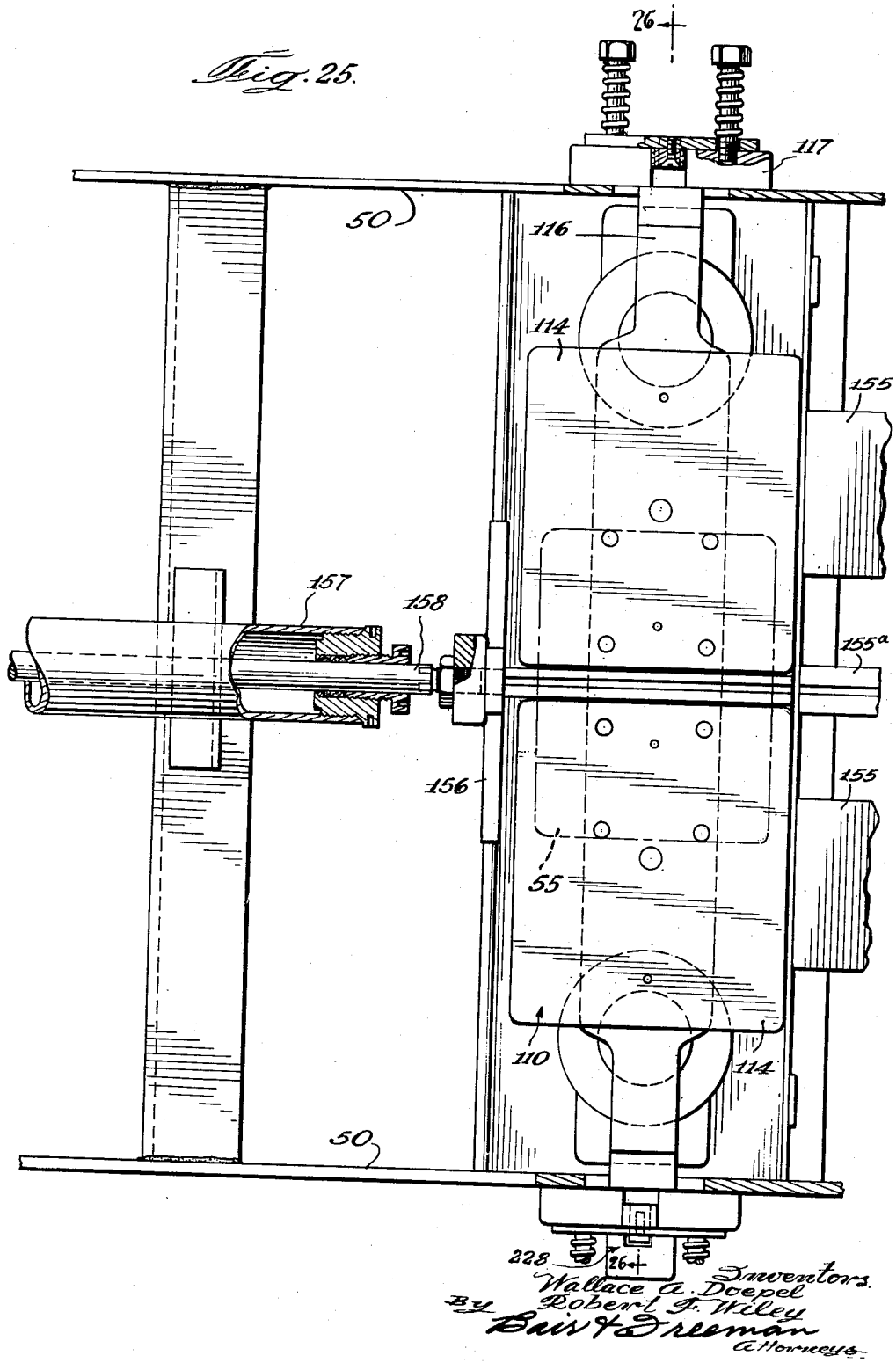
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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 12

Fig. 25.



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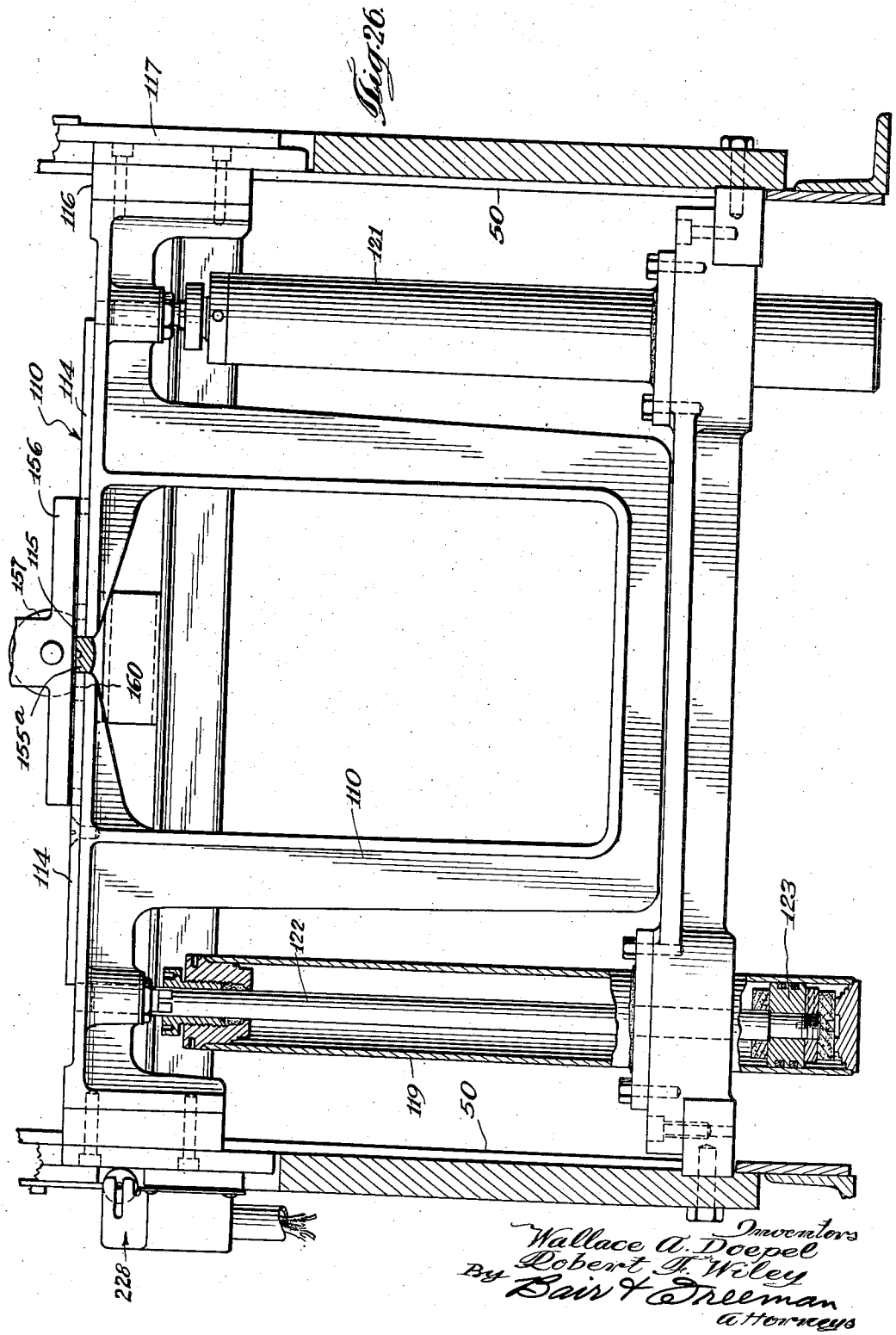
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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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Fig. 26



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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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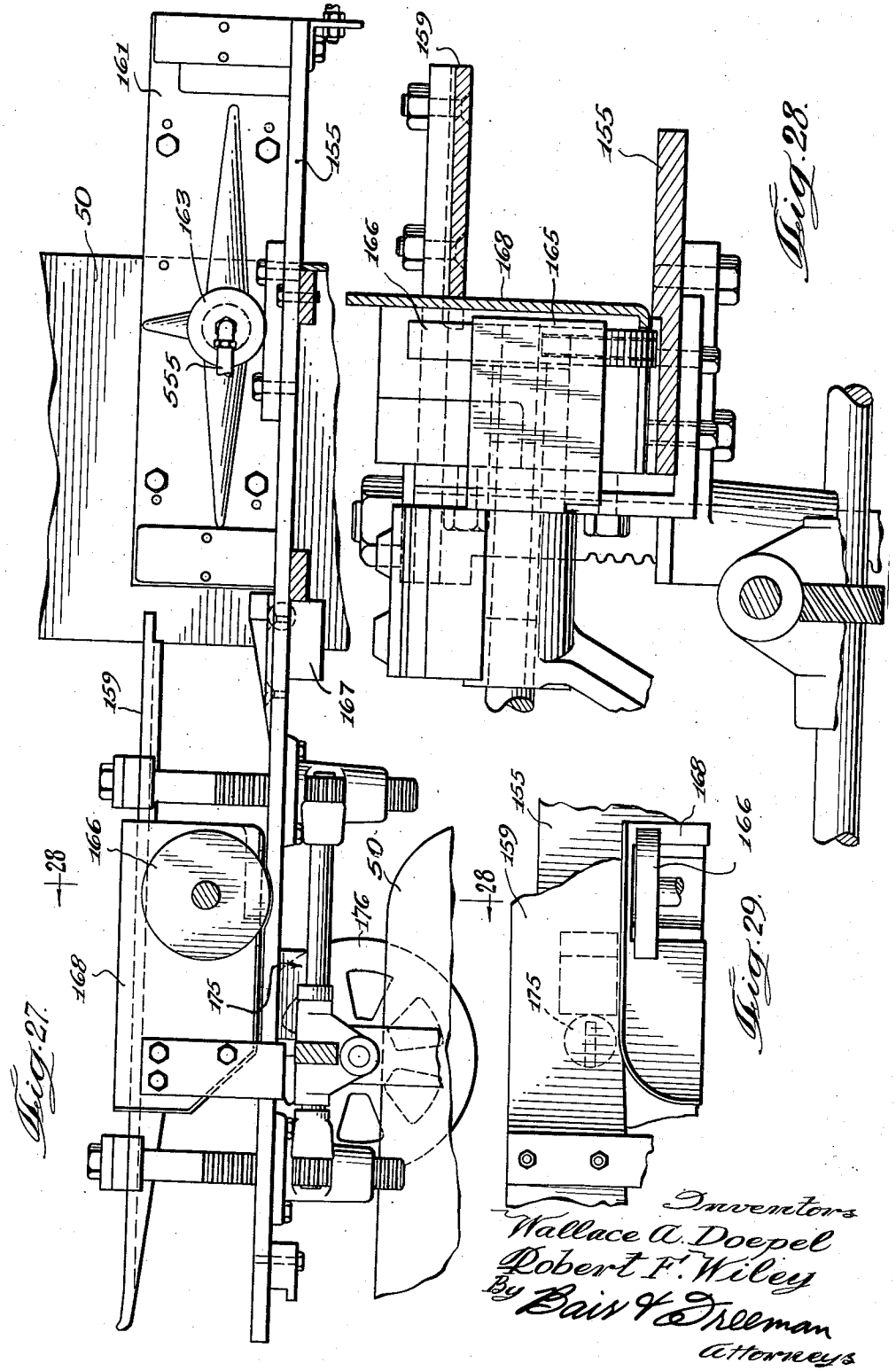


Fig. 27.

Fig. 28.

Fig. 29.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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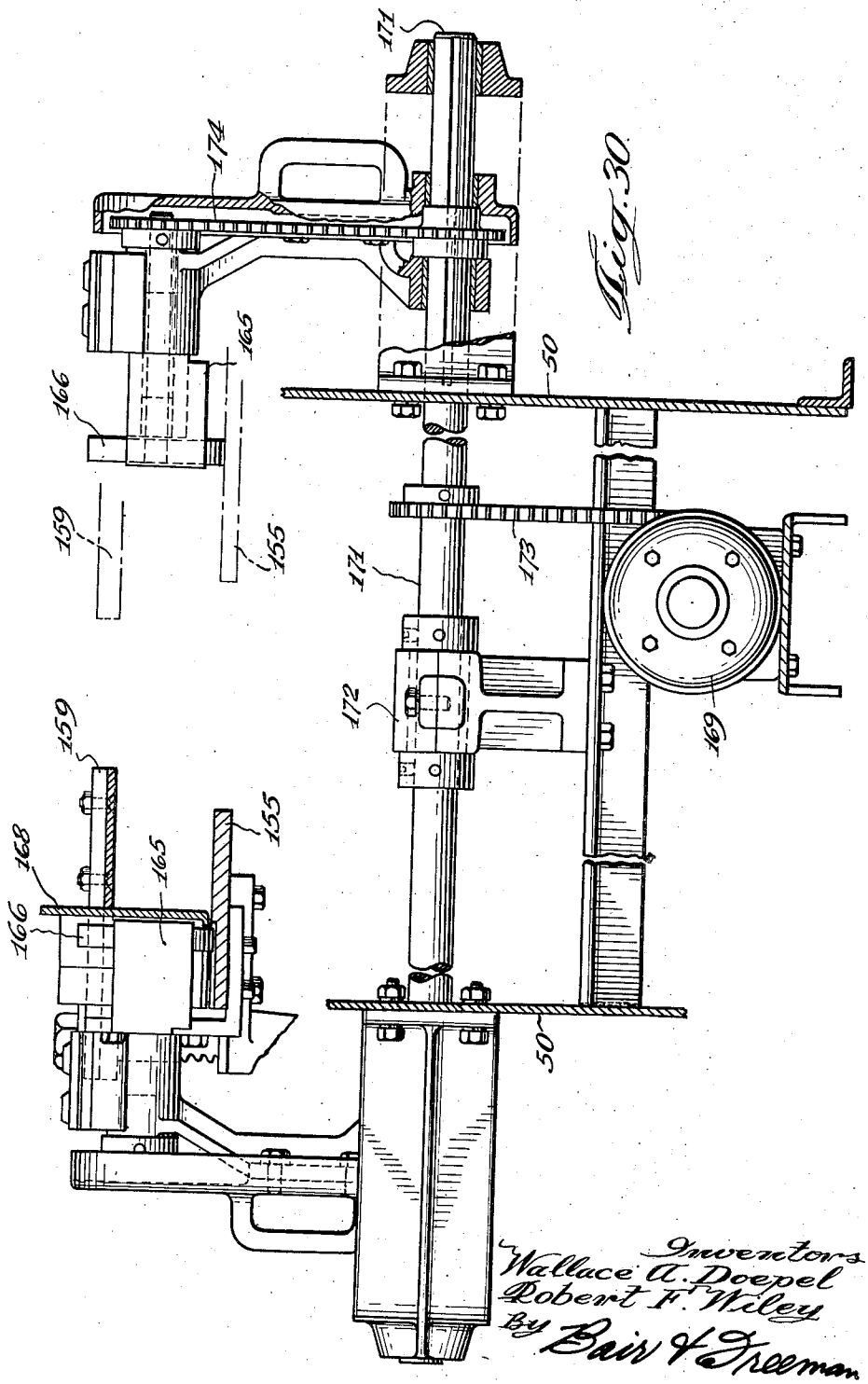


