Oct. 27, 1959 J. F. IMBS 2,909,875

FOLDING AND SEALING MACHINES

Filed May 14, 1953 5 Sheets-Sheet 1

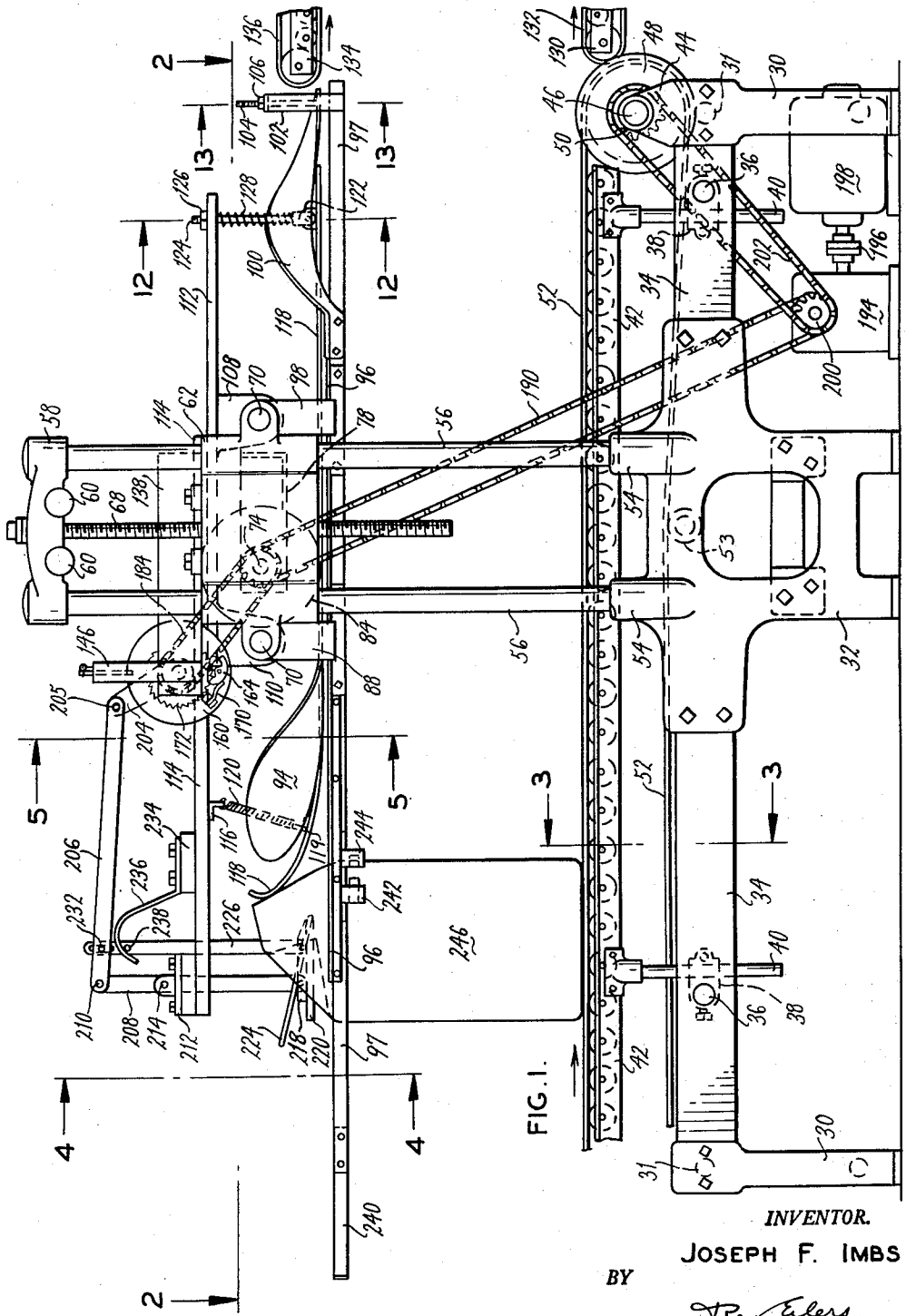


FIG. 1.

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Oct. 27, 1959 J. F. IMBS 2,909,875

