

April 2, 1963

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3,083,512

METHOD AND APPARATUS FOR CLOSING AND TYING BAG TOPS

Filed June 27, 1960

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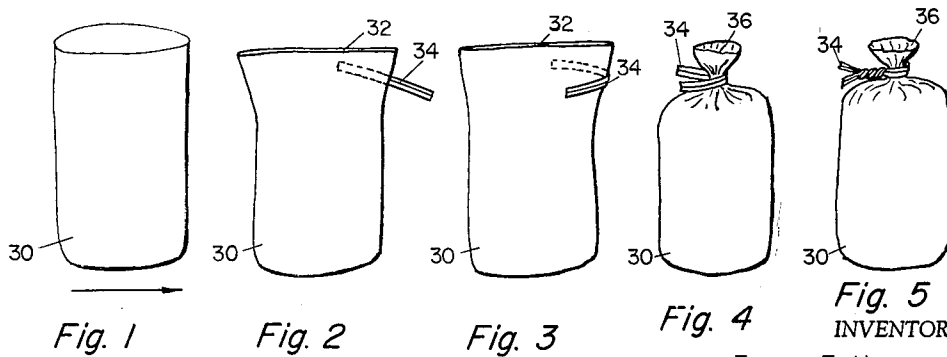
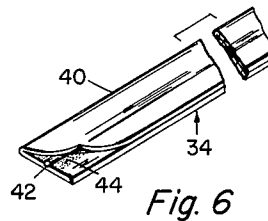
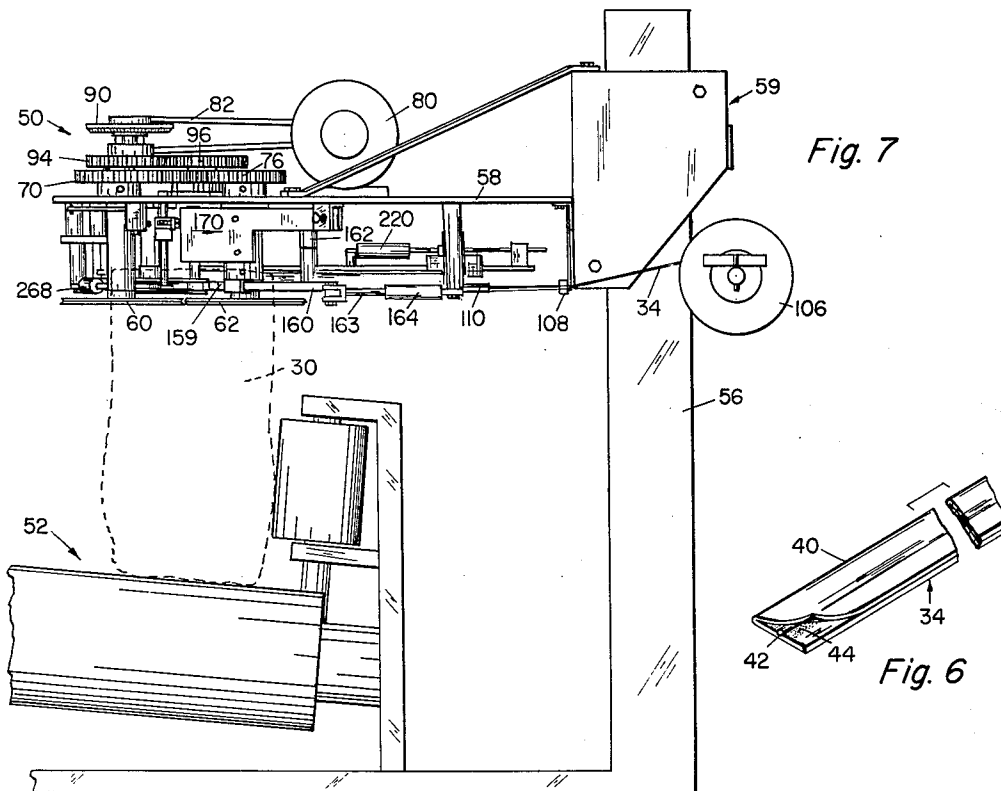


Fig. 4 INVENTOR.

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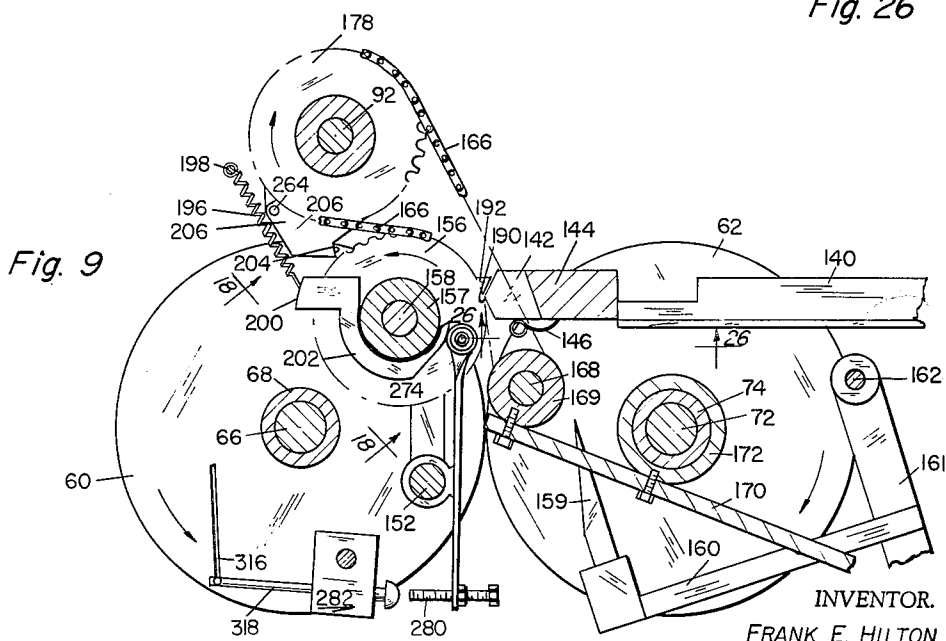
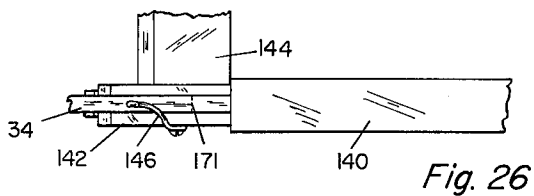
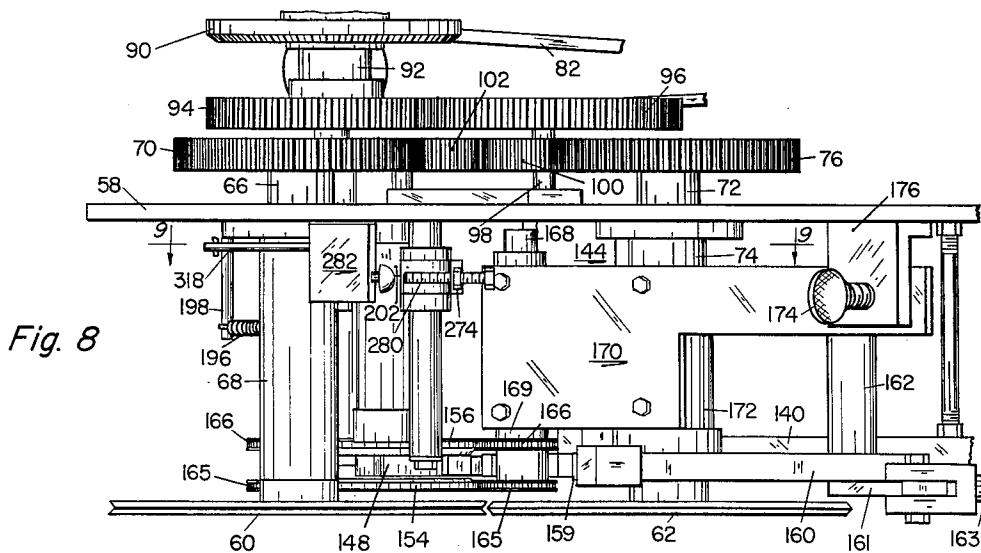
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METHOD AND APPARATUS FOR CLOSING AND TYING BAG TOPS