Fig. 30.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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Fig. 31

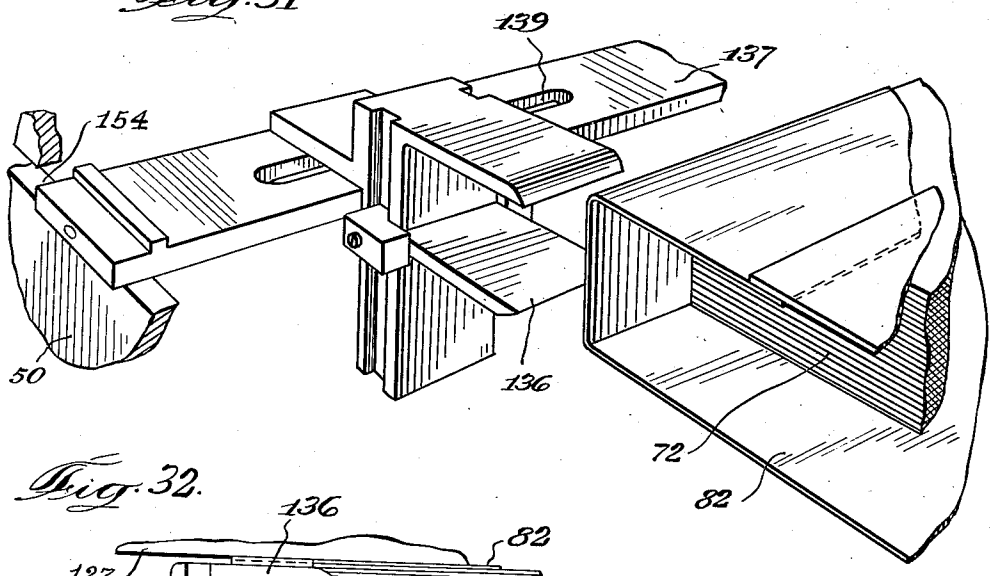


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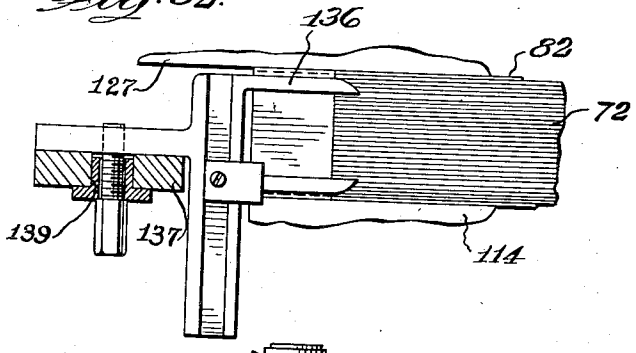


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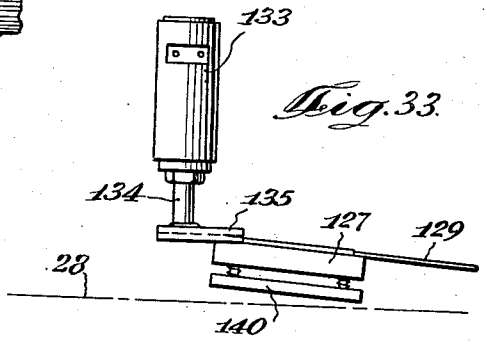
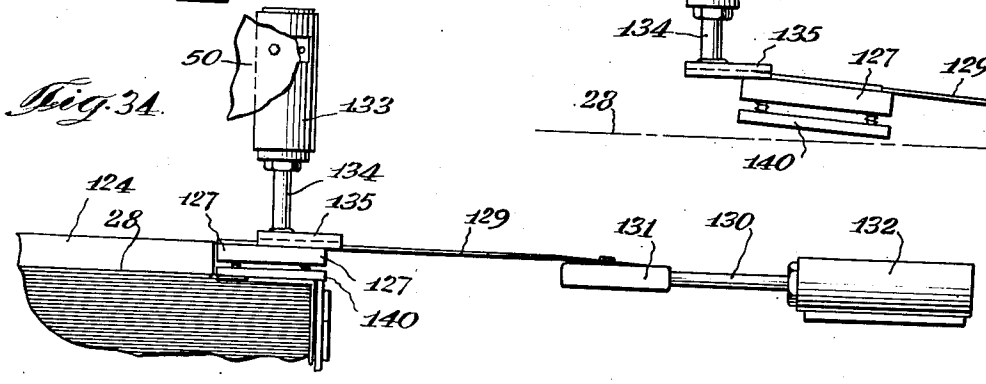


Fig. 34.



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Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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Fig. 35.

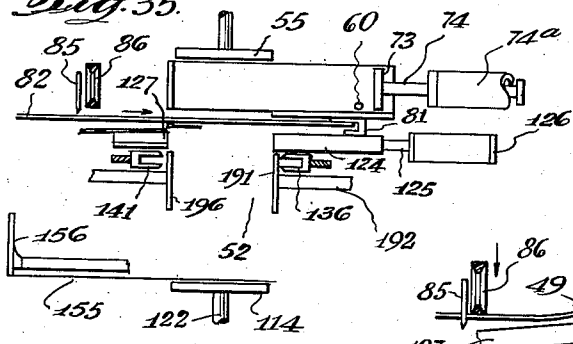


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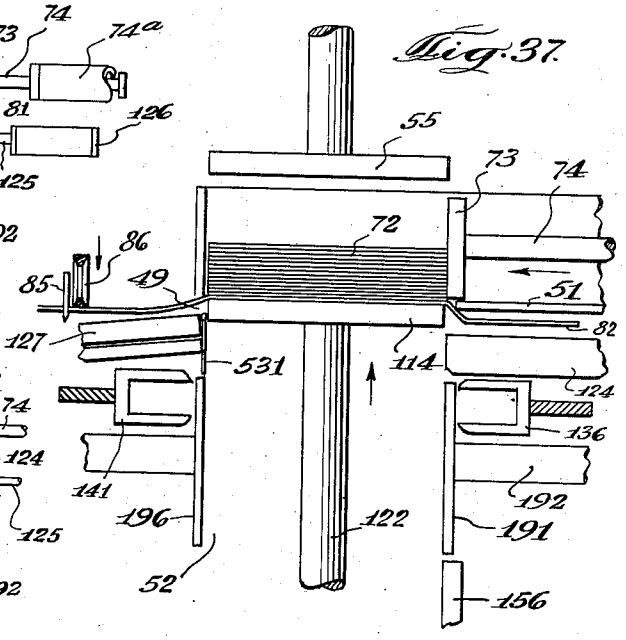


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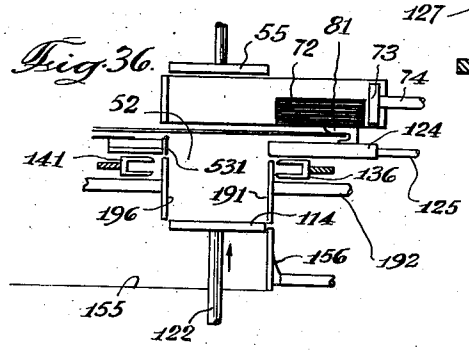


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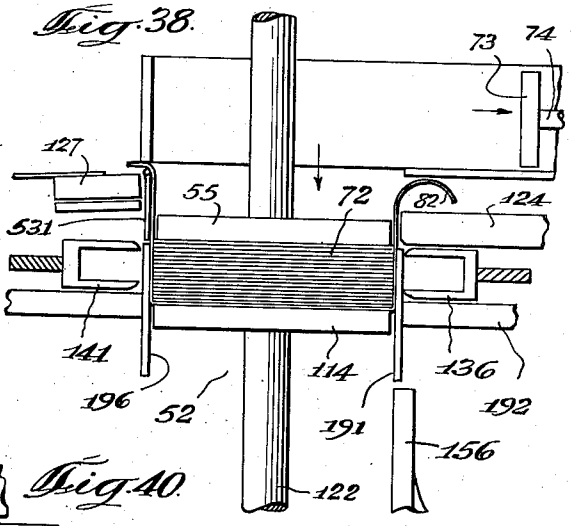


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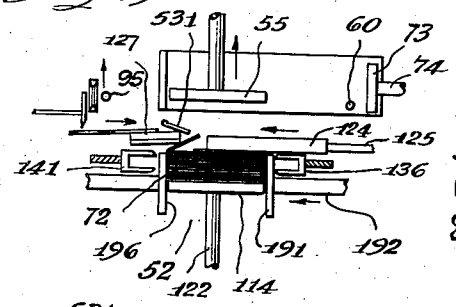
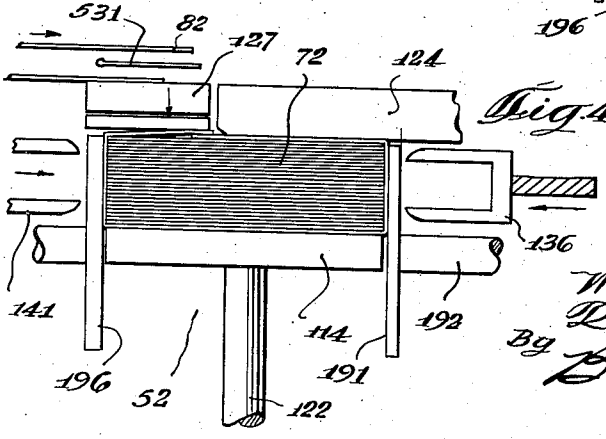


Fig. 40.



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Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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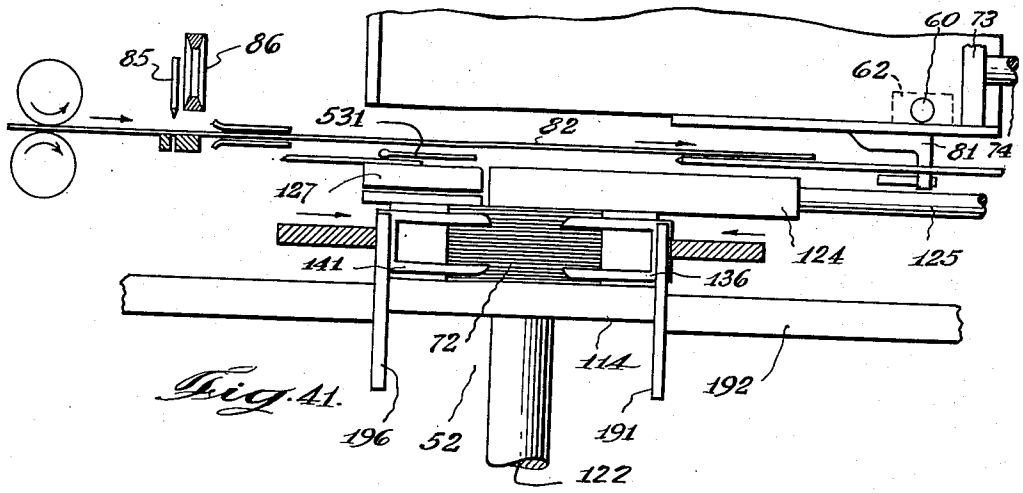


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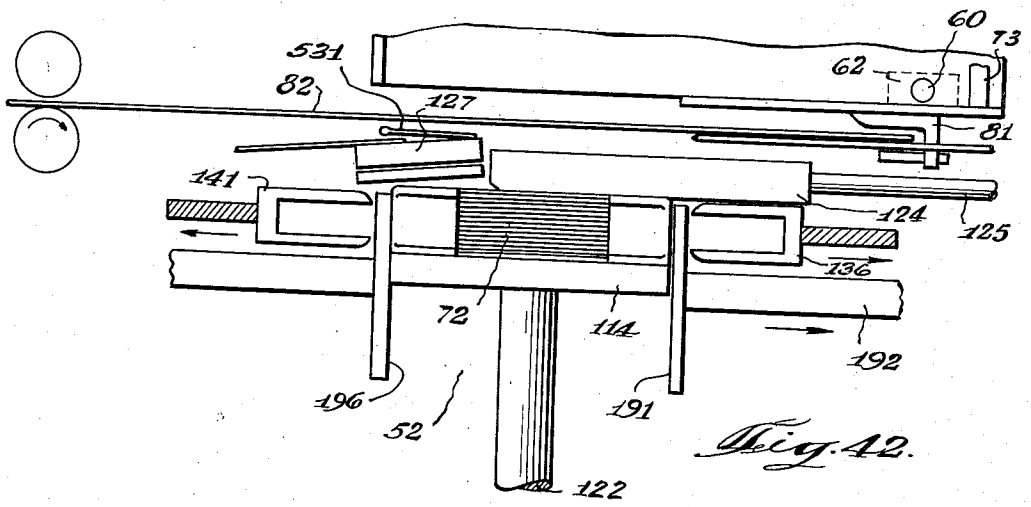


Fig. 42.