FOLDING AND SEALING MACHINES

Filed May 14, 1953 5 Sheets-Sheet 2

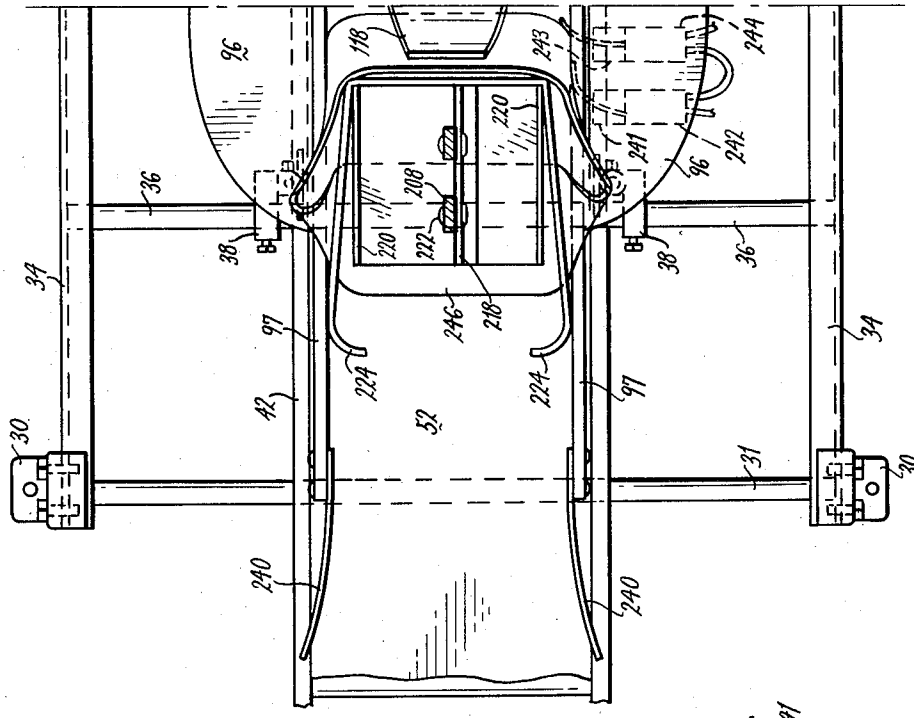


FIG. 2A.

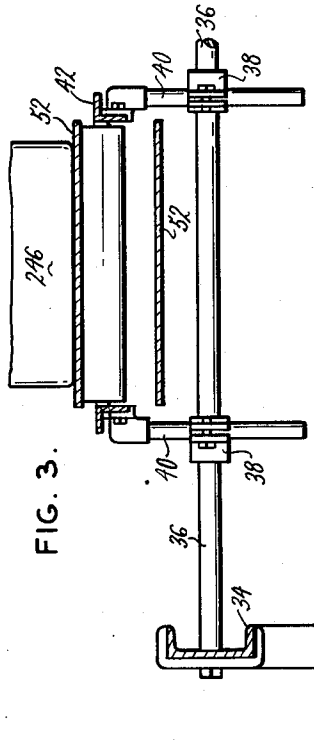


FIG. 3.

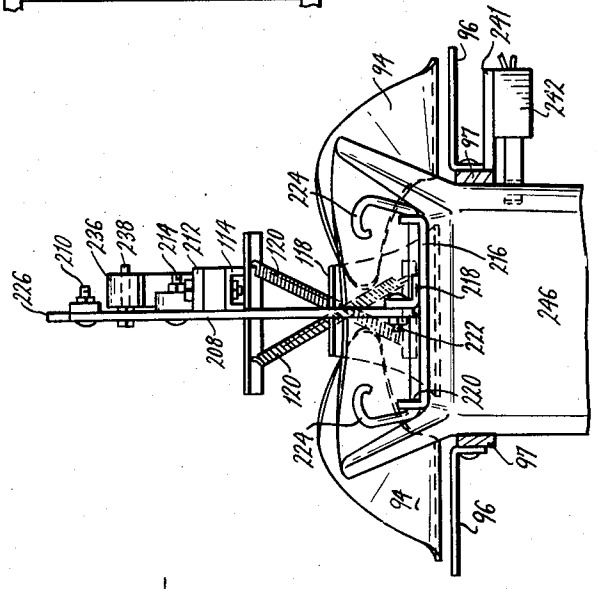


FIG. 4.

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FOLDING AND SEALING MACHINES