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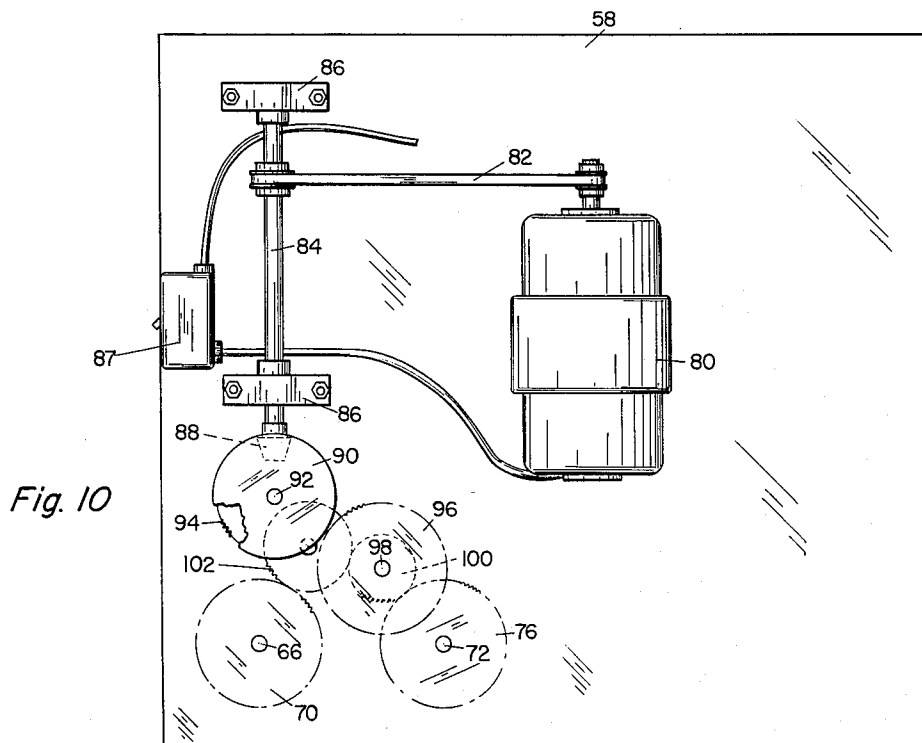


Fig. 10

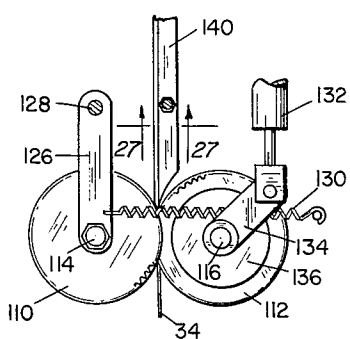


Fig. 12

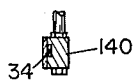


Fig. 27

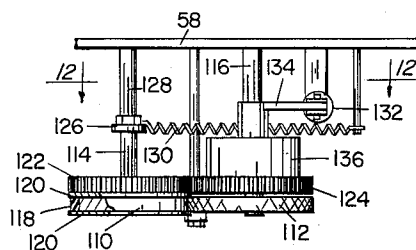


Fig. 11

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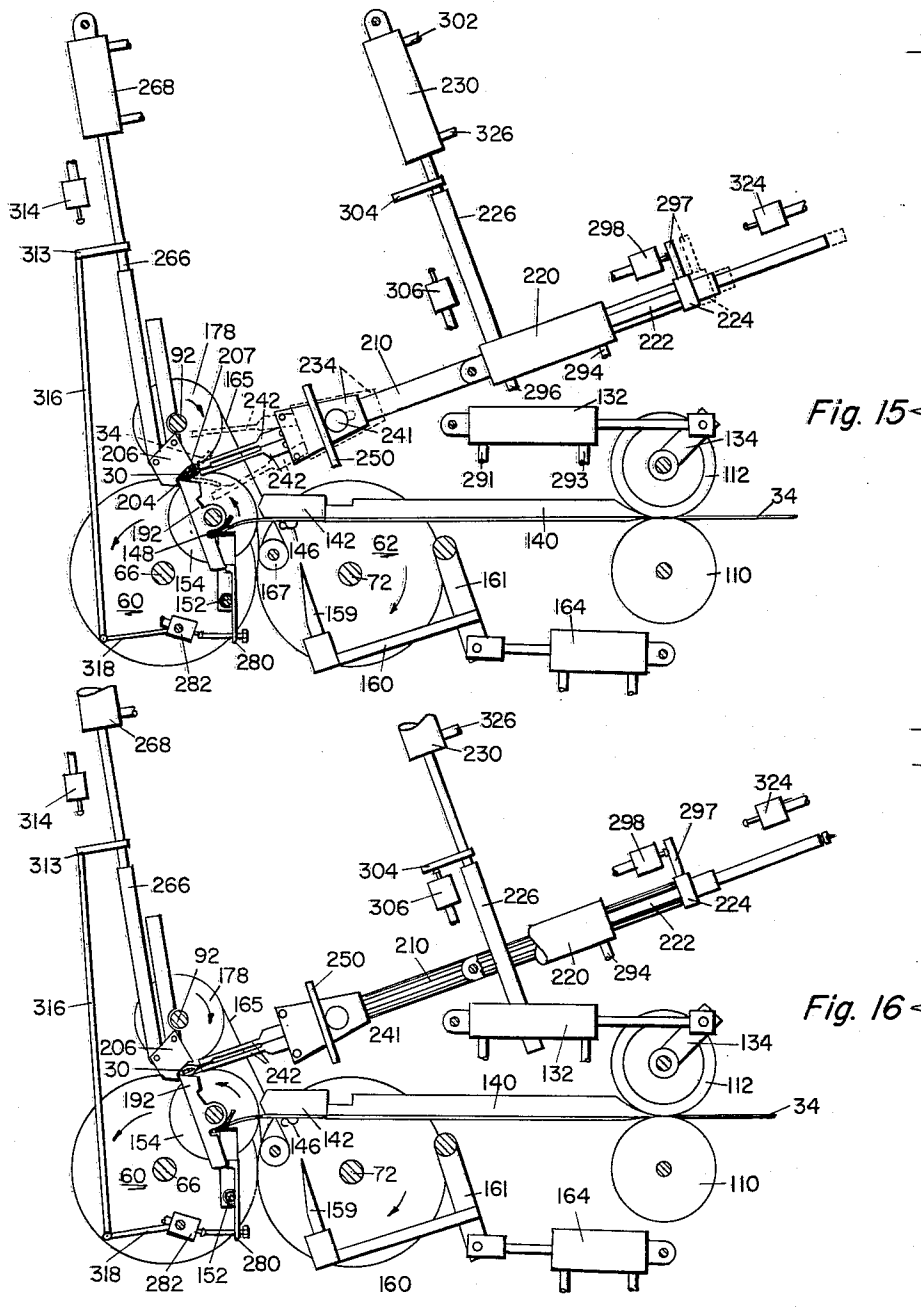
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METHOD AND APPARATUS FOR CLOSING AND TYING BAG TOPS