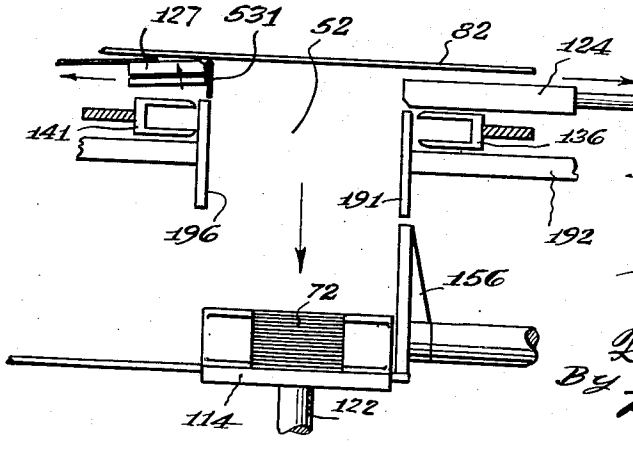


Fig. 43.

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Aug. 3, 1954 W. A. DOEPEL ET AL 2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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Fig. 44.

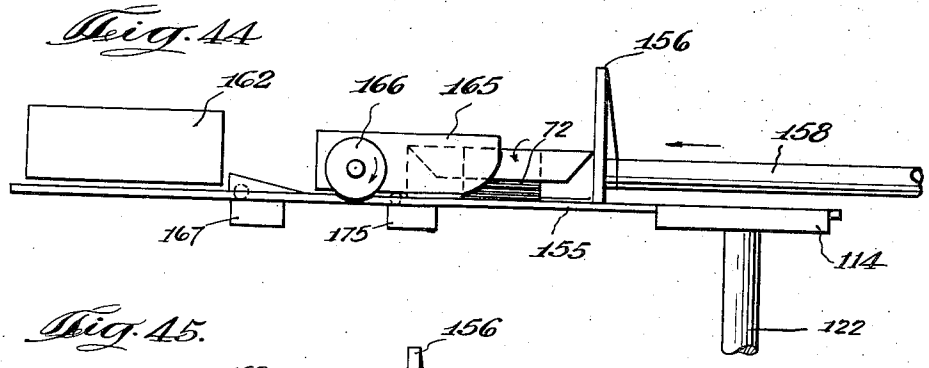
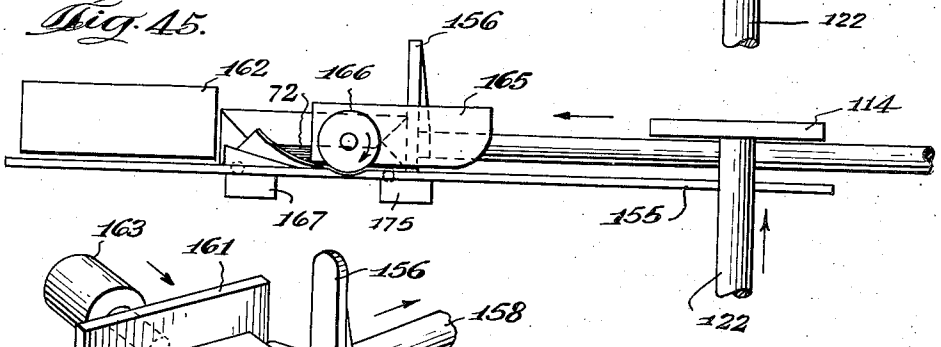


Fig. 45.



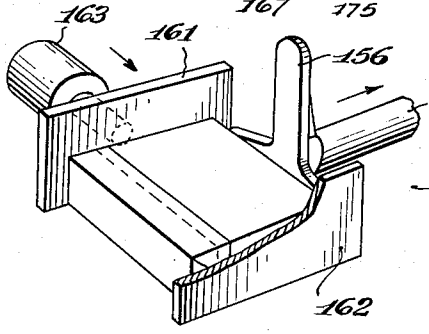


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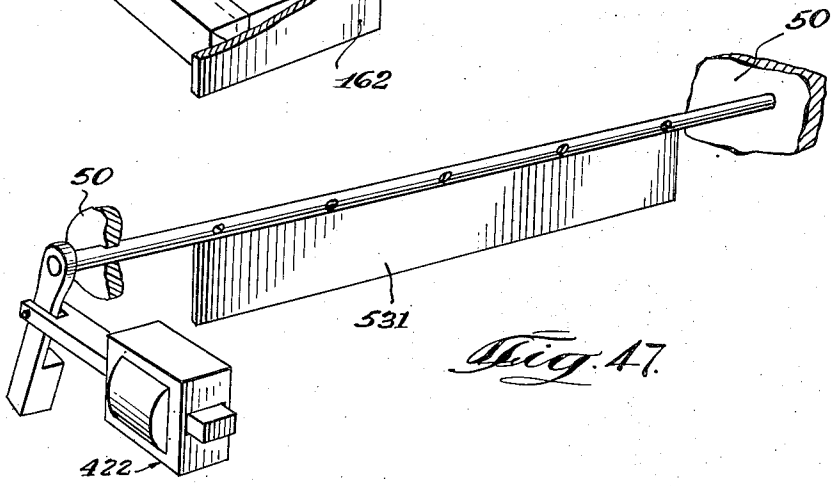


Fig. 47.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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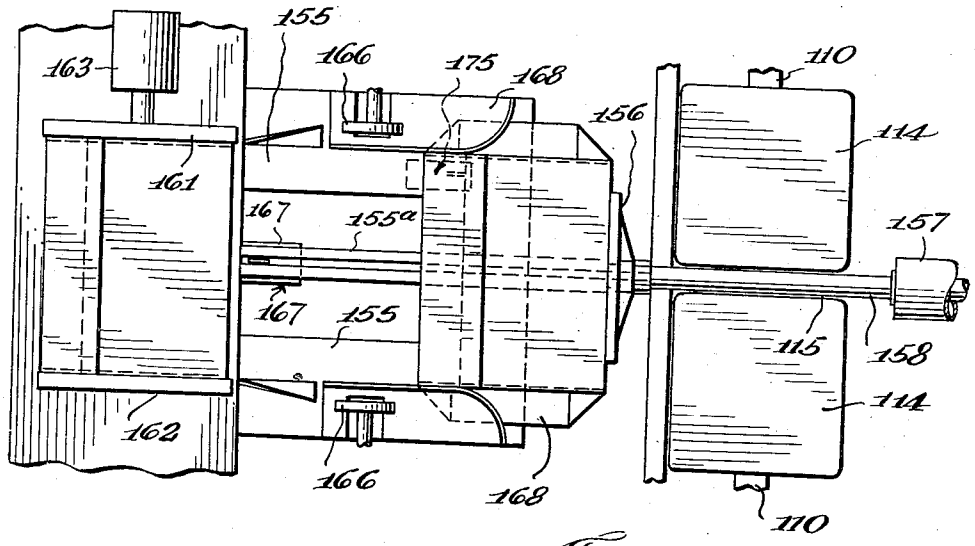


Fig. 48.

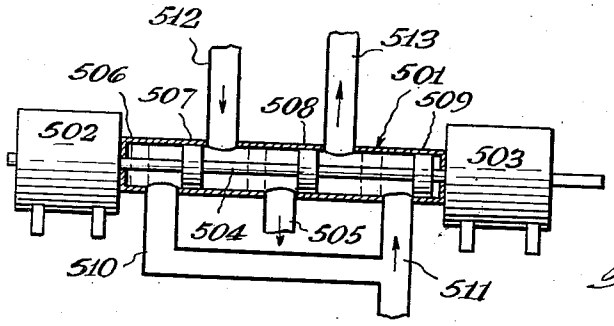


Fig. 49.

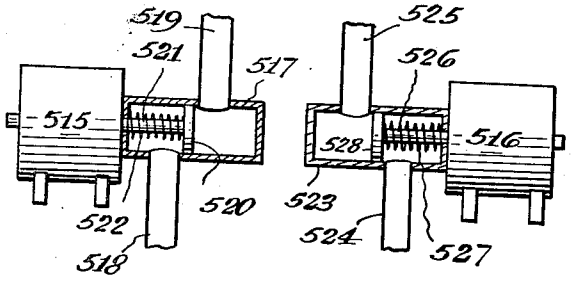


Fig. 50.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

Filed July 9, 1949

24 Sheets-Sheet 21

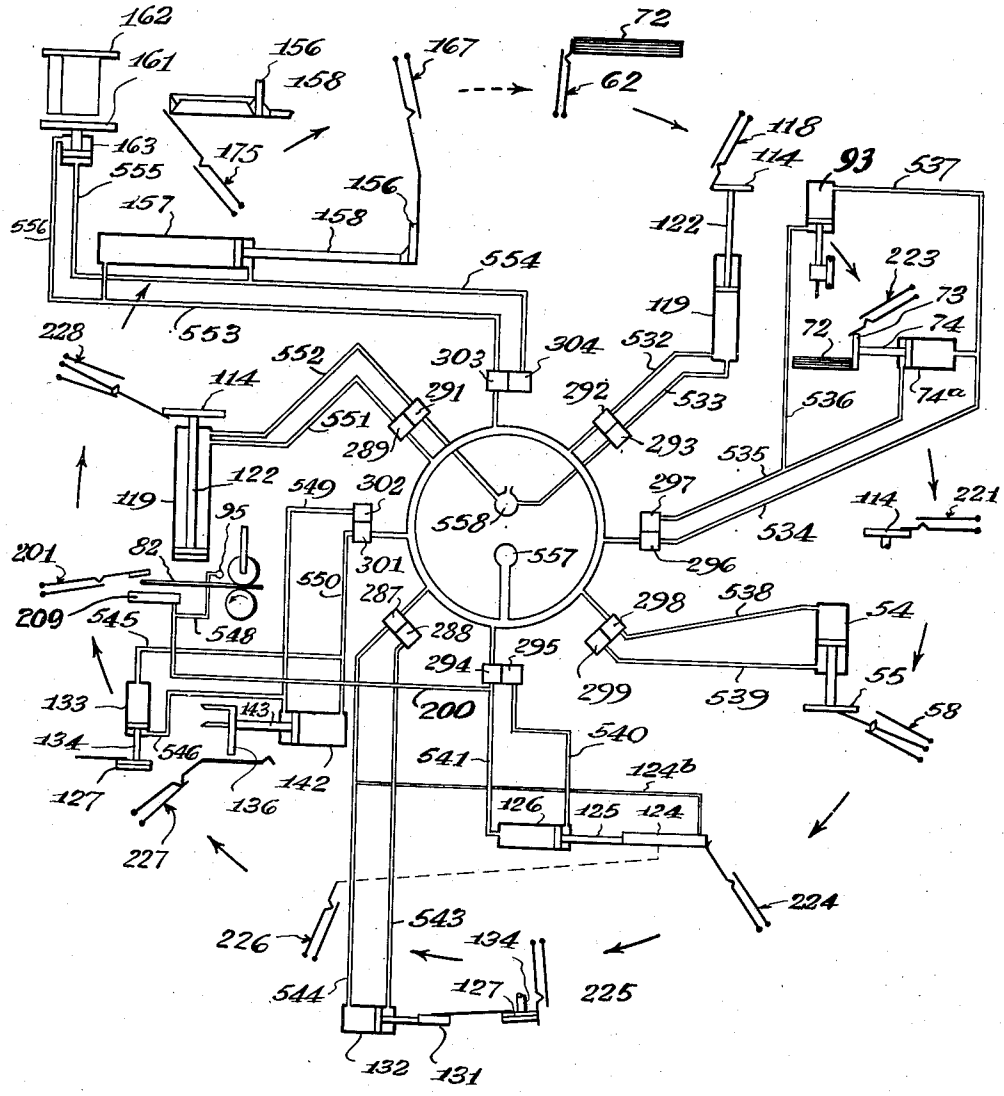


Fig. 51.

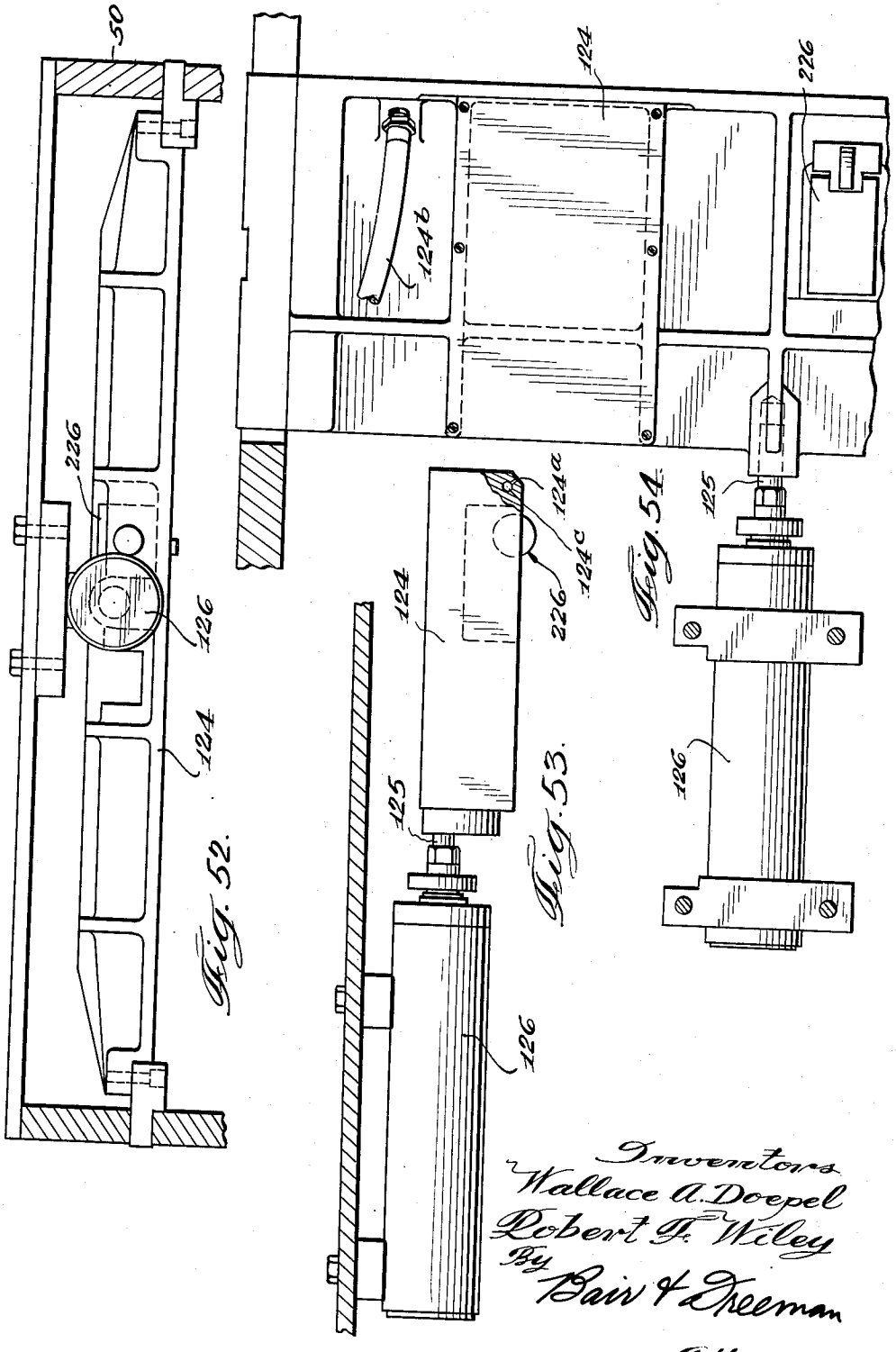
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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 23

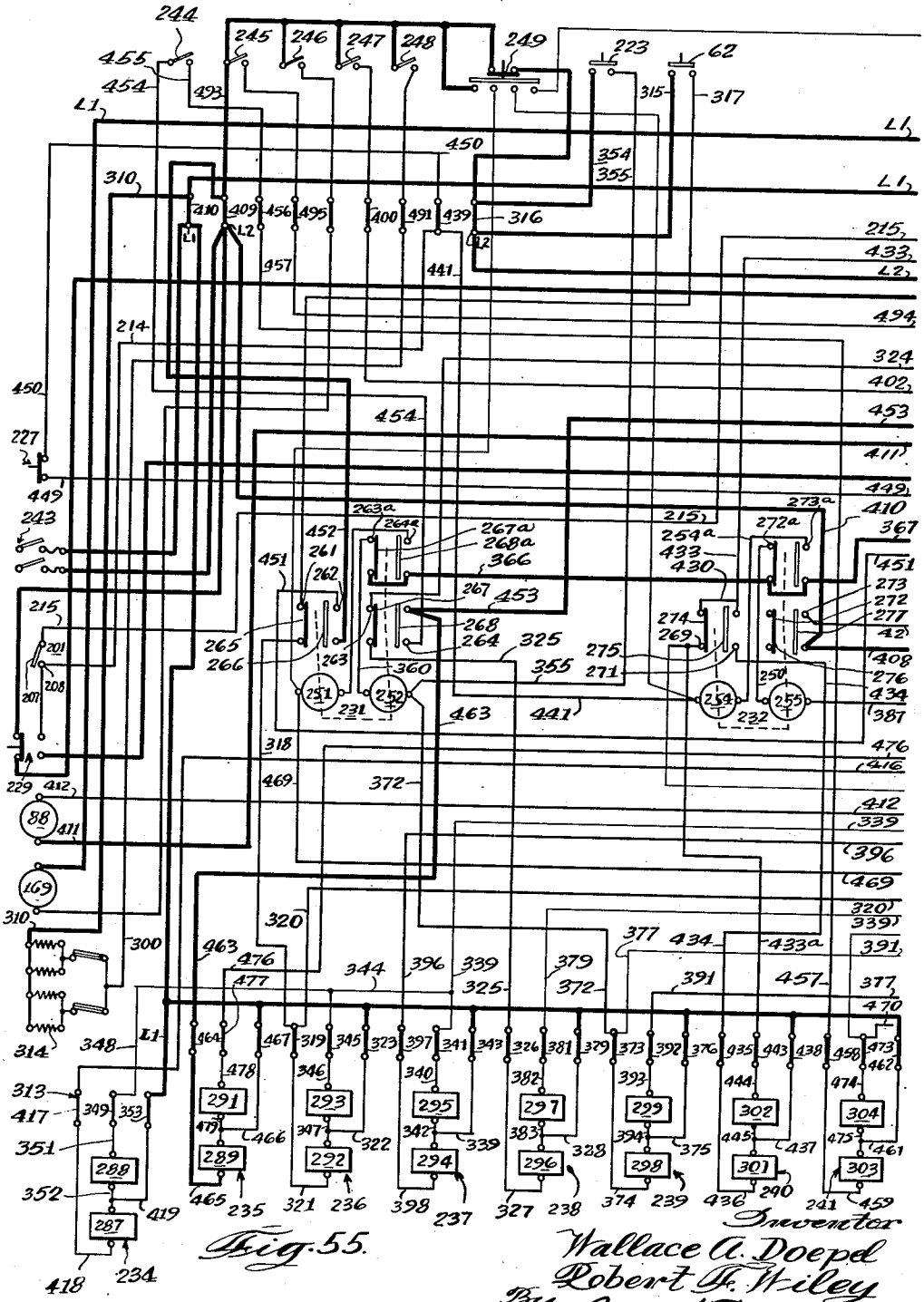


Fig. 55.

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MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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24 Sheets-Sheet 24

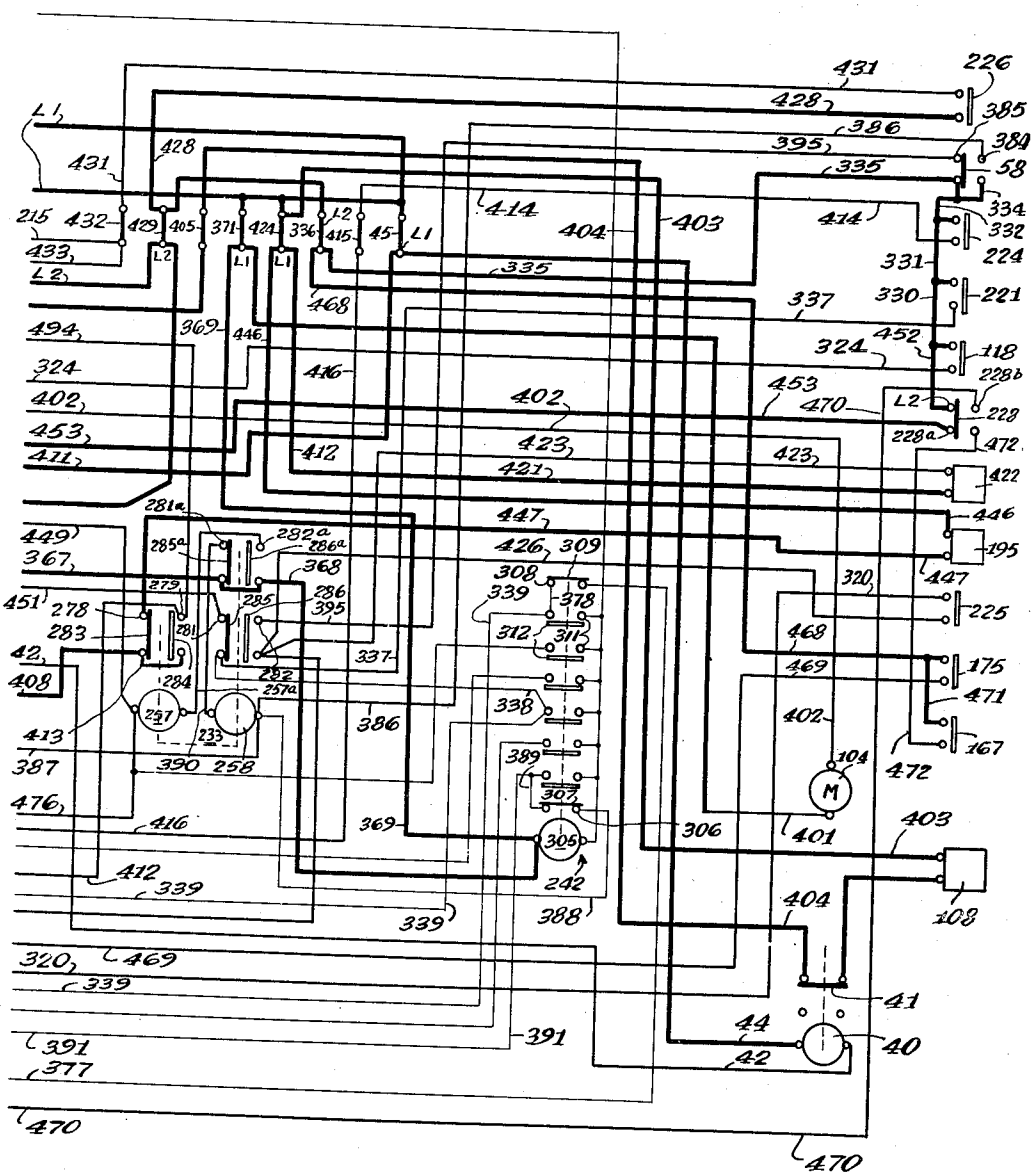


Fig. 56

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UNITED STATES PATENT OFFICE

2,685,157

MACHINE FOR WRAPPING ARTICLES AND CONTROL THEREFOR

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Application July 9, 1949, Serial No. 103,875

9 Claims. (Cl. 53—129)

1

This invention relates to a machine designed primarily for wrapping articles such as stacks of loose sheets of paper, currency, books or the like, as well as to a control for such machine.

It has been the general practice to wrap paper sheets, books and the like by hand, except under conditions where paper of very inferior grade was being packaged. It is seldom that two packages of loose paper sheets or books prepared for the market are of the same thickness, and it is also well known that the thickness varies with different climatic conditions. Furthermore, changes in the thickness of stacks of sheets may vary because of air which is entrapped between the sheets when they are superimposed during the formation of stacks or books.

Machines have been developed to attempt to overcome the foregoing objections and to provide a machine which would operate automatically upon stacks of loose sheets of paper in proper succession, so that the wrapping paper would be drawn tightly and sealed around each stack even though there were variations in thicknesses either due to a different number of sheets being present, climatic conditions or air being entrapped. The prior machines were fully automatic from the start of the cycle, where an operator feeds stacks to the machine, to the end of the cycle where the packages are ejected, tightly wrapped and sealed.

The prior machines were constructed with a somewhat complicated electrical and pneumatic control. It is an object of the present invention to simplify and improve upon both the electrical and pneumatic control for wrapping machines.

It is also an object of the present invention to provide improved control of the wrapping paper feed and cut-off.

It is a further object of this invention to provide improved adjustments for paper or books of different sizes.

It is an additional object of the invention to improve upon certain mechanical details of prior machines.

With these and other objects in view, our invention consists in the construction, arrangement and combination of the various parts of our device whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in our claims and illustrated in the accompanying drawings, wherein:

Figure 1 is a front perspective view of a paper wrapping machine constructed in accordance with the invention;

Figure 2 is a perspective rear view of the machine;

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Figure 3 is an end view of the left hand side of the machine, as viewed in Figure 1;

Figure 4 is a view of the right hand end of the machine, as viewed in Figure 1, with the usual cover panels removed;

Figure 5 is a plan view of the cutting and gluing mechanism for one end of the wrapping paper seal;

Figure 6 is a sectional view showing the mechanism of Figure 5;

Figure 6*a* is a sectional view taken on line 6*a*—6*a* of Figures 5 and 6;

Figure 7 is a sectional view taken on line 7—7 of Figure 6;

Figure 8 is a diagrammatic view of the wrapping paper feed rolls and control solenoid;

Figure 9 is a detail view of the wrapping paper feed rolls;

Figure 10 is a side view partially in section of an air beam switch and associated mechanism;

Figure 11 is a top view of the mechanism shown in Figure 10;

Figure 12 is a sectional view taken on line 12—12 of Figure 10;

Figure 13 is a partial perspective view showing a detail of the mechanism shown in Figure 10;

Figure 14 is a front view of the mechanism for adjusting the air beam switch to compensate for various lengths of wrapping paper;

Figure 15 is a sectional view of the adjustment taken on line 15—15 of Figure 14;

Figure 16 is a plan view of the adjusting mechanism for the air beam switch;

Figure 17 is a plan view of the mechanism for forming the No. 2 side fold in the wrapping paper;

Figure 18 is a front view of the folding mechanism shown in Figure 17;

Figure 19 shows the mounting for the folding mechanism shown in Figures 17 and 18;

Figure 20 is a plan view of the mechanism for forming the No. 1 side fold in the wrapping paper;

Figure 21 is a side view of the folding mechanism shown in Figure 20;

Figure 22 is a detail sectional view of the folding mechanism taken on line 22—22 of Figure 20;

Figure 23 is a plan view of the upper ram and associated parts, which ram forces the paper to be wrapped downwardly;

Figure 23*a* is a partial diagrammatic perspective view of the feed table, top cam and delivery ram;

Figure 24 is a partial sectional view of the ram and associated mechanism shown in Figure 23;

Figure 25 is a plan view of the ejecting ram and the sealing table;

Figure 26 is a sectional view of the ejecting ram

and the sealing table, taken on line 26—26 of Figure 25;

Figure 27 is a view of the final flap folding and glue applying mechanism;

Figure 28 is a partial sectional view taken on line 28—28 of Figure 27;

Figure 29 is a partial view showing the position of the switch adjacent the folding mechanism in Figures 27 and 28;

Figure 30 is a vertical sectional view of a portion of the machine showing the drive for the final flap glue wheels;

Figure 31 is a perspective view of one of the tuckers;

Figure 32 is a diagrammatic view showing one of the tuckers moved inwardly;

Figure 33 is a partial view of the No. 2 seal plate;

Figure 34 is a diagrammatic view of the No. 2 seal plate and the pneumatic cylinders associated therewith.

Figure 35 is a diagrammatic view showing the position of the parts of the top ram, the loading or delivery ram, the wrapping paper, the wrapping paper knife and glue belt, the sealing table, the top sealing plates, the side flap folders, the tuckers, and the ejecting ram, as they are positioned at the end of a previous cycle;

Figure 36 shows the position of the parts as the delivery ram begins to move the stacked sheets into their position over the well of the machine;

Figure 37 is a diagrammatic view of the parts shown in Figures 35 and 36 at the time the stack of papers is positioned over the opening or well in the receiving table and just prior to the time that the top ram descends;

Figure 38 shows the next position of the parts wherein the top ram and the sealing table are descending;

Figure 39 shows the next position of the parts with the top ram retracting and the top seal plates moving toward each other;

Figure 40 shows the next position of the parts with the top seal plates positioned to fold and seal the top of the wrapping paper;

Figure 41 shows the next position of the parts with the end tuckers moved inwardly;

Figure 42 shows the following position of the parts with the end tuckers moved outwardly;

Figure 43 shows the next step wherein the top seal plates are moved outwardly and the partially wrapped stack of paper is moved downwardly in position to be ejected and have the end folds completed by the ejecting ram and first and second end flap folders;

Figure 44 shows the ejecting ram moved forwardly and shows the first end flap being folded;

Figure 45 shows the next step when the package has passed through the first end flap folder and glue is being applied to the end flap;

Figure 46 shows the second end folder with the package passing therethrough;

Figure 47 is a perspective view of a flipper plate, solenoid and connecting linkage;

Figure 48 is a diagrammatic plan view of the sealing table ejecting ram and flap folders and receiving table for the partially wrapped package.