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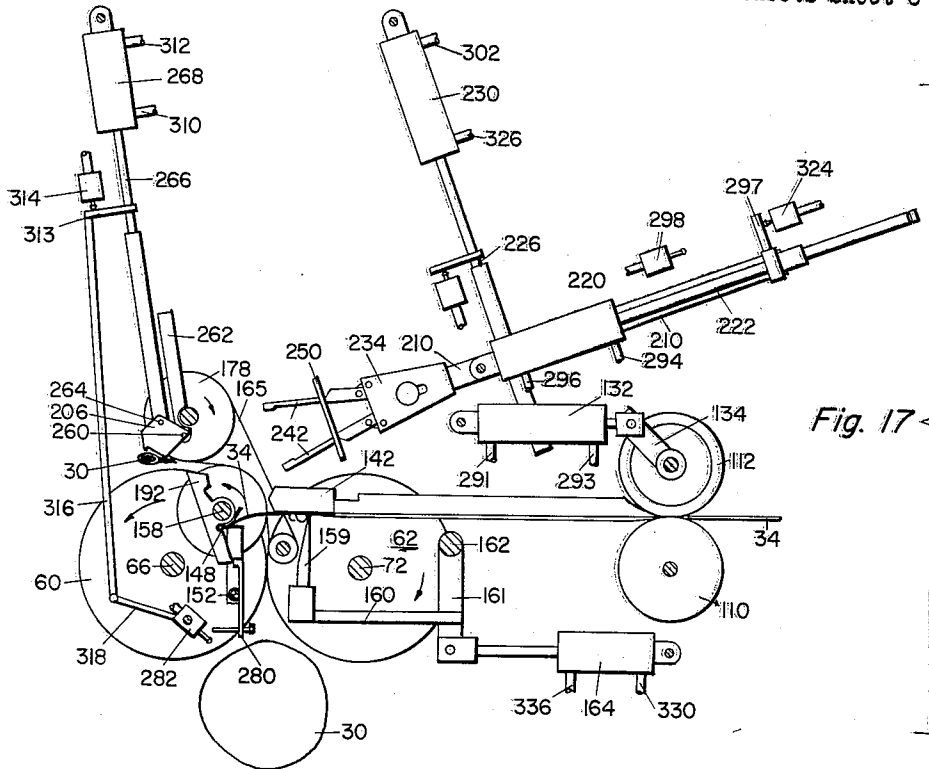
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METHOD AND APPARATUS FOR CLOSING AND TYING BAG TOPS

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Fig. 19

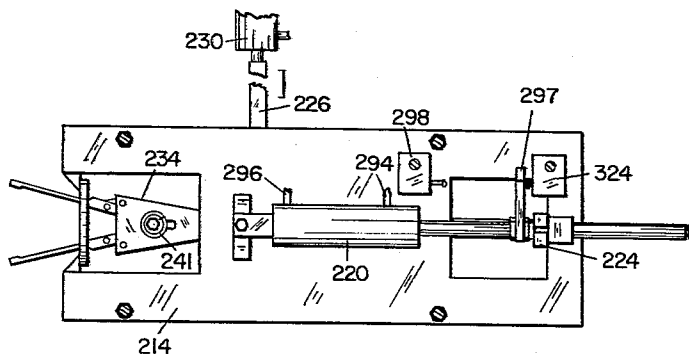


Fig. 20

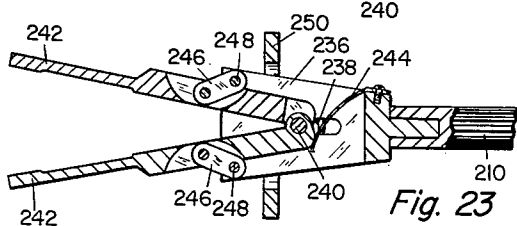
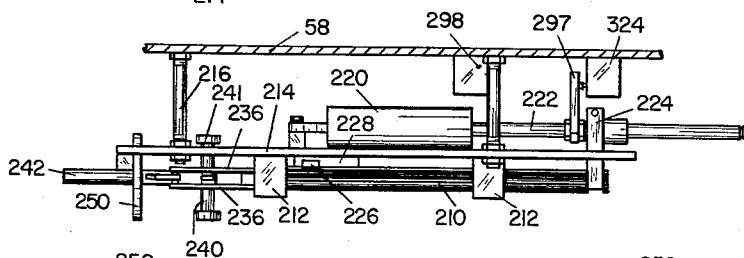


Fig. 23

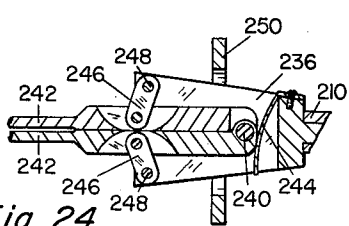


Fig. 24

Fig. 21

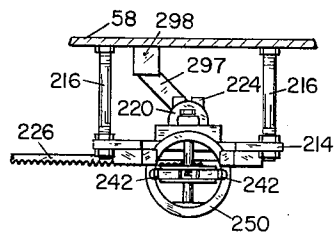
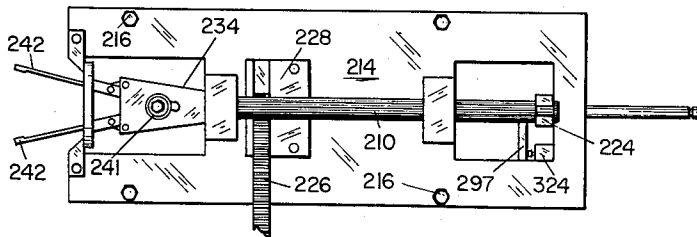


Fig. 22

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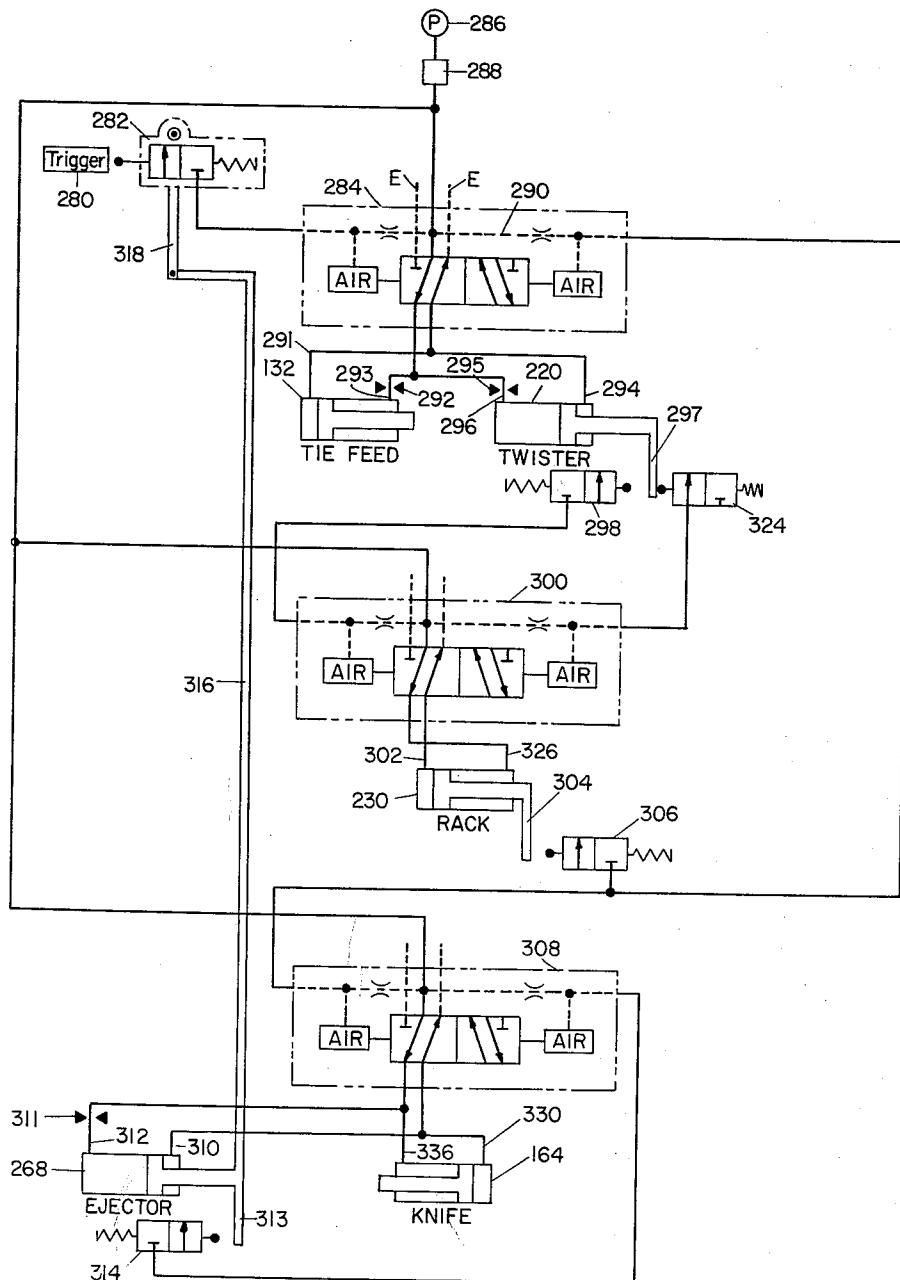