Figure 49 is a diagrammatic view of one of the valves for controlling the flow of compressed air to the double acting pneumatic cylinders.

Figure 50 is a diagrammatic view of the type of valve utilized for applying compressed air to one or the other ends of a pneumatic cylinder and for exhausting air from one or the other ends thereof.

Figure 51 is a diagrammatic chart showing the pneumatic connections to various parts of the machine and also showing the sequence of operations and the various switches which are opened and closed during a complete cycle.

Figure 52 is an end view of the No. 1 top seal plate;

Figure 53 is a side view of the No. 1 top seal plate;

Figure 54 is a partial top view of the No. 1 top seal plate; and

Figures 55 and 56 are a complete wiring diagram for controlling the operation of the machine.

Referring specifically to the drawings, numeral 50 designates generally the frame structure for the machine throughout. A horizontal table 51 for receiving the paper or books to be wrapped is best shown in Figures 1 and 23*a*. As best shown in Figures 35 to 43, a well 52 is provided and is positioned directly below an opening 49 in the table 51.

A pneumatic cylinder 54 is supported by a standard 53 on the top of the machine and has a piston 57 therein for moving a piston rod 56 to raise and lower a top ram 55. The ram 55 is positioned directly over the well 52 and the opening 49 in the table 51. A switch 58 is associated with the top ram structure, for a purpose hereinafter described. All the pneumatic cylinders used in the machine are of the double acting type.

A pair of movable plates 59 and 61 are positioned on the table 51. The plates 59 and 61 are simultaneously adjustable toward or away from each other, since the plates are provided with threaded ears 63 and 64 through which threaded portions 66 and 67 of a shaft 65 extend. The threads 66 and 67 are threaded in opposite directions. A wheel 68 is provided on the shaft 65 for rotating the same and when the shaft is rotated, it is obvious that the plates 59 and 61 will move simultaneously toward or away from each other. This provides adjustment for different size paper or books. The plate 59 is provided with a slot 71 therein, as best shown in Figure 24, and a pin 69 extends through the slot to guide and limit the movement of the plates 59 and 61. A switch 62 is provided on the plate 61 for a purpose hereinafter described and has a button 60 extending outwardly from the inside face of the plate 62.

The stack of material to be wrapped is designated by numeral 72 throughout the drawings.

A loading or delivery ram is shown at 73 and is flush with the top of the table 51 so that it will move a stack of material under the ram 55 and over the opening 49 in the table 51. The ram is operated by a pneumatic cylinder 74 having a piston 75 therein which imparts movement to a piston rod 76 secured to the ram head 73. A switch 223 is adapted to be opened and closed by movement of the ram 73 as best shown in Figure 23*a*. The sheet of wrapping paper throughout the drawings is designated by the numeral 82. The paper 82 is projected beneath the opening 49 in the table 51.

Paper cutting and top gluing mechanism

As best shown in Figures 5, 6, 6*a* and 7, the mechanism for cutting the paper to proper size and applying adhesive or glue to the severed edge thereof comprises a support 101 for supporting a pair of pneumatic cylinders 93 and 94 on standards 90. The paper is fed over a table 83 and a space 84 is provided above the table 83 for permitting such feeding. A knife 85 is secured to

a piston rod 112 which is in turn secured to a piston 111 in the cylinders 93 and 94. A knife blow pipe 95 is positioned above the knife to keep the paper flat.

Pulleys 87 are supported and driven by motor 88 and the pulleys drive a continuous belt 86. The belt is adapted to contact a glue-applying wheel 92 which rotates in a glue pot 89. The belt 86 is shaped as shown in Figure 6a and scrappers 90 are provided to remove excess glue from belt 86. An elongated foot member 92 is adapted to be operated by the cylinders 93 and 94 and, when compressed air is supplied to the top of said cylinders, the knife 85 cuts the paper and the foot 92 presses down on the lower run of the belt 86, thus applying glue to the severed edge of the paper. When compressed air is applied to raise the pistons in the cylinders 93 and 94, the knife is raised and the foot 92 is likewise raised so that no adhesive is applied to the paper as it is passing through the opening 84.

As best shown in Figure 7, provision is made for adjusting the position of the severing and gluing mechanism longitudinally of the machine to provide for cutting and gluing strips of wrapping paper of this size. For this purpose a shaft 96 is provided which has gears 97 and 98 thereon which mesh with a ratchet 113 on table 101 to move the entire assembly. A wheel 99 is provided for rotating the shaft 96.

Wrapping paper feed

The roll of wrapping paper is designated by numeral 102, as best shown in Figures 1, 2 and 3. The sheet of wrapping paper 82 is removed from the roll 102 and passes over an idler roll 103. A motor 104 with a suitable gear reducer are provided for driving one of a pair of drive rolls 105, preferably the lower roll. A chain 100 is provided for this purpose. The upper roll is held in spaced relation from the lower roll by a solenoid 108 which, when deenergized permits the upper roll to drop by gravity and engage the paper between the two rolls and feed the same. The solenoid 108 is energized and deenergized at predetermined times during a cycle of operation as described in detail hereinafter. This provides intermittent delivery of the strip of paper 82.

Package forming apparatus

A package supporting table or sealing table is best shown in Figures 25 and 26 and is designated generally by the numeral 110. The sealing table is formed of a generally U-shaped frame member having a split table 114 carried thereby. The table is grooved longitudinally thereof as shown at 115. The sealing table 110 is provided with guide members 116 which slide in channels 117 so that the entire mechanism may be reciprocated vertically. A switch 118 is associated with the sealing table and is adapted to be operated by movement thereof.

Pneumatic cylinders 119 and 121 are secured to the frame of the sealing table to raise and lower it. The cylinder 119 has a piston 123 therein which operates a piston rod 122 to raise and lower the table. The cylinder 121 likewise has a piston therein (not shown).

As best shown in Figures 33 to 43 and 52 to 54, a first or No. 1 seal plate is shown at 124 and is adapted to be reciprocated across the top of the well 52 by means of a pneumatic cylinder 126 which reciprocates a piston rod 125 secured to the seal plate 124. A blow pipe 124a comprising a plurality of apertures in the lower forward corner of the seal plate 124 is supplied with compressed air through a conduit 124b and a bore 124c in the plate 124.

As best shown in Figures 33 and 34, a second or No. 2 top seal plate 127 is provided and is adapted to also be reciprocated partially across the top of the well 52. The seal plate 127 is connected by a resilient strap 129 to a member 131 which member is attached to a piston rod 130 which is reciprocated by a pneumatic cylinder 132. Preferably the seal plate 127 has a resiliently mounted plate 140 thereon, which is provided with heaters (not shown).

A pair of pneumatic cylinders 133, only one of which is shown, force the seal plate 127 downwardly. When the seal plate 127 is in its extended position, compressed air is applied to the pneumatic cylinders to force the seal plate downwardly against the bias of the spring strap 129, as best shown in Figure 34. Since adhesive has been applied to the edge of the wrapper which is pressed downwardly against the other edge of the wrapper, a tight seal is quickly made by the pressure of the seal plate 127 and by the application of heat. It is clear from the drawings in Figures 33 and 34 that the cylinder 133 operates a piston rod 134 which in turn forces a shoe 135 downwardly with respect to the seal plate 127. Also that the seal plate may slide relatively to the shoe 135.

As best shown in Figures 31, 41 and 42, end tuckers 136 and 141 are adapted to be reciprocated across the ends of the partially wrapped package to tuck the ends of the wrapper inwardly. The tuckers 136 and 141 are carried on bars 137 which are adapted to slide in slots formed in the side of the machine. Only one of the bars 137 is shown. The position of the tuckers 136 and 141 may be varied by the provision of the slot 138 in the plate 137. This provides for wrapping stacks of sheets of different sizes. The mechanism for reciprocating the tuckers 136 and 141 is best shown in Figures 1 and 2. Referring first to Figure 2, one of the tucker bars is moved by a pneumatic cylinder 142 which is connected through a bell crank 143 to a shaft 146 which rocks the lever arm 150. The rocking movement of the arm 150 reciprocates connecting lever 144 and reciprocates the bar 137 through a slot 148 in the side of the machine. A second connecting arm 145 reciprocates the tucker on the same side of the package through a slot 147 in the side of the machine.

The tuckers on the other side of the package are reciprocated by a pneumatic cylinder (not shown) which oscillates a shaft 153 which in turn imparts its movement to a lever arm 152. The lever arm 152 reciprocates a connecting lever 149 to operate one tucker and lever arm 151 operates the other tucker by imparting movement to the plate 137 through slot 154 in the side of the machine.

The well 52 is formed by a pair of side folding plates generally indicated by the numerals 191 and 196. These plates are shown in detail in Figures 17 to 22 inclusive.

Referring specifically to Figures 20 to 22 for a description of the side folding plate 191, the mechanism is supported by brackets 190 which are mounted on rods 192. A plate 193 is also supported by the rods 192. The plate 191 is adapted to be reciprocated a short distance by a solenoid 195 which has its armature attached to a rod 194 which is in turn secured to the

plate 191. The spring 196 tends to bias the plate 191 to its extended position, and the solenoid 195 retracts the plate 191 a short distance, as shown in Figure 22. A bushing 193a is disposed in plate 193 and provides a bearing for the rod 194. A stop collar 194a is provided on rod 194 and cooperates with bushing 193a to limit movement of rod 194. The control for the solenoid 195 will be described hereinafter.

The side folding plate 196 is best shown in Figures 17 to 19 inclusive. The plate is connected to a plate 196a and both are supported from the frame of the machine by rods 199 to which is secured a stationary plate 200d. The stationary plate 200d has vertical slots 200a therein and bolts 200b are secured to plate 196a and extend through the slots 200a. The plates 196 and 196a may, therefore, move vertically relative to plate 200d. A leaf spring 198a is secured to the bracket 198 and extends beneath the plate 196a, biasing it upwardly. The plate 196 is, therefore, permitted limited flexible vertical movement whereby, as the package is forced down between folding plates 191 and 196, some give is present to prevent tearing of the wrapping paper.

As best shown in Figures 3, 25, 27 and 48, a package receiving table 155 is positioned below the well 52 and the sealing table 110 is adapted to be lowered so that it will be flush with the receiving table 155.

An ejecting ram 156 is operated by a pneumatic cylinder 157 and reciprocates a piston rod 158 to reciprocate the ram 156. The ram 156 is provided with a guide member 160 which is positioned beneath the sealing table 114 as well as the receiving table 155. The groove 115 in the sealing table 114 communicates with a guide 155a in the receiving table 155. This permits the ejecting ram 156 to travel the full length of the sealing table and receiving table.

As best shown in Figures 3, 46 and 48 final end folding members 161 and 162 are provided on the sides of the receiving table 155 adjacent the end thereof. The final end fold member 161 is adapted to be reciprocated a short distance by a pneumatic cylinder mechanism 163. Also the plates 161 and 162 may be provided with electric heaters (not shown).

The first end flap is folded on the package by means of plates 165 which are best shown in Figures 44 and 45. These plates are likewise shown in Figures 27 to 29 inclusive. A glue wheel 166 is provided on each side of the receiving table 155 for applying adhesive to one of the end flaps as the package passes through the first end folding mechanism, shown at 165. The wheel 166 rotates in a glue pot 168 and applies adhesive as the package passes through the folder 165. A switch, shown at 175 in Figure 29, is adapted to be contacted by the package as it passes through the folder 165, and another switch 167 is adapted to be operated by the ejector 156 when it approaches the end of its outward movement.

The drive for the lower glue wheels 166 is best shown in Figure 30. A motor 169 drives a shaft 171 which is supported by a bracket 172 from the frame of the machine. The shaft is driven through a chain 173 and a second chain 174 in turn drives the glue wheels 166. The drive for only one of the glue wheels 166 has been shown, but it is obvious that both are identical. Horizontal plates 159 are provided near the end of the receiving table 155 so that the package will be held firmly as it passes the final fold plates 161 and 162.

Air beam switch

Referring now to Figures 10 to 16 inclusive for a description of the air beam switch and adjustment therefor, the main body member of the switch is shown at 201 and is supported on a bracket 202 having openings 203 provided therein which constitute bearings for a shaft 204. The main body member 201 is pivoted on the bracket 202 and is formed of relatively light material so that a stream of air is capable of holding it in a raised position against bias of a small spring 206. The spring 206 tends to rotate the body 201 in a clockwise direction as viewed in Figure 10. The bracket 202 includes a body member 205 which has a vertical opening 212 therein. An air supply conduit is shown at 200 and connects with a block 208 having a horizontal air passage 210 and a vertical orifice 211 therein. A contact 207 is provided on the body member 201 and a contact 209 adapted to engage with the contact 207 is supported by the body 205. Electrical energy is supplied to the contacts 207 and 209 by conductors 215 and 214 respectively. A rod 213 supports the entire air beam switch. The air beam switch is positioned beneath the top table 51. A wrapping paper guide and stop is provided and is shown at 81 on the air beam switch. The wrapping paper 82 is shown in dot and dash lines in Figure 10 in a position just prior to the time it cuts off the stream of air from the orifice 211. When this occurs, air no longer passes through the opening 212 and ceases to strike against a cup 215a on the movable body member 201 of the air beam switch. The spring 206 therefore rotates the member 201 in a clockwise direction and closes contacts 207 and 209 until the wrapping paper 82 is removed and ceases to block the stream of air from the orifice 211. Contacts 207 and 209 are also closed when no compressed air is emanating from orifice 211.