Fig. 25

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METHOD AND APPARATUS FOR CLOSING AND TYING BAG TOPS

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Filed June 27, 1960, Ser. No. 38,987

14 Claims. (Cl. 53-134)

The present invention relates to methods and apparatus for gathering together compliant sheet material and more particularly to methods and apparatus for positioning and twisting ties about the tops of open mouth bags and like articles.

It is the general object of the present invention to provide a machine of relatively simple, sturdy design for automatically positioning and tightening ties about the upper ends of filled, open mouth bags at a relatively high rate of speed.

More specifically, it is an object of the invention to provide a machine having means for gathering the top portion of an open mouth bag and positioning and twisting a tie member thereabout so as to maintain the bag closed.

A further object of the invention is to provide a machine for automatically closing the top of a bag by gathering the same together and securing said top with a tie member comprising a malleable wire positioned between opposite strips of paper, plastic or like sheet material.

A still further object is to provide new and improved means for gathering together the top of a bag to enable closure of the same.

Another object of the invention is to provide a new and improved method for attaching a tie member to the top of a bag.

Still other objects and advantages of the invention will become apparent hereinafter.

In accordance with the illustrated embodiment of the invention, an open mouth bag is fed along a predetermined path into means which compress the opposite sides of the bag and feed the bag lengthwise of the compressed top against a tie member extending at right angles to the path of the bag. The tie member is partially folded about the sides of the bag and its motion is arrested while the bag is fed lengthwise of the compressed top into the bight of the tie. Thereafter, the tie ends are brought together to wrap the same about the top and finally twisted together to secure the tie member about the bag top.

For a more detailed description of the invention, reference is made to the accompanying drawings and description thereof.

In the drawings:

FIG. 1 is a view in perspective illustrating an open mouth bag which has been previously filled with merchandise and to which the tie member is to be secured in accordance with the method of the invention;

FIGS. 2, 3 and 4 are diagrammatic views showing different successive steps of the method of attachment of the tie to the bag shown in FIG. 1;

FIG. 5 is a view of the bag with the tie attached thereto;

FIG. 6 is an enlarged fragmentary perspective view of a tie member adapted for use in the present invention, one end of the device being shown open more clearly to illustrate details thereof;

FIG. 7 is an elevation of a machine made in accordance with the present invention;

FIG. 8 is an enlarged, elevational view of a portion of the machine shown in FIG. 7, certain parts being omitted;

FIG. 9 is a fragmentary sectional view taken generally

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along line 9-9 of FIG. 8 showing certain details of the apparatus;

FIG. 10 is a fragmentary top view of the apparatus showing the power means and drive assembly therefor;

FIG. 11 is a fragmentary view of the tie feeding apparatus;

FIG. 12 is a view of the tie feeding apparatus looking in the direction of the arrows 12-12 of FIG. 11;

FIG. 13 is a somewhat diagrammatic top plan view of a portion of the apparatus of the invention showing its condition in the initial stages of operation thereof;

FIG. 14 is a view similar to FIG. 13 showing a further step in operation of the machine;

FIG. 15 is still another view of the machine showing it in the condition where the bag has been gathered and the tie ends brought together to wrap the tie about the bag;

FIG. 16 is a view showing the condition of the machine after the tie ends have been twisted together to secure it in position about the bag;

FIG. 17 is a diagrammatic view showing the condition of the machine after the bag has been discharged from the same;

FIG. 18 is a fragmentary elevational view of the machine taken generally along line 18-18 of FIG. 9;

FIG. 19 is a top plan view of the twisting mechanism utilized in the apparatus of the invention;

FIG. 20 is a side elevation of the twisting mechanism;

FIG. 21 is a bottom plan view of the twisting mechanism;

FIG. 22 is an end elevation of the twisting mechanism;

FIG. 23 is an enlarged, fragmentary view of the head of the twisting mechanism showing it in one condition of operation thereof;

FIG. 24 is a further enlarged, sectional view of the twister head showing it in another condition of operation;

FIG. 25 is a schematic view of the pneumatic circuit for effecting operation of the machine of the invention; and

FIG. 26 is an enlarged, fragmentary elevation of a portion of the machine taken generally along the lines 26-26 of FIG. 9; and

FIG. 27 is a fragmentary, sectional view of the tie guide taken along lines 27-27 of FIG. 12.

Referring now to the drawings, the present invention is primarily concerned with closing and positioning of ties about the upper ends of bags of paper, polyethylene and similar materials, and which have been previously filled with produce, toys, or other merchandise. The method of the present invention and which is carried out by the machine herein described is illustrated in part by the diagrammatic views of FIGS. 1 to 5, inclusive and is further illustrated in FIGS. 13 to 17, inclusive. As shown in those views, open mouth bags 30 are fed along a predetermined path in the direction indicated. Pressure is applied at right angles to the direction of movement of the bag to the opposite sides of the bag at the top thereof so as to press such sides together as indicated at 32 in FIG. 2. A measured length of a tie 34 previously severed from a supply roll is fed in a direction at right angles to the path of the bag and the bag is fed lengthwise of its compressed top against the tie. As this occurs the tie is partially doubled about the top of the bag as shown in FIG. 3. Thereafter, the feeding of the bag against the tie 34 is continued while the tie is held relatively stationary so as to cause the top of the bag to gather in the bight of the tie as shown at 36 in FIG. 4. Finally, the ends of the tie 34 are brought together and twisted so as to secure the tie about the top of the bag as shown in FIG. 5.

While any suitable form of tying device may be used in carrying out the method of the present invention, a

preferred type of tie is that shown in Patent 2,732,001, P. R. Halstead. Referring to FIG. 6, such a tie 34 comprises a malleable wire 42 positioned between opposite strips of paper 40 or like sheet material. Such a tie may comprise a strip of paper folded on its longitudinal center line about a wire 42 extending lengthwise thereof. The opposite folds of the paper are secured together by a suitable adhesive indicated at 44 so as to secure the wire therebetween.

Referring now more particularly to FIG. 7, the bag tying apparatus or machine of the invention is indicated generally at 50 and is shown mounted over a conveyor 52 upon which bags to be filled such as indicated by dotted lines at 30 may be carried one by one to the bag tying apparatus. As will become apparent, the bag tying apparatus need not be associated with a conveyor, but, if desired, bags to be tied may be fed thereto by hand or by other suitable apparatus not a part of this invention.

The bag tying machine may be supported on a suitable standard 56 and comprises a horizontally extending base plate 58 supported on the stand 56 by any suitable mounting bracket assembly indicated at 59. Means are provided in the machine to engage the top portion of a bag 30 carried to the machine on the conveyor 52 or otherwise presented to the machine and initiate movement of the bag through the machine along a predetermined course or path and which means comprises a pair of collecting wheels 60, 62 mounted in opposed relation for rotation about vertical axes. As best shown in FIG. 8, the wheel 60 is provided with a grooved periphery and the wheel 62 has a cooperative V-shaped periphery, the wheels being spaced apart just sufficiently to permit the bag 30 to pass therebetween but to pressurably engage the sides of the bag so as to support the same. The reversed bend of the wheel peripheries tends to hold the bag 30 in position between the wheels so that it will not slip out. As will be apparent, the wheels 60, 62 also provide means for applying pressure to the opposite sides of a bag adjacent the top thereof to press the same together in a direction at right angles to the direction of movement of the bag.

Means are provided for driving the wheels 60, 62. Referring more particularly to FIGS. 8, 9 and 10, the wheel 60 is secured to a shaft 66 suitably journaled in a shaft mounting sleeve 68 bolted or otherwise secured to the plate 58. The shaft 66 extends above the plate 58 and to its upper end is secured a gear 70. The wheel 62 is secured to a shaft 72 which likewise is journaled within a shaft support sleeve 74 supported from the plate 58. The shaft 72 extends above the plate 58 and to its upper end is secured a gear 76. The power means for the machine comprises an electric motor 80 connected by a belt 82 to a jack shaft 84 journaled in brackets 86 upon the plate 58. A switch 87 is provided for the motor. A bevel gear 88 mounted on the end of the jack shaft 84 drives a cooperative gear 90 mounted upon a vertical shaft 92 upon which is mounted a gear 94 which meshes with a gear 96 mounted on a stub shaft 98. The stub shaft 98 carries a driving gear 100 which meshes directly with the gear 76 and also meshes with a gear 102 which drives the gear 70. The gear train just described drives other portions of the apparatus as will presently appear.

Means are provided for feeding a length of tie 34 at right angles to the path of the bag 30 and in front of the bag top as it emerges from between the collector wheels 60, 62. A supply roll 106 of the tie material may be mounted in any convenient spot on the machine such as on the post 56. From the roll 106, the tie material is led through a guide 108 and thence between a pair of feed rolls 110, 112 mounted upon shafts 114, 116, respectively, as shown in FIGS. 11 and 12. The wheel 110 is provided with a layer of rubber 118 or similar material around its periphery and preferably is provided with opposite side plates 120 which extend beyond the periphery of the layer 118 and between which the wheel 112 fits

so that the tie material is securely held in place between the wheels. The surface of the wheel 112 may be knurled or otherwise provided with a gripping surface. The shaft 114 has fixed thereto a gear 122 which meshes with a gear 124 fixed to the shaft 116. The shaft 114 is supported upon one end of an arm 126 which is swingably mounted upon a shaft 128 extending downwardly from the plate 58. The spring 130 or other resilient means is provided to urge the wheel 110 against the wheel 112. The shaft 116 is suitably journaled in the plate 58.

Means are provided for driving the wheels 110, 112 to feed a predetermined length of strap. With reference to FIGS. 12 and 13, such means may comprise an air cylinder 132 having a piston connected to an arm 134 of an overrunning clutch 136 which may be of any conventional type arranged so that upon rotation of the arm 134 in a clockwise direction, the gear 124, will be correspondingly driven in the same direction to cause the wheels to feed a length of strap and when the arm 134 is rotated in a counterclockwise direction the wheels 112, 110 will remain stationary. Since such clutches are well known to the art, the details thereof are not shown herein. From the wheels 110, 112, the strap is led through a guide channel 140 suitably supported from the frame plate 58 and thence across an anvil block 142, which is rigidly supported from the frame 58 by a massive support arm 144, and under a tie holding spring 146 (see FIG. 9). Referring to FIG. 13, the end of a tie member is fed from the anvil block 142 across the path of the bag 30 to a clip 148 mounted on a support arm 150 supported from the frame plate by a shaft 152. Cooperatively arranged with the anvil 142 is a knife 159 mounted on an arm 160 rigidly connected to an arm 161 pivotally supported on a shaft 162 depending from the plate 58. The arm 161 is connected to the piston rod 163 of an air cylinder 164 so that by operation of the cylinder, the arms 161, 160 are swung to cause the knife 159 to strike the anvil 142, the knife being positioned so as to sever a tie along the line 171 indicated by dotted lines in FIG. 26. Means hereinafter to be described are provided for operating the cylinder 164.

Means are provided for grasping the top of a bag as it emerges from between the wheels 60, 62 so as to carry the bag against a tie member 34 positioned in its path and force the tie into a pocket means which causes the tie partially to fold about the bag. With reference to FIGS. 8, 9 and 13, such bag grasping means comprises a pair of vertically spaced wheels or stub toothed sprockets 154, 156 mounted upon a shaft 158 which is suitably journaled in a supporting sleeve 157. The sprocket 154 is positioned below the elevation of the tie member 34 when it is held in the clips 146, 148 and the sprocket 156 above the elevation of the tie member. The sprockets 154, 156 are substantially tangent to the plane of the nip of the wheels 60, 62 and are, therefore, also substantially tangent to the path of the bag 30 as it emerges from between the wheels 60, 62, as will be apparent. Mounted in cooperative relationship with the sprocket wheels 154, 156 are a pair of flexible elements or chains 165, 166, respectively. The chains 165, 166 are trained about idler sprockets 167 mounted upon a shaft 168 journaled in a shaft support sleeve 169 secured to one end of a plate 170. The plate 170 is attached to a sleeve 172 which is pivotally mounted upon the shaft support 74. Bearing against the opposite end of the plate 170 is an adjustment screw 174 threaded through a bracket 176. This permits adjustment of the position of the shaft 168 to retain the desired tension on the chains 165, 166. The chains 165, 166 are also trained about a pair of sprockets 178 fixed to the shaft 92. The chains 165, 166 are arranged to engage the sprockets 154, 156 through about a quarter of the circumference of the latter.

With reference to FIGS. 9, 13 and 14, as a bag emerges from between the wheels 60, 62, it will be engaged in the

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nip between the sprockets 154, 156 and the corresponding chains 165, 166 so as to be carried therebetween. It will be understood that a bag is fed to the machine so that the top edge thereof is positioned slightly above the elevation of the uppermost chain 166. As the tie 34 and bag 30 are advanced between the wheels 154, 156 and opposed chains, they are carried into a first pocket means which causes the tie partially to be folded about the approaching edge of the bag and which pocket means will now be described.

The pocket means is defined in part by the anvil 142 which is formed with a beveled end surface 190. Mounted in opposed relation to the surface 190 is a tie holder member 192 which is pivotally supported upon the shaft 158 between the sprockets 154, 156. The member 192 is provided with a beveled end surface 194 which defines with the anvil surface 190 a V-shaped pocket as most clearly shown in FIG. 13. The member 192 is biased against the anvil block 142 by means of a spring 196 connected between a bracket 198 depending from the plate 58 and a riser element 200 which extends upwardly from the end of the tie member opposite the surface 194 as best shown in FIG. 18. The riser element 200 supports a cam 202, the function of which will be described hereinafter.

As shown in the drawings and particularly FIGS. 13 to 17, inclusive, the end of the member 192 defining the surface 194 extends beyond the periphery of the sprockets 154, 156 and, accordingly, the member 192 will presumably press the tie member 34 against the surface of the bag 30 as it is carried around the sprockets thus to hold the tie in place. As the bag moves around the sprockets, the member 192 will swing with the bag until it hits the projecting finger 204 of the head 206 of an ejector assembly and which head forms a stop to arrest movement of the member 192. It will be observed that the chains 165, 166 hold the bag 30 against the sprockets 154, 156 as the latter rotates so that the bag is directed into a new path substantially at right angles to its path between the collecting wheels 60, 62. The head 206 and tie holder member 192 define a second pocket means into which the tie member 34 is initially pressed as indicated by dotted lines in FIG. 15. The head 206 is positioned so that the pocket thus defined is just beyond the point of divergence of the chains 165, 166 and sprockets 154, 156 so as to receive the bag top which is moving in a narrow, elongated condition between the sprockets and the chains and cause it to be gathered between the opposite sides of the tie 34. Preferably, the head 206 is formed with a toe 207 on its inner edge which bends the tie end engaging the same inwardly for reasons apparent hereinafter.