The air beam switch must be adjusted for different lengths of wrapping paper and such an adjustment is shown in Figures 14 to 16 inclusive. The adjustment includes a slot 216 in the body of the machine and an adjusting knob 217 for longitudinally moving the supporting rod 213 which obviously moves the entire air beam mechanism. A pointer 218 and a dial 219 are provided for indicating the position of the air beam switch. The switch is retained in position by frictional engagement of a member 220 with the frame of the machine, the member being held in such frictional engagement by a spring 220a.

Control mechanism

A switch 221 is positioned so that it will be contacted by the sealing table 110 in its up position. The switch 223 is positioned so that the loading ram 73 contacts it during its reciprocation. A switch 224 is positioned to be operated by the No. 1 seal plate 124 as it is moved to the extended position. A switch 225 is adapted to be operated by the second seal plate 124 and is operated when the sealing table is jammed upwardly, as will be apparent hereinafter. A switch 227 is adapted to be opened by this jam-up action and is closed when the tuckers are in the starting position. A switch 228 is operated when the sealing table is in the lowermost position. A switch 229 is a check switch for stopping operation of the entire machine in case of emergency.

All of the above switches are shown in Figures 55 and 56, which is a wiring diagram of the electrical control for the machine, as well as in the piping diagram Figure 51, and in the mechanical drawings where practical.

Referring particularly to Figures 4, 55 and 56, it will be noted that the control includes three main double acting relays 231, 232 and 233. Also there is included a plurality of double acting valve relays for directly opening and closing valves in pneumatic lines to the various cylinders and other pneumatically operated parts of the machine. These valve operating relays are shown generally at 234, 235, 236, 237, 238, 239, 240 and 241.

The valves that are operated by the valve relays 234 to 241 are standard pneumatic valves of two slightly different types. One type is shown at 501 in Figure 49 and comprises a forward solenoid 502 and a reverse or return solenoid 503 which solenoids position a valve rod 504 in one of two positions. The valve rod 504 extends through a valve body 506 and is provided with three spools 507, 508 and 509 thereon, the valve body 506 has two inlet passages 510 and 511 for compressed air. It likewise has two outlet passages 512 and 513 for conveying compressed air to one or the other side of the piston of a double acting fluid pressure operated means such as a hydraulic cylinder or jack, as such devices are sometimes referred to. The valve body also has a passage 505 connected adjacent the center thereof which is vented to atmosphere.

When the valve spools are positioned as shown in Figure 49, compressed air flows through inlet passage 511, valve body 506 and through passage 513 to one side of the piston of a hydraulic jack. At the same time, the opposite side of the piston is exhausted to atmosphere through passage 512, valve body 506 and passage 505. The piston is, therefore moved in one direction.

When the valve spools 507, 508 and 509 are moved to the dotted line position in Figure 49 by energization of solenoid 502, it is obvious that the piston of the hydraulic jack is moved in the opposite direction.

The other type of valve is shown at 514 in Figure 50. This type of valve is utilized when it is desired to exhaust one side of the piston of a double acting hydraulic jack at a different time than that at which pressure fluid is supplied to the other side thereof.

It is necessary to have four individual valves to operate one hydraulic jack in this case, but only two have been shown for controlling flow of fluid to and from one side of the piston, since it will be clear that flow to the other side of the piston will be controlled in the same manner.

In this type of valve, forward and reverse solenoids 515 and 516 are utilized. The solenoid 515 has a valve body 517 connected thereto having offset passages 518 and 519 communicating therewith. Solenoid 515 moves a valve rod 521 against the bias of a spring 522, when energized, to move a spool 520 and place the passages 518 and 519 in communication. Passage 518 may be connected to a supply of compressed air and passage 519 to one side of the piston of a hydraulic jack. Therefore, when solenoid 515 is energized, compressed air is supplied to one side of said piston tending to move it. When solenoid 515 is de-energized, spring 522 closes passage 519 with respect to passage 518.

The other solenoid 516 has a valve body 523 connected thereto having offset passages 524 and 525 communicating therewith. Solenoid 516 moves a valve rod 526 against the bias of a spring 527, when energized, to move a spool 528 and place the passages 524 and 525 in communication. Passage 524 may be open to atmosphere and passage 525 is connected to the same side of the piston of the hydraulic jack as passage 519. Therefore, when solenoid 516 is energized, that side of the hydraulic jack is exhausted to atmosphere.

In addition to the above, the control system includes a reset switch mechanism shown generally at 244 which is an auto-manual switch. A main line multi-breaker switch is shown at 243. A number of other switches are shown as follows: 245 is a switch for the top glue motor 88; switch 246 is for the end glue motor 169; switch 247 is for the main wrapping paper drive motor 104; switch 248 is for the various heaters; switch 249 is a reset switch which resets the entire control system to the start of the cycle if the cycle is for some reason interrupted. The reset switch 249 and its connections and the relay 242 do not form any part of our invention; further detailed description thereof (except their connections to the operating parts of the control) is, therefore, unnecessary.

The main relay 231 includes two coils 251 and 252, and as best shown in Figure 4, a standard toggle mechanism 253 holds the movable switch contacts in one or the other of two positions when one or the other of the coils is energized. Likewise, main relay 232 includes two coils 254 and 255 with similar toggle mechanism 256. Main relay 233 includes two coils 257 and 258 with suitable toggle mechanism 259.

Relay 231 includes six sets of fixed contacts 261, 262, 263, 264, 263*a* and 264*a*. The relay likewise includes movable contact plates 265 and 266 which are mechanically attached to each other and are associated with contacts 261 and 262 respectively. Also the relay includes movable switch plates 267 and 268 which are attached to each other and are associated with fixed contacts 263 and 264 respectively. Movable switch plates 267*a* and 268*a* are attached to each other and are associated with fixed contacts 263*a* and 264*a*, respectively.

Relay 232 has similar movable switch plates 274, 275, 276, 277, 276*a* and 277*a*; and fixed contacts 269, 271, 272, 273, 272*a* and 273*a*. Relay 233 also has similar movable switch plates 283, 284, 285, 286, 285*a* and 286*a*; and fixed contacts 278, 279, 281, 282, 282*a* and 283*a*.

Referring now to the valve operating relays, relay 234 has two coils 287 and 288 for controlling forward and reverse movement to the No. 2 seal plate 127 and controls the supply of air to the No. 1 blow pipe 124*a* in No. 1 seal plate 124.

Valve relay 235 has two coils 289 and 291 for controlling the forcing of the sealing table down and for exhausting air from the bottom of the pneumatic cylinders 119 and 121 which operate the sealing table at one point in the cycle.

Valve relay 236 has a coil 292 provided thereon which controls the pneumatic cylinders 119 and 121 to force the sealing table 114 up and a coil 293 which controls exhaust of air from the top of such cylinders at two times in the cycle of operation.

Valve relay 237 has a coil 294 which controls moving the No. 1 seal plate 124 inwardly and controls delivery of air to the air beam switch 201 and to the knife blow pipe 95. It also has a coil 295 which controls retraction of the No. 1 seal plate 124 and controls cutting off the supply

of air to the air beam switch 201 and the knife blow pipe 95.

Valve relay 238 is provided with a coil 296 which controls the pneumatic cylinder 74 for forcing the loading ram 73 forwardly and for forcing the knife and the glue belt foot 92 downwardly. A coil 295 provided on the relay 238 returns the loading ram 74 and raises the knife 85 and glue belt foot 92.

Valve relay 239 has a coil 298 provided thereon which controls the pneumatic cylinder 54 which forces the top ram 55 downwardly. A coil 299 associated with the relay 298 controls the same pneumatic cylinder to raise the top ram 55.

Valve relay 240 is provided with a coil 301 which controls the pneumatic cylinders 142, and 133 and 133a to force the tuckers 136 and 141 inwardly and the No. 2 top seal plate 127 downwardly. Coil 302 associated with the relay 240 controls return of the tuckers 136 and 141 and controls raising of the top seal plate 127.

Valve relay 241 has a coil 303 provided thereon which controls the pneumatic cylinders 157 and 163 to force the discharge or ejector ram 156 forwardly and to operate the end sealing plate 161. A coil 304 provided on relay 234 controls return of the discharge ram 156 and the retraction of the end sealing plate 161.

The reset relay is provided with a coil 305 and with a set of contacts 306 which are normally bridged by a movable switch plate 307. The relay includes fixed contacts 308 which are normally bridged by movable contact plate 309. The relay also includes a plurality of fixed contacts 311 which are normally open and with a plurality of movable contact plates 312 which are adapted to close the contacts 311. All of the movable contact plates are mechanically connected together, and for the description of the present invention, it is only necessary to consider the fixed contacts 306 and 308 which are normally bridged by the movable contact plates 307 and 309, respectively.

The binding posts for the valve relays are shown generally by the numeral 313 and the end seal heaters are shown by the numeral 314.

Operation

When a stack of paper or books to be wrapped is placed on table 51, it is pushed by the operator in front of the loading ram 73 and contacts switch 62 at the side of the table, which switch is normally open. The switches and relays shown in Figures 55 and 56 are all in their normal positions at the start of a cycle with the exception of the main line switch 243 and switches 244 to 248 inclusive, which are manually closed prior to operating the machine.

Reference will also be made throughout the description of the operation to Figures 31 to 46 inclusive, and the diagram, Figure 51, which shows the sequence of the operation. Figure 35 shows the position of the parts at the end of the previous cycle. The paper 82 has been fed across the well to effect closing of contacts 207, 208 of the air beam switch 201. At this time the delivery ram 73 is retracted and ejecting ram 156 is extended. The top ram 55 is up and the sealing table 114 is down. The top sealing plates 124 and 127 and the tuckers 136 and 141 are in their retracted position. The knife 85 and glue belt 86 are raised.

Figure 36 shows the start of a new cycle at the time the stack of paper to be wrapped contacts the switch 62 to close the same.

When the switch 62 is closed, the following circuits are established to raise the sealing table 114. Throughout the description where binding posts have L1 or L2 power, the circuit is described only as far as the binding posts, and it is obvious that L1 and L2 power exists at such binding posts from the main line L1, L2. Furthermore, the binding posts have been given a number and also the symbol L1 or L2, as the case may be.

Referring again to switch 62, a circuit from binding post 316 supplies L2 power to one terminal of the switch through a conductor 315. The circuit to the "sealing table up" valve relay 236 is completed through conductor 317 through closed contacts 261 of main relay 231, through conductor 318 to binding post 319, through conductor 321, through coil 292 of relay 236 and through conductor 322 to binding post 323 where L1 power is present. This energizes the coil 292 which in turn controls the flow of compressed air to the bottom of the cylinders 119 and 121 to raise the sealing table. Air has already been exhausted from the top of the cylinders, as will appear hereafter.

As the sealing table 114 travels upwardly, it contacts switch 113 which starts the loading ram 73 and lowers the knife 81 and glue belt 86 in the following manner: L2 power is supplied from terminal 336 through conductors 330, 331, 332, 334 and 335. The circuit to the loading ram relay 238 is completed when switch 113 is closed through conductor 324, closed contacts 263 of main relay 231, through conductor 325 to binding post 326, through conductor 327, coil 296 of relay 238 and conductor 328 to binding post 329 where L1 power is present. Energization of the coil 296 opens the necessary valves to supply compressed air to one side of the loading ram cylinder 73 and to the knife and glue belt cylinders 93 and 94, causing the loading ram to move forwardly to position a stack of material 72 over the well 52 and causing cut-off of the wrapper and the application of glue to the severed end thereof. The position of the parts at this time are shown in Figure 37. It will be noted that the sealing table 114 has been raised to a point where it is substantially flush with the table 51 and supports the wrapping paper 82 where it passes over the well 52. At this time the wrapping paper extends outwardly from all four sides of the stack 72, but extends further outwardly from two sides of the package, as shown in Figure 37.

When the sealing table reaches the uppermost position, it contacts and closes switch 221 in the top of the end side casting to exhaust air from the bottom of sealing table cylinders 119 and 121. The following circuits are established: L2 power is supplied to one of the terminals of switch 221 from binding post 336, through conductors 331, 332, 334 and 335. The circuit is completed from the other side of switch 221, through conductor 337, one terminal 281 of main relay 233, through conductors 338 and 339 to binding post 341. L2 power is also supplied to binding post 345 through conductor 344 and to binding post 349 through conductor 348. Coil 295 of valve relay 237 is energized through conductor 349 and conductor 342 which connects to L1 power at binding post 343. Coil 293 of valve relay 236 is energized through conductor 346 and conductor 347 which connects to L1 power at binding post 323. Coil 288 of valve relay 234 is energized through conductors 351 and 352, the latter connecting to L1 power at binding post 353.

Energization of coil 293 exhausts air from the bottom of cylinders 119 and 121 for the sealing

table 110, so that the next operation of forcing the sealing table down may be completed. However, energization of coils 288 of valve relay 236 and coil 293 of valve relay 237 has no effect at this time, since these coils have been already energized once before to return their associated valves (not shown).

When the sealing table 114 is in its uppermost position, it also operates switch 228 to send the ejecting ram 156 back, in a manner hereinafter described.

The loading ram 73 in its extended position contacts and closes switch 223 and sends the top ram down (Figure 38) and returns itself to starting position. It also cuts switch 62 out of the circuit until switch 175 is contacted near the end of the cycle, as will be described hereinafter. Switch 62 is cut out of the circuit because coil 252 of main relay 231 is energized by the closing of switch 223. The following circuits are established to accomplish the foregoing results: L2 power is supplied to one terminal of switch 223 from binding post 316, through conductor 354. Another circuit is completed from the other terminal of switch 223 through conductor 355, coil 252 of main relay 231, conductor 360, closed contacts 263*a*, conductors 366, 367, 368 and 369 to terminal 371 where L1 power is present. This energizes coil 252 and opens contacts 261, 263 and 263*a* of relay 231 and closes contacts 262, 264 and 264*a* of relay 231. This cuts switch 62 out of the circuit, since no power may flow through conductor 317. It also positively insures deenergization of coil 252 when contacts 263*a* open and conditions the circuit to positively energize coil 251 at the proper time.

When switch 223 is closed, another circuit is established through conductor 355, conductor 372, binding post 373, conductor 374, through coil 298 of valve relay 239 and through conductor 375 to binding post 376 where L1 power exists. Energization of coil 298 operates a valve to supply compressed air to the cylinder 54 which forces the top ram 55 downwardly. Since air is exhausted from beneath the cylinders which raise the sealing table 114, the sealing table is pushed partially downwardly by the top ram 55 and the parts assume the position shown in Figure 38. At this time the package 72 is forced downwardly between the sidefold plates 191 and 196 or through the well 52, and the first side folds of the wrapping paper are made by folding the extending ends of the paper upwardly as shown in Figure 38. The wrapping paper is also withdrawn from the air beam switch 201 and its contacts 208 and 209 open.