When the bag has been gathered or compressed into the pocket defined by the head 206 and member 192, a tie twisting means operates to bring the ends of the tie together so as to wrap the same around the gathered bag top and thereafter twist the ends of the tie together and which means will now be described with particular reference to FIGS. 19 to 24. The tie twister comprises an elongate pinion shaft 210 which is supported by bushings 212 beneath a subframe or plate 214 which in turn is suspended from the frame plate 58 by supporting rods 216. The bushings 212 support the shaft 210 for longitudinal and rotational movement. To effect longitudinal movement of the shaft 210, means are provided such as an air cylinder 220 having a piston connected to a rod 222 which is in turn connected to a yoke 224 attached to the shaft 210. Means for effecting operation of the cylinder 220 will be described hereinafter.

Means for rotating the shaft 210 comprises a rack 226 mounted to slide in a guide 228 on the underside of the frame 214 as shown in FIG. 20 and adapted to be reciprocated by an air cylinder 230 to the piston rod of which the rack is connected. Again, the means to operate the cylinder 230 will be described hereinafter.

Mounted on what shall be termed the forward end of

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the pinion shaft 210 is a twister head 234 which comprises a pair of spaced apart plates 236 extending parallel to the axis of the shaft 210. Each of the plates 236 is provided with an elongate slot 238 through which extends a pressure shaft 240 which is slidable longitudinally of the slots. Mounted on the ends of the shaft 240 are rollers 241. Disposed between the plates 236 is a pair of generally forwardly extending, tie pinching fingers 242 which as shown in FIGS. 23 and 24 are pivotally mounted at one end thereof on the pressure shaft 240 for movement toward and away from each other. A spring 244 is provided to urge the fingers and pressure shaft 240 to a forward position relative to the head 234 and in which position the shaft 240 engages the forward ends of the slots 238. Pivotally connected at one end, one to each of the fingers, is a pair of links 246 which are pivotally connected at their opposite ends by pins 248 to the plates 236, the latter connection being rearward of the connection of the links to the fingers. The axes of the connections of the links 246 are parallel to the axis of the pressure shaft 240. Mounted on the frame plate 214 forwardly of the plates 236 is a ring element 250 which is coaxial with the pinion shaft 210. The ring 250 is positioned to be engaged by the pressure shaft rollers 241 upon movement of the pinion shaft 210 toward its forward position. As best indicated in FIGS. 15 and 16, the ring 250 is positioned so that it will be engaged by the pressure shaft rollers when the fingers 242 have been moved to a position straddling the ends of the tie held in the second pocket means as shown in dotted lines in FIG. 15. Upon further forward movement of the pinion shaft 210, the plates 236 will be thrust relatively forwardly with respect to the fingers 242 inasmuch as the movement of the latter will be arrested by the ring. Such forward movement of the plates 236 will cause the links 246 to force the fingers 242 together so as to pinch the ends of the tie 34 between the ends of the fingers as shown in FIG. 15, the action of the links in this respect being illustrated in FIGS. 23 and 24. The inward bending of the tie end by the toe 207 is to make certain that such end will be between the fingers 242. When the fingers 242 have been brought together so as to bend or wrap the tie 34 about the gathered bag top, the motor 230 is actuated to move the rack 226 longitudinally and which will thus cause the pinion 210 and twister head to rotate causing the tie member to be twisted so as to secure the same about the top of the bag. Preferably the ends of the tie 34 are twisted through at least about one and one-half turns to assure the tie is securely attached to the bag.

It will be observed that the pocket defined by the holder 192 and head 206 faces substantially at right angles to the plane between the collector wheels 60, 62. The pocket is actually at an angle of about 110° with respect to such plane and the axis of the twister is coaxial with the axis of the pocket. The purpose of this arrangement is to position the tie ends so that they are readily accessible to the twister. Thus, as the bag proceeds through the machine, the top thereof is gathered, the tie is doubled thereabout, and the bag and tie are rotated about 90° from the initial path of the bag so as to present the ends of the tie to the twister.

Means are provided to eject the bag from the machine after the tie is twisted about the top. As soon as the tie 34 has been twisted and tightened about the bag top, the head 206 is moved to an out-of-the-way position to permit the bag 30 to be removed from the machine. The head 206 is pivotally mounted about a pin 260 on a bracket 262 suitably suspended from the frame plate 58. The head 206 is also pivotally connected by a pin 264 to the piston rod 266 of an air cylinder 268. When the rack 226 hits the end of its tie twisting stroke, the cylinder 268 is actuated by means to be described to retract the piston rod 266 causing the head 206 to rotate as shown in FIG. 17. As the head 206 rotates, the bag top is propelled by the

chains 165, 166 toward the side of the machine so that it may pass around the sprockets 178 as the bag is carried along by the conveyor 52. The tie ends between the fingers 242 will simply slip from between the fingers since little pressure is applied to the tie ends by the fingers. As soon as the bag 30 is moved past the member 192, the spring 196 will return the member 192 to its original position in engagement with the anvil block 142. Thereafter, the cylinder 268 is operated to return the head 206 to its original position (see FIG. 13). Finally, the cylinder 220 is operated by means to be described to move the twister assembly to its rearward position. As soon as such rearward movement begins, the fingers separate by reason of the urging of the spring 244 which causes the finger ends to cam outwardly and apart.

The pneumatic circuit for operating the various air cylinders of the machine and the sequence of operation of the machine will now be described with particular reference to FIGS. 13 to 17, inclusive, and FIG. 25 which is a schematic drawing of the pneumatic circuit in which the valves and motors are shown utilizing J.I.C. symbols for pneumatic equipment.

FIG. 13 shows the condition of the machine at the start of a cycle. In this condition, a tie member 34 has been severed from a length of tie and is held by the holders 148, 146 across the path of the bag 30 advancing through the machine. As indicated in FIG. 13, as the bag is grasped by the rollers 60, 62, the opposite sides of the bag are pressed together and the top is in fact somewhat elongated and the bag is then fed lengthwise of the top into the nip between the sprockets 154, 156 and chains 160, 162. The bag is then carried by such sprockets and chains against the tie member 34 and presses the center portion of the tie member into the pocket defined by the member 192 and block 142, thus causing the tie to double and partially to fold about the leading edge of the bag (see FIG. 14). As described previously, the bag 30 is carried around the periphery of the sprockets 154, 156 and such movement of the bag causes the member 192 to be rotated about its axis until it hits the head 206, tie member being carried with the bag into the pocket defined by the member 192 and head 206 as shown in FIG. 15. As the member 192 rotates, cam 202 also rotates causing the cam follower 274 to swing clockwise about the pin 152 (see FIG. 9). The end of the cam follower 274 constitutes a trigger 280 which is caused to strike the actuator pin of a normally closed bleeder valve 282 when the member 192 hits the head 206. The valve 282 is connected to one end of the cylinder of a two position, four-way button bleeder operated air valve 284. Such valves comprise a spool mounted within a cylinder having straight-through and cross-over passages therein for alternate alignment with the exit and entrance ports provided in the cylinder wall. Internal restricted passages indicated by dotted lines 290 connect the source of air to the opposite ends of the valve cylinder so that upon exhausting air from and dropping the pressure at one end of the cylinder, the spool is shifted by reason of the greater pressure in the opposite end toward the bled end to align the particular set of passages with the ports in the cylinder wall. An example of such a valve is Modern Air brand valve, Model BV 4 2020.