Still another circuit is established by closing the switch 223 to return the loading ram 73 and to raise the knife 85 and glue belt 86. This circuit is established through conductors 355, 372 and 377 through closed contacts 398 of relay 242, conductors 378 and 379 to binding post 381, through conductor 382, coil 297 of valve relay 239 and through conductor 383 to binding post 329 where L1 power is present. This energizes coil 297 and supplies compressed air to the loading ram cylinder 74 and to the knife and glue belt foot cylinders 93 and 94 to reverse their direction of movement which returns the loading ram 73 and raises the knife 85 and glue belt foot 92.

When the top ram descends, it trips switch 53 on the top ram casting and first opens contacts 385 and closes contacts 384 of that switch. This first sends the top ram 55 back which retrips switch 53, thus again closing contacts 385 and opening contacts 384 of that switch. Closing of contacts 384 energizes coil 255 of relay 232 and coil 258 of relay 233. This operation opens contacts 269, 272 and 272*a*, and closes contacts 271, 273 and 273*a* of relay 232. Energization of coil 258 opens contacts 278, 281 and 281*a*, and closes contacts 279, 282 and 282*a* of relay 233. This latter operation starts the top glue motor 88 and sends the top seal plate 124 out over the well 52 which now has the package 72 therein. The position of the parts at this time is shown in Figure 39.

The following circuits are established to accomplish the above results: When contacts 334 of switch 53 are closed, L2 power is supplied to one of the contacts from binding post 336 throuhg conductors 334 and 335. Circuits for energizing coils 255 and 258 are established through conductor 386 through coil 259, conductor 390, through closed contacts 281*a*, conductors 368 and 369 to binding post 371 where L1 power is present. This energizes the coil 258 of main relay 233. Another circuit is established through conductors 386 and 387, through coil 255 of main relay 232, conductor 250, closed contacts 272*a*, through conductors 367, 368 and 369 to binding post 371, thus energizing coil 255.

Another circuit is established through conductor 386, conductor 388, closed contacts 306 of relay 242, through conductors 389 and 391, to binding post 392, through conductor 393, coil 299 of valve relay 239 and conductor 394 to binding post 376, where L1 power is present. This energizes coil 299 which opens a valve to permit compressed air to flow to the top ram cylinder 57 to raise the top ram 55.

The wrapper feed is under control of a timer 40 which periodically makes and breaks a contact 41 to energize and deenergize wrapper solenoid 108. Paper is fed when the solenoid 108 is deenergized. Conductors 403 and 404 supply energy to solenoid 108.

As the top ram is raised, it again closes contacts 395 of switch 53. The circuit is then established and sends out the sealing plate 124 as follows: Through conductor 395, closed contacts 282 of relay 233, through conductor 396 to binding post 397, through conductor 398, coil 294 of valve relay 237, and conductor 399 to binding post 343 where L1 power exists. Energization of the coil 294 opens a valve to supply compressed air to the cylinder 126 to force sealing plate 124 out. It also again supplies compressed air to the air beam swich 201, opening its contacts and to the knife blow pipe 95.

Energization of coils 255 and 258 of the main relays 232 and 233 cause the following operations: Power to the side fold solenoid 195 is cut off and side fold solenoid 195 which is normally energized is deenergized. This is because contacts 278 of main relay 233 open; power therefore is no longer supplied through conductor 447 to solenoid 195; solenoid 195 is always connected to binding post 424 where L1 power exists through a conductor 446. When the solenoid 195 is deenergized, the spring 196 associated with the side fold plate 191 forces the plate against the side of the package to assist in making the first side fold. Thereafter the first stop sealing plate 124 folds the first side fold as shown in Figure 39.

The wrapper motor 104 operates continuously and is energized from line L1 through conductor 401 and from line L2 through conductor 402.

The top glue motor 88 is also energized through a conductor 411 which is connected to L1 power at binding post 410. The other side of the top glue motor is connected to line L2 through conductor 412, closed contacts 281 of main relay 233 and conductors 408 and 419 to binding post 409, where L2 power is present.

When the top sealing plate 124 goes out, it contacts and closes switch 224 on the far side horizontal casting. This sends the sealing plate 127 out and operates the wrapper guide solenoid 422. The following circuits are established to accomplish these functions. Switch 224 has one of its terminals connected to L2 power at binding post 336, through conductors 332, 334 and 335; the other terminal of switch 224 energizes coil 287 of valve relay 234 through conductor 414, binding post 415, conductor 416, binding post 417, conductor 418, coil 287 and conductor 419 to binding post 353 where L1 power is present. Energization of coil 287 supplies compressed air to cylinder 132 to force the No. 2 top seal plate 127 inwardly. The position of the parts at this time is best shown in Figure 40.

Another circuit is established when contacts 282 of main relay 233 and contacts 385 of switch 58 are closed to energize the flipper solenoid 422. The circuit is from line L1, through conductor 421, solenoid 422, conductor 423, closed contacts 282, conductor 395, closed contacts 385 and conductor 335 to line L2 at binding post 336.

A pivoted flipper plate 531 (Figure 47) is thus brought up to flip the wrapping paper as it comes over the well 52.

When the sealing plate 127 goes out, it contacts and closes switch 225 on the casting holding the ream guide plate which energizes coil 292 of relay 236 causing the package to be jammed upwardly, thus putting it under pressure and insuring that all air is removed from between the sheets and that the wrapper is tightly wrapped about the package. At this time while the top sealing plate 127 has been sent outwardly to make the second side fold, it has not been forced downwardly by the cylinder 133 and therefore the wrapping paper may be tightened around the sheets to insure a compact package.

The circuit for jamming the sealing table when switch 225 is closed is as follows: L2 power is applied to one terminal of switch 225 through a conductor 426, closed contacts 282 of main relay 233, through conductor 395, closed contacts 385 of switch 58, and through conductor 335 to binding post 336. The other terminal of switch 225 energizes coil 292 of relay 236 through conductor 320 to binding post 319, through conductor 321, coil 292 and conductor 322, to binding post 323 which has L1 power.

The jamming-up action of the sealing table 114 causes the package 72 to contact and close switch 226 inside the sealing plate 124. Closing of switch 226 energizes coil 301 of valve relay 240 which permits compressed air to flow to the tucker cylinders only one of which is shown, namely, 142, and to the cylinder 133 to force the top seal plate 127 downwardly, as shown in Figure 40, so that the edge of the wrapper, coated with adhesive, is pressed against the other edge of the edge of the wrapper which has been folded over and so that the end tucks will be made. As the tuckers 136 and 141 move in, they open the normally closed contacts of switch 227.

When switch 226 is closed, coil 301 of valve relay 240 is energized by the following circuits: L2 power is supplied to one terminal of switch 226 through a conductor 428 which is connected to binding post 429. A conductor 431 is connected to the other terminal of the switch 226, and connection to line L1 through binding post 432, conductors 433 and 430 through closed contracts 271 of main relay 232, through conductor 434, binding post 435, through conductor 436, coil 301 of valve relay 240 and through conductor 437 to binding post 338 where L1 power is present. Coil 301 is thereby energized and the tuckers 136 and 141 are moved inwardly as shown in Figure 41. Also the top sealing is effected by the seal plate 127 being forced downwardly by its cylinders 133 and 133*a*, as shown in Figure 41.

Opening of the contacts of switch 227 at this time does not affect the circuits. At this time the parts of the machine are in the position shown in Figures 34 and 41. The wrapping paper 82 is being fed by the wrapping motor 104, and when it enters recess 61 in the air beam switch, it breaks the flow of air in the air beam switch, thus permitting closing of contacts 207 and 208 thereof. The closure of contacts 207 and 208 energize coil 254 of main relay 232 which returns the tuckers 136 and 141, permits raising of the top sealing plate 127, and breaks the circuit to the wrapper guide solenoid 422. At the same time, the timer 49 closes contacts 41 to energize the wrapper solenoid 108 and stop the paper feed.

The circuit for energizing the coil 254 of main relay 232 is as follows: Contact 208 is connected to L1 power through conductor 214, binding post 439, conductor 441, through coil 254 of relay 232, through conductor 254*a*, closed contacts 273*a*, through conductors 367, 368 and 369, to binding post 371 where L1 power exists. The other terminal 208 of the air beam switch 201 is connected to line L2 through conductor 215, binding post 432, conductor 431, through the contacts of switch 226 which is still closed, and through conductor 428 to binding post 429 where L2 power is present. When coil 254 is energized, contacts 268, 272 and 272*a* are closed, and contacts 271, 273 and 273*a* are opened. The circuit is therefore broken to the top glue motor 88 and to the wrapper guide solenoid 422.

At the same time the coil 302 of valve relay 240 is energized to return the tuckers 136 and 141 and raise the top seal plate 127. The circuit for energizing coil 302 is as follows: From line L1 through closed contacts of the air beam switch 201, through conductor 215, binding post 432, conductor 433, closed contacts 269 of relay 232, through conductor 443*a*, binding post 443, conductor 444, coil 302 and conductor 445 to binding post 438 where L1 power is present. The parts at this time are in position shown in Figure 42.

When the tuckers 136 and 141 are returned to the starting position, one of the tucker levers contacts and closes switch 227 on the outside of the side casting of the machine. Re-closing of switch 227 now energizes coil 257 of main relay 233 by the following circuits: from binding post 371, where L1 power exists through conductors 369, 368, coil 257, closed contacts 332*a* of main relay 233, conductor 257*a*, conductor 449, through the closed terminals of switch 227, conductor 450, binding post 439, conductor 214, closed contacts 207, 208 of air beam switch 201, conductor 215, to binding post 432, through conductor 431, closed contacts of switch 226 and through conductor 428 to binding post 429 where L2 power is present.

When coil 257 is energized, it recloses contacts 278, 281 and 281a of main relay 233 and opens contacts 279, 282 and 282a thereof. The closing of contacts 278 and 281 of relay 233 results in sending the No. 2 seal plate 127 back because coil 288 of valve relay 234 is energized; also the sealing table 114 is sent down by energization of coil 293 of valve relay 236; in addition the No. 1 seal plate is sent back by energization of coil 295 of valve relay 237 (Figure 43). Furthermore, the circuit to solenoid 195 is broken permitting the spring 196 to force the side folding plate back. The circuits to top glue motor 88 and flipper solenoid 422 are also broken. The circuits for energizing the various relay valves are as follows: From line L2 at binding post 409 through conductor 452, through closed contacts 262 of main relay 231, through closed contacts 281 of main relay 233, through conductors 338, 339, to binding posts 341, 345 and 349. The circuit from the binding post 341 passes through conductor 340, coil 295 and conductor 342, to binding post 343, at which L1 power exists. The circuit from binding post 345 is through conductor 346, coil 293 and conductor 347 to binding post 323, at which L1 power exists. The circuit from binding post 349 is through conductor 351, coil 288 and conductor 352, to binding post 353, at which L1 power exists.

As stated, the energization of coil 295 permits compressed air to flow to cylinder 126 for returning the No. 1 seal plate 124. It also stops the flow of air to the air beam switch 201 thus permitting contacts 207 and 208 to remain closed even though no wrapping paper is present to block the flow of air in the air beam switch to afford closing of contacts 207, 208. Furthermore, air to the knife blow pipe 95 is stopped. Energization of coil 293 permits exhaust of air from the bottom of sealing table cylinders 119 and 121, so that the sealing table 114 may be forced downwardly when air is supplied to the top of said cylinders. Energization of coil 288 permits the flow of compressed air to cylinder 132 for returning the No. 2 sealing plate 127. It also stops the flow of air to the blow pipe 85a. This is the time referred to above when it was stated that coils 288 and 295 had already been energized after coils 287 and 294, respectively, have been energized.

In order to force the sealing table 114 downwardly, the coil 291 of valve relay 235 is also energized at this time. The circuit is from binding post 467 where L1 power exists, through conductor 479, coil 291, conductor 478, binding post 477, conductor 476, conductor 449, through closed contacts of switch 227, through conductor 450, binding post 439, conductor 214, closed contacts 207, 208 of air beam switch 201, conductor 215, binding post 432, conductor 431, closed contacts of switch 226 and through conductor 428 to binding post 429 where L2 power is present.

When the contacts 278 of main relay 233 close, current is again supplied through the circuit hereinbefore described to the solenoid 195, for retracting side fold plate 191.

When the sealing table starts up and before coil 252 of main relay 231 closes contacts 262, contacts 228a of the switch 228 were opened and contacts 228b were closed. One contact 228b is connected to a contact of switch 167 by conductor 472. As long as switch 167 is open, and it is normally open, coil 304 which returns the ejecting ram 156 cannot be energized through conductor 452.

When the sealing table 114 reaches its lowest limit of travel, contacts 228a are closed. The ejecting ram is forced outwardly, the end seal cylinder is operated to open the end sealer and air is exhausted from the top of the sealing table cylinders 119 and 121.

When contacts 228a close, the following circuits are established: One of the contacts 228a is connected to L2 power through conductors 452, 330, 331, 332, 334 and 335 to binding post 336. The other contact 228a energizes coil 303 of valve relay 241 through conductors 453, closed contacts 264 of main relay 231, conductor 454, closed contacts of the auto-manual switch 244, conductor 455, binding post 456, conductor 457, binding post 458, conductor 459, through coil 303, through conductor 461 to binding post 462 where L1 power is present. Energization of coil 303 sends the discharge ram 156 out and opens the end sealer clamp 161. See Figures 44 and 45.

Another circuit is established from conductor 453 through a conductor 463, binding post 464, conductor 465, through coil 289, of valve relay 235 and conductor 466 to binding post 467 where L1 power is present. Energization of coil 289 exhausts air from the top of the sealing table cylinders 119 and 121 so that they are prepared for the next cycle of operation.

The package contacting switch 175 in the center of the folding chute bottom plate is contacted very quickly after contacts 228a are closed by a package being forced forwardly by the ejecting ram 156. Closure of switch 167 energizes coil 251 of main relay 231 to again close contacts 261 and 263 and to therefore again place the first switch 62 in the circuit. It also cuts contacts 228a out of the circuit until such contacts are opened by sealing table 114 rising.

The circuit for energizing coil 251 is as follows: One side of switch 175 is connected to L2 power through conductor 468 to binding post 336. The other terminal of the switch 175 is connected to L1 power through conductor 469, coil 251, through conductor 251a, closed contacts 264a of relay 231, through conductors 366, 367, 368 and 369 to binding post 371, where L1 power exists. Placing switch 62 again in the circuit prepares the machine for the next cycle of operation when a stack of paper is forced against switch 62 to close the same.

As the discharge ram contacts switch 167 at the end of the fold chute, it returns the discharge ram and closes the end sealer clamp 161. However, the sealing table 114 must have been raised by the operator closing switch 62 by forcing another article to be wrapped thereagainst to close contacts 228b and open contacts 228a before the discharge ram may return and the end sealer clamp 161 close. This prevents any possibility of the discharge ram 156 striking the sealing table 114. This is accomplished by connecting switch 167 to coil 304 of valve relay 241 through contacts 228b of switch 228. The following circuits are established when the contacts of switch 167 are closed and contacts 228b are closed. One terminal of switch 167 is connected to line L2, through conductors 471, 468 to binding post 336. The other contact of switch 167 is connected to one of the contacts 228b through a conductor 472. The other contact 228b is connected to the coil 304 and line L1 through conductor 470, binding post 473, conductor 474, through coil 304 and conductor 475, to binding post 464 where L1 power is present. Energization of coil 304 opens the

necessary valve to supply compressed air to the discharge ram cylinder 157 and the end seal cylinder 163 to return the discharge ram 156 and to open the end sealer clamp 161.

When the sealing table 114 again is raised and contacts a switch 118, it starts the loading ram 156 and operates the wrapper cut-off knife 85 and glue belt foot 92.

The end seal heaters 314 are connected across the line through conductors 310.

The top glue motor 86 runs continuously and is connected to line L1 at binding post 410 through a conductor 411. The motor 88 is connected to line L2 through conductor 412, conductor 494, binding post 495, conductor 496, through closed switch 245 and through conductor 493 to binding post 499.

The check switch has normally closed contacts 229*a* and normally open contacts 229*b*. Closure of the normally open contacts 229*b* by manual operation energizes coils 251, 254 and 257 of the main relays and immediately returns such relays to their starting position. This stops operation of the cycle regardless of the point in the cycle that the contacts 229*b* are closed. It does not, however, stop operation of the continuously running motors 88 and 104. Such a check switch is standard insofar as its operation is concerned, and no further description is believed to be necessary.

Likewise the reset switch 249 and reset relay 242 are standard apparatus, and it will be apparent that when the normally closed contacts of the reset switch 249 are opened and the normally opened contacts closed the entire mechanism will return to its starting position. The check switch 229 stops the cycle of the machine wherever it may be, and reset switch 249 returns all relays and valves to their starting position.

Figure 51 is a flow diagram of the operations of the machine showing the pneumatic connections to the various cylinders or hydraulic jacks. The sequence of operations may be followed by starting with the closure of No. 1 switch 62 which is shown at the top center of the diagram. Switch 62 is closed by the material of the package to be wrapped.

The next operation is that No. 2 switch 118 is closed by the sealing table being forced upwardly. Compressed air is supplied to the hydraulic cylinder 119 through a conduit 532 and is controlled by valve relay 292 of the type shown in Figure 50. Exhaust of compressed air from the lower part of the cylinder 119 is controlled by valve relay 293 of the type shown in Figure 50 and the air passes through a conduit 533.

The next switch which is closed is the No. 3 switch shown at 223. This switch is operated by the loading ram 73. Compressed air for loading ram is controlled by valve relays 296 and 297 of the type shown in Figure 49 and the compressed air passes through conduits 534 and 535.

Compressed air for operating the knife and glue foot cylinders 93 and 94 is also controlled by valve relays 296 and 297 of the type shown in Figure 49 and flows through conduits 536 and 537.

Next the No. 4 switch 221 is closed by the seal table 114.

Next the No. 5 switch shown at 58 is closed by the top ram 55 which is operated by cylinder 54. Compressed air for the top ram is under control of valve relays 298 and 299 of the type shown in Figure 49 and is supplied to opposite sides of the cylinder through conduits 538 and 539.

Next the No. 6 switch shown at 224 is closed by the No. 1 top seal plate 124. Compressed air for reciprocating the top seal plate 124 is supplied through conduits 540 and 541 and is under the control of valve relays 294 and 295 of the type shown in Figure 49.

The No. 7 switch shown at 225 is closed next in the sequence by reciprocation of the No. 2 seal plate 127. The seal plate 127 is operated by the hydraulic cylinder 132 and compressed air is supplied thereto through conduits 543 and 544. The compressed air is under the control of valve relays 287 and 288 of the type shown in Figure 49. The valve relay 287 also controls the supply of air to the blow pipe in the top seal plate 124 through a conduit 124*b*.

The No. 8 switch shown at 226 is closed as explained hereinbefore by jamming-up action of the seal table 114. The switch is in the bottom of the No. 1 seal plate 124, hence the dotted line in Figure 51 between the seal plate 124 and switch 226.

The No. 9 switch 227 is closed by the tuckers 136 in their starting position and the air beam switch 201 is also closed about this time by the wrapping paper breaking the air beam. Compressed air for operating the tuckers 136 is controlled by valve relays 301 and 302 and is supplied to tucker cylinder 142 by conduits 549 and 550. The relays 301 and 302 are of the type shown in Figure 49 and also control the supply of compressed air to No. 2 seal plate 134 vertical cylinder 133 through conduits 545 and 546 to force seal plate 134 down.

Compressed air for the air beam switch 201 is controlled by valve relay 294 of the type shown in Figure 49 and is supplied through the conduit 200. Compressed air for the knife blow pipe 95 is also controlled by valve relay 294 and is supplied through conduits 200 and 542.

Switch No. 11 shown at 223 is next operated by sealing table 114 and compressed air and exhaust from the top of sealing table cylinder 119 is controlled by valve relays 289 and 291 of the type shown in Figure 50. Conduits 551 and 552 control the air supply and exhaust to the top of cylinder 119.

Next switch No. 12, shown at 175 is closed by action of the ejecting ram 156. Compressed air for the ejecting ram cylinder 157 is controlled by valve relays 303 and 304 of the type shown in Figure 49 through conduits 553 and 554. Valve relays 303 and 304 also control the supply of compressed air to end seal plate 161 cylinder 163 through conduits 553, 556 and 554, 555.

Next switch No. 13, shown at 167 is closed by action of the ejecting ram 156 to condition the machine for the next cycle and to place No. 1 switch 62 again in the circuit.

In Figure 51 numeral 557 designates diagrammatically a source of compressed air, such as an air compressor and numeral 558 designates a vent to atmosphere.

Some changes may be made in the construction and arrangement of the parts of our device without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claims any modified forms of structure or use of mechanical equivalents which may be reasonably included within their scope.

We claim as our invention:

1. In a wrapping machine, a structure having opposed walls to confine the sides of a product to be wrapped, a seal table mounted for vertical reciprocation between said walls, a delivery table to deliver the product over one of said walls to a

position between the walls, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a top ram mounted for advance and retreat relative to said seal table, first and second top seal plates mounted for horizontal reciprocation above said opposed walls, two pairs of side tuckers for tucking certain of the projecting ends of the wrapper, an ejecting ram for the product and wrapper, an end flap folder chute including end folder plates to fold the remaining projecting ends of the wrapper, said first top seal plate being provided with apertures therein, means for supplying compressed air to said first top seal plate which is adapted to escape through said apertures and be directed against said wrapper, said compressed air being supplied to said first top seal plate during the time said second top seal plate is moved forwardly.

2. In a wrapping machine, a structure having opposed walls to confine the sides of a product to be wrapped, a seal table mounted for vertical reciprocation between said walls, a delivery table to deliver the product over one of said walls to a position between the walls, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a top ram mounted for advance and retreat relative to said seal table, first and second top seal plates mounted for horizontal reciprocation above said opposed walls, two pairs of side tuckers for tucking certain of the projecting ends of the wrapper, an ejecting ram for the product and wrapper, an end flap folder chute including end folder plates to fold the remaining projecting ends of the wrapper, said first top seal plate being provided with apertures therein, and means for supplying compressed air to said first top seal plate which is adapted to escape through said apertures and be directed against said wrapper.

3. In a wrapping machine, a structure having opposed walls to confine the sides of a product to be wrapped, a seal table mounted for vertical reciprocation between said walls, a delivery table to deliver the product over one of said walls to a position between the walls, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a top ram mounted for advance and retreat relative to said seal table, first and second top seal plates mounted for horizontal reciprocation above said opposed walls, two pairs of side tuckers for tucking certain of the projecting ends of the wrapper, pneumatic means for operating said tuckers, an ejecting ram for the product and wrapper, an end flap folder chute including end folder plates to fold the remaining projecting ends of the wrapper, means for applying adhesive to the severed edge of said wrapper, means for pressing one of the top folds of the wrapper downwardly to seal the same comprising a leaf spring mounting for one of said top seal plates, additional pneumatic means for bending said leaf spring and thereby effecting such downward movement of said one top seal plate, and means to supply compressed air to said pneumatic means and to said additional pneumatic means for causing simultaneous operation thereof.

4. In a wrapping machine, a structure having opposed walls to confine the sides of a product to be wrapped, a seal table mounted for vertical reciprocation between said walls, a delivery table to deliver the product over one of said walls to a position between the walls, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a top ram mounted for advance and retreat relative to said seal table, first and second top seal plates mounted for horizontal reciprocation above said opposed walls, two pairs of side tuckers for tucking certain of the projecting ends of the wrapper, an ejecting ram for the product and wrapper, pneumatic operating means therefor, an end flap folder chute including end folder plates to fold the remaining projecting ends of the wrapper, means provided to apply adhesive to the end flaps of the partially wrapped package, means for movably mounting one of the end folder plates in the folding chute for movement toward the product being wrapped, pneumatic operating means for so moving said end folder plate, and means for simultaneously supplying compressed air to said first pneumatic operating means to cause retraction of said ejecting ram and to said second pneumatic operating means to move said one of said end folder plates toward and into contact with the product being wrapped, and simultaneously to said first pneumatic operating means to cause an ejecting operation by said ejecting ram and to said second pneumatic operating means to move said one of said end folder plates out of contact with and away from the product being wrapped.

5. In a wrapping machine, a structure having opposed walls to confine the sides of a product to be wrapped, a seal table mounted for vertical reciprocation between said walls, a delivery table to deliver the product over one of said walls to a position between the walls, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a top ram mounted for advance and retreat relative to said seal table, first and second top seal plates mounted for horizontal reciprocation above said opposed walls, two pairs of side tuckers for tucking certain of the projecting ends of the wrapper, an ejecting ram for the product and wrapper, operating means therefor, an end flap folder chute including end folder plates to fold the remaining projecting ends of the wrapper, means provided to apply adhesive to the end flaps of the partially wrapped package, means for movably mounting one of the end folder plates in the folding chute for movement toward the product being wrapped, operating means therefor, and control means for supplying actuating fluid simultaneously to both of said operating means to retract the one and advance the other or vice versa.

6. In a wrapper severing mechanism, a struc-

ture having opposed walls, a delivery table, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a wrapper flipper plate disposed adjacent one side of one of said opposed walls, means for pivotally mounting said flipper plate, electromagnetic means for swinging said flipper plate upwardly to prevent said wrapper from sagging between said opposed walls, a circuit for said electromagnet, and means to energize said circuit as a wrapper starts across said opposed walls.

7. In a wrapper severing mechanism, a structure having opposed walls and a delivery table, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, a wrapper flipper plate disposed adjacent one side of one of said opposed walls, means for pivotally mounting said flipper plate, and means for swinging said flipper plate upwardly to prevent said wrapper from sagging between said opposed walls, comprising a solenoid and linkage, and means for energizing said solenoid when the wrapper starts across said opposed walls.

8. In a wrapper severing mechanism, a structure having opposed walls, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, one of said opposed walls being mounted to afford movement thereof toward and away from the other opposed wall while a partially wrapped product is between them, a spring for biasing said movably mounted wall toward said other wall to compact the product and wrapper, and a solenoid and linkage connected to said movable wall to pull it away from said other wall against the bias of said spring when said solenoid is energized for permitting free movement of the product and wrapper between and relative to said walls by said top ram and/or said seal table.

9. In a wrapper severing mechanism, a structure having opposed walls, a delivery table, means for directing a wrapper across said opposed walls and positioning it with its opposed ends projecting beyond the walls and with one end under said delivery table, a knife for periodically severing said wrapper when it is directed across said opposed walls, means for reciprocating said knife, one of said opposed walls being mounted to afford movement thereof toward and away from the other opposed wall while a partially wrapped product is between them, a spring for biasing said movably mounted wall toward said other wall to compact the product and wrapper, and a solenoid and linkage connected to said movable wall to pull it away from said other wall against the bias of said spring when said solenoid is energized for permitting free movement of the product and wrapper between and relative to said walls by said top ram and/or said seal table, said solenoid being deenergized a predetermined part of a cycle of operation of said wrapper severing mechanism.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
528,657	Dexter	Nov. 6, 1894
561,772	Dexter	June 9, 1896
810,005	Tierney	Jan. 16, 1906
860,176	Wing	July 16, 1907
1,336,838	Heeter	Apr. 13, 1920
1,341,134	Leumann	May 25, 1920
1,851,457	Smith	Mar. 29, 1932
1,970,352	Wohlrobe	Aug. 14, 1934
2,011,505	Smith	Aug. 13, 1935
2,059,368	Kruttschnitt	Nov. 3, 1936
2,066,449	Barrett	Jan. 5, 1937
2,113,239	Petskeyes	Apr. 5, 1938
2,146,997	Smith	Feb. 14, 1939
2,162,230	Salfisberg	June 13, 1939
2,192,793	Lawson	Mar. 5, 1940
2,196,666	Moore	Apr. 9, 1940
2,229,487	Stevens	Aug. 11, 1942
2,318,355	Bailey	May 4, 1943
2,346,194	Sjostrom	Apr. 11, 1944
2,458,612	Luzzatto et al.	Jan. 11, 1949