The valve 284 is connected to a suitable source of air indicated by pump 286 and a surge tank 288. Air exhausts from the valve to atmosphere through either port E. Thus, upon operation of the valve 282 to open the same, air is exhausted from the left end of the cylinder of the valve 284 and the spool thereof shifts to the left causing the cross-over section of the spool to align with the ports thereof whereupon air pressure from the source is admitted through the port 291 of the air cylinder 132 causing the same to operate to feed a length of tie into the tie holders 146 and 148. A restriction 292 is positioned in the line from the other port 293 of the cylinder 132 so as to slow the stroke of the piston thereof

and thus slightly delay the advance of a tie across the bag path to make sure that the bag 30 which is being gathered is clear of the path of the tie. At the same time, air is admitted through the port 294 of the twister assembly cylinder 220 to cause the twister assembly to advance toward the tie and bag in the pocket defined by the member 192 and head 206. To give sufficient time for the bag to be completely gathered before the twister fingers engage the tie ends, a restriction 295 is placed in the line leading from the opposite port 296 of the valve. As the fingers 242 of the twister close upon the end of the tie and the pinion 210 reaches its forward position, a lever 297 mounted upon the piston shaft of the motor 220 strikes a normally closed pilot bleeder valve 298 as shown in FIG. 15 to cause the same to bleed air from the left end of a four-way, two position valve 300. This causes the spool of the valve 300 to shift to the left causing air to pass from the pump 286 into the rack cylinder 230 through the port 302 thereof. Admission of air through the port 302 causes the rack 226 to be pushed forwardly rotating the pinion shaft 210 and the twister assembly to cause the tie to be twisted about the top of a bag. As the rack reaches its forward position, an actuator pin 304 carried thereon strikes the operating button of a normally closed bleeder valve 306 which is connected to the right end of the valve 284 and left end of a four way, two position valve 308. This has the dual effect of bleeding air from the right end of the valve 284 and from the left end of the valve 308 causing the spool of the latter to shift left so as to admit air from the pump 286 to the ejector air cylinder 268 through port 310 thereof. This causes the cylinder 268 to operate to swing the head 206 as shown in FIG. 17 releasing and ejecting the tied bag from the pocket. A restriction 311 is provided in the line leading from the opposite port 312 of the cylinder 268 to show the action of the same and permit the bag completely to clear the pocket and head 206 before the head is returned to its original position. When the head 206 is fully retracted, a lever 313 carried on the piston rod of the cylinder strikes the operating button of a normally closed bleeder valve 314 to open the same. The lever 313 is also connected through links 316, 318 to the valve 282 in such manner as to move it to an out-of-the-way position from the trigger 280, as shown in FIG. 17, immediately as the piston of the motor 268 begins to move so that the valve 282 may close. This causes the spool of the valve 284 immediately to shift back to the right to its original position as shown in FIG. 25 and in which position air is fed to the cylinder 220 of the twister motor through the port 296 thereof causing the twister assembly immediately to be retracted and which, of course, will cause the fingers 242 to be opened. At the same time the twister returns, air is admitted through the port 293 of the tie feed motor cylinder 132 to cause the tie feed to return to its original position. When the twister is back to its original position as shown in FIG. 17, the lever 297 strikes the actuating button of a bleeder valve 324 to open the valve and bleed air from the right end of the valve cylinder 300. The bleeder valve 298 will, of course, have closed previously so that the spool of the valve 300 shifts left to its original position shown in FIG. 25 causing air to pass into the rack cylinder 230 through port 326 thereof whereupon the rack will be withdrawn to its original position. As the rack motor 230 returns to its original position, the valve 306 will, of course, automatically close.

Returning again to the operation of the valve 308, upon shifting of the spool thereof from its initial position, air will be passed into the knife cylinder 164 through port 330 thereof causing the knife 159 to be advanced against the anvil block 142 whereupon it will sever a length of tie 34 from the end of the length of tie material laying across the anvil block. As mentioned previously, when the ejector head 206 reaches its fully open posi-

tion, the valve 314 is opened by the lever 313. This causes air to bleed from the right end of the valve cylinder 308 whereupon the valve spool returns to its position as shown in FIG. 25 and air is admitted to the port 336 of the knife cylinder 164 to withdraw the knife to the position shown in FIG. 13. Air is also admitted through the port 312 of the ejector cylinder 268 to cause the head 206 to return to its original position and reposition the valve 282 so that it can be engaged by the trigger 280. The restriction 311 will, of course, slow down the return movement of the head 206 which again is advantageous in permitting full removal of the tied bag. At this point the machine has returned to its position as shown in FIG. 13 and is ready to receive a new bag for processing.

While the machine has been described with particular reference to placing ties about the tops of bags, it will be apparent that it may be adapted to gathering and bundling pliant sheet material in other organizations.

Having illustrated and described a preferred embodiment of the invention, it should be apparent to those skilled in the art that the invention permits of modification in arrangement and detail. I claim as my invention all such modifications as come within the true spirit and scope of the appended claims.

I claim:

1. Apparatus for twisting a tie about the top of an open mouth bag comprising means for feeding a bag along a predetermined path, means for positioning a tie transversely of said path, means for gathering the top portion of said bag and pressing the same against said tie so as partially to fold said tie about said top portion, and a tie-twister for engaging the ends of said tie and twisting the same together about the bag top.

2. Apparatus for positioning and securing a tie comprising a length of malleable wire disposed between opposite flat strips of paper or the like about the top of an open bag comprising means for feeding a bag along a predetermined path, means for feeding across said path a length of said tie with the plane of said tie extending normal to said bag path, means for gathering the top portion of said bag and pressing the same against said length of tie so as partially to fold said tie about said gathered bag top portion, and means for twisting the doubled ends of said tie together.

3. In a machine for twisting a tie about a bag, bag feeding means for initiating movement of said bag through said machine along a predetermined line, a twister mounted adjacent the path of said bag for engaging the ends of a tie extending in a direction transverse to said line, means for positioning a length of tie in the path of said bag so as to be engaged by the top portion of said bag, means for gathering the top of said bag and feeding the same against said tie so as partially to fold said tie thereabout, means for completing the doubling of said tie about said bag and presenting the same with said tie ends extending transverse to said line so as to present said tie ends to said twister, and means to operate said twister to engage the ends of said doubled tie and twist the same.

4. A machine for wrapping a tie about the top of a bag comprising means for advancing a bag along a predetermined path, means in said path defining a pocket, means for positioning a tie transversely of said path forwardly of said pocket, means for gathering the top portion of said bag and pressing said bag and tie into said pocket so as partially to fold the tie about the bag, a tie twister, and means for actuating said twister to engage the ends of said tie and twist the same together.

5. In a machine for placing a tie about the top of a bag, means for carrying a bag along a predetermined path, means for positioning a substantially straight tie across the path of travel of said bag, means to engage the opposite sides of said bag adjacent the top thereof and press the same together to narrow the width of said top in the direction at right angles to the direction of travel of said

bag, means to feed said narrowed top lengthwise against said tie so as to gather said bag top thereagainst and fold said tie about said top, means to engage the ends of said tie and bring them together to wrap said tie about said bag, and means to twist said tie ends about one another to secure said tie in place.

6. A machine for wrapping a tie about the top of an open bag comprising means for advancing a bag along a predetermined path, means in said path defining a pocket, means for positioning a substantially straight tie transversely of said path forwardly of said pocket, means to engage the opposite sides of said bag adjacent the top thereof to press the same together in the direction at right angles to said path, means for pressing said bag and said tie into said pocket so as to gather said bag in said pocket and partially fold the tie about the bag, a tie-twister, and means for actuating said twister to engage the ends of said tie and twist the same together to secure said tie about the top of said bag.

7. In a machine for twisting a tie about a bag, means for advancing a bag along a predetermined path, a twister mounted adjacent said path for engaging the ends of a tie extending substantially at right angles to said path, means for positioning a length of tie so as to be engaged by the top portion of a bag as it is advanced in said path, means for gathering the top of said bag and doubling said tie thereabout, means for turning said bag and tie to present the ends of the latter to said twister, and means to operate said twister to engage the ends of said doubled tie and twist the same.

8. In a machine for twisting a tie about a bag, means for advancing a bag along a predetermined path, a twister mounted adjacent said advancing means movable in a path transverse to the direction of said first mentioned path between operative and inoperative positions, means for feeding a tie at right angles to said bag path, means for gathering the top of said bag and doubling said tie thereabout, means for turning said bag and tie to present the ends of the latter to said twister, and means to move said twister into said operative position and to engage said tie ends and twist the same.

9. In a bag tying machine, collecting means to receive a vertical, open top bag and press the top of a pair of the opposite sides of said bag together and advance said bag lengthwise of said sides, means for feeding a tie at right angles to the path of said bag and in front of said bag top as it emerges from said collecting means, means for partially folding said tie about the approaching bag, wheel means positioned to engage a side surface of said bag as it emerges from said collecting means, means for driving said wheel means, means to hold said bag against said wheel means as the same rotates so that said bag is directed into a new path substantially at right angles to said path through said collector means, means to hold said tie against said bag as the same rotates with said wheel means, means in said new path and adjacent said wheel means operative to define a pocket for receiving and holding the mid portion of said tie whereby the top portion of a bag is fed and compressed by said wheel means into said pocket and against said tie, a tie twister adjacent said pocket for engaging the ends of said tie and twisting the same together, and means to actuate said tie twister.

10. In a bag tying machine, a pair of opposed collector wheels to engage a bag adjacent the top thereof and compress the opposite sides of said bag together as it passes between said wheels, wheel means tangential to the plane between said collector wheels and positioned to engage a side surface of said bag emerging from said first wheels, pressing means mounted in cooperative relation with said wheel means to press said bag thereagainst through about a quarter turn of said wheel means so that said bag is directed into a new path substantially at right angles to said plane, means for driving said collector wheels and said wheel means, means in said new path adjacent said

wheel means operative to define a V-shaped pocket, means forwardly of said pocket for feeding a tie into the path of said bag whereby the top portion of said bag is compressed into said pocket and against said tie, a tie twister adjacent said pocket for engaging the ends of said tie to bring the same together so that said tie surrounds said bag top portion together, and means for actuating said tie twister.

11. In a bag tying machine, collecting means to receive a vertical open top bag and compress a pair of opposite sides of said bag together and advance said bag lengthwise of said sides, means for feeding a tie at right angles to the path of said bag and in front of said bag top as it emerges from said collecting means, means defining a pocket for receiving said tie and partially folding the same about the approaching bag, said means including a fixed member and a cooperating tie holder member mounted for pivotal movement about a vertical axis, a pair of coaxial, vertically spaced wheels positioned to engage a side surface of said bag as it enters said pocket, said second pair of wheels being positioned one above and one below said pocket means, a pair of endless flexible elements mounted in cooperative relation one with each of said second pair of wheels to press said bag thereagainst, the engagement of said flexible elements with said wheels extending substantially from the point of tangency of said second wheels with said plane through an arc of about 90°, said tie holder member being pivotal about said axis and being slightly longer than the diameter of said wheels whereby it will pressurably engage said tie against the surface of said bag as the latter is carried between said wheels and flexible elements through the arc of engagement thereof, stop means adjacent the end of said arc to engage said tie holder member and cooperatively therewith to define a V-shaped second pocket for receiving the mid portion of said tie, said second pocket being just beyond the point of divergence of said flexible elements and said second wheels whereby the top portion of a bag is fed and compressed into said pocket and against said tie, a tie twister comprising a pair of fingers, means to cause said fingers to engage the ends of said tie while the same is in said second pocket and bring the same together so that said tie surrounds said bag top portion, and means thereafter to rotate said fingers to twist said tie ends together.

12. In a bag tying machine, a pair of opposed collector wheels mounted for rotation about vertical axes to engage a bag adjacent the top thereof and compress the opposite sides of said bag together as it passes between said wheels, means for driving said collector wheels, means for feeding a tie at right angles to the path of said bag and in front of said bag top as it emerges from said wheels, means defining a pocket for receiving said tie and partially folding the same about the approaching bag, said pocket means including a fixed member and a cooperating tie holder member mounted for pivotal movement about a vertical axis, a second pair of vertically spaced wheels coaxial with said axis and tangential to the plane between said collector wheels and positioned to engage a side surface of said bag as it enters said pocket, said second pair of wheels being positioned one above and one below said pocket means, a pair of endless flexible elements mounted in cooperative relation one with each of said second pair of wheels to press said bag thereagainst, the engagement of said flexible elements with said wheels extending substantially from the point of tangency of said second wheels with said plane through an arc of about 90°, means for driving said second pair of wheels and said flexible elements, said tie holder member being pivotal about said axis and being slightly longer than the diameter of said wheels whereby it will pressurably engage said tie against the surface of said bag as the latter is carried between said second pair of wheels and flexible elements through the arc of engagement thereof, stop means adjacent the end of said

arc to engage said tie holder member and cooperatively therewith to define a V-shaped second pocket for receiving the mid portion of said tie, said second pocket being just beyond the point of divergence of said flexible elements and said second wheels whereby the top portion of a bag is fed and compressed into said pocket and against said tie, a tie twister comprising a pair of fingers, means to cause said fingers to engage the ends of said tie while the same is in said second pocket and bring the same together so that said tie surrounds said bag top portion, and means thereafter to rotate said fingers to twist said tie ends together.

13. In a bag tying machine a twister for pinching and twisting together the ends of a tie, said twister comprising a frame, a shaft mounted on said frame for movement longitudinally of its axis and for rotation about said axis, means for moving said shaft longitudinally between a forward operative position and a rearward inoperative position, a twister head mounted on the forward end of said shaft comprising a pair of tie pinching fingers, means pivotally mounting said fingers by one end on said head for movement toward and away from each other, the opposite ends of said fingers extending generally forwardly of said head, said fingers being bodily movable relative to said head in a direction parallel to said shaft axis between a forward position and a rearward position, means operatively arranged between said head and said fingers to move the same together when said fingers are moved to said rearward position thereof and to move said fingers apart when said fingers are moved to said forward position thereof, resilient means urging said fingers to said forward position, means to engage said finger mounting means and arrest movement of said fingers upon forward movement of said shaft and said twister head whereby said fingers move relatively rearwardly with respect to said head and are thus moved together, and means to rotate said shaft.

14. In a bag tying machine a twister for pinching and twisting together the ends of a tie, said twister comprising a frame, a pinion shaft mounted on said frame for movement longitudinally of its axis and for rotation about said axis, means for moving said pinion shaft longitudinally between a forward operative position and a rearward inoperative position, a twister head mounted on the forward end of said pinion shaft comprising a pair of spaced apart plates extending parallel to said axis, each of said plates having an elongate slot therein parallel to said axis, a pressure shaft extending through said slots and outwardly beyond said plates, said pressure shaft being movable longitudinally of said slots, a pair of generally forwardly extending fingers disposed between said plates and pivotally mounted at one end thereof on said pressure shaft for movement to and from each other, spring means operatively arranged between said fingers and said plates to urge said fingers and pressure shaft forwardly relative to said pinion shaft, a pair of links pivotally connected at one end one to each of said fingers and at their opposite ends to said plates outwardly of said fingers and rearwardly of their connection to said fingers for pivotal movement about axes parallel to the axis of said pressure shaft, a ring element on said frame coaxial with said pinion shaft and encircling said fingers forwardly of said pressure shaft and positioned to engage said pressure shaft and arrest movement thereof upon movement of said pinion shaft toward said forward position whereby said fingers will be moved together upon continued movement of said head, and means to rotate said pinion shaft.

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