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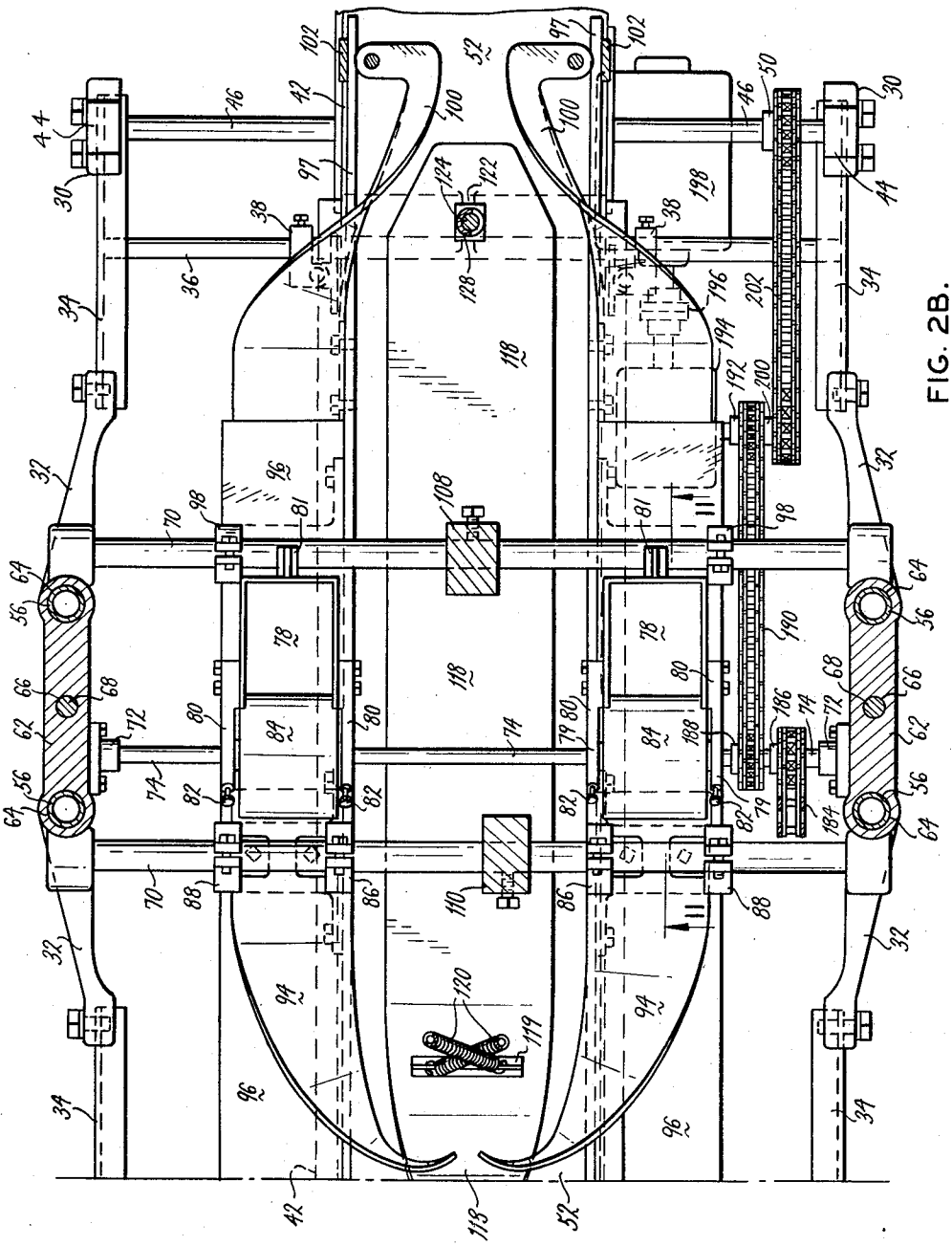


FIG. 2B.

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Oct. 27, 1959 J. F. IMBS 2,909,875

FOLDING AND SEALING MACHINES

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FIG. 5.

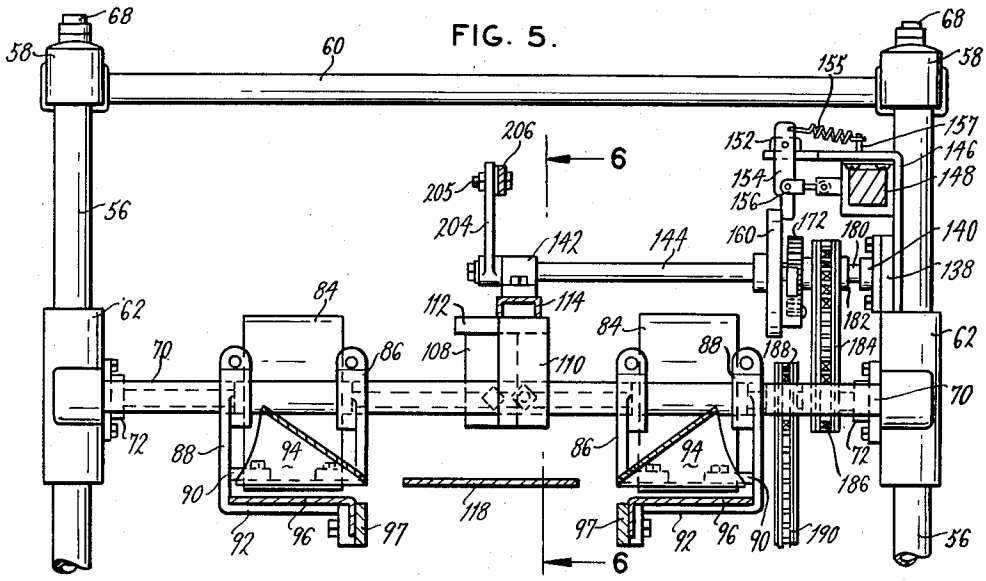


FIG. 6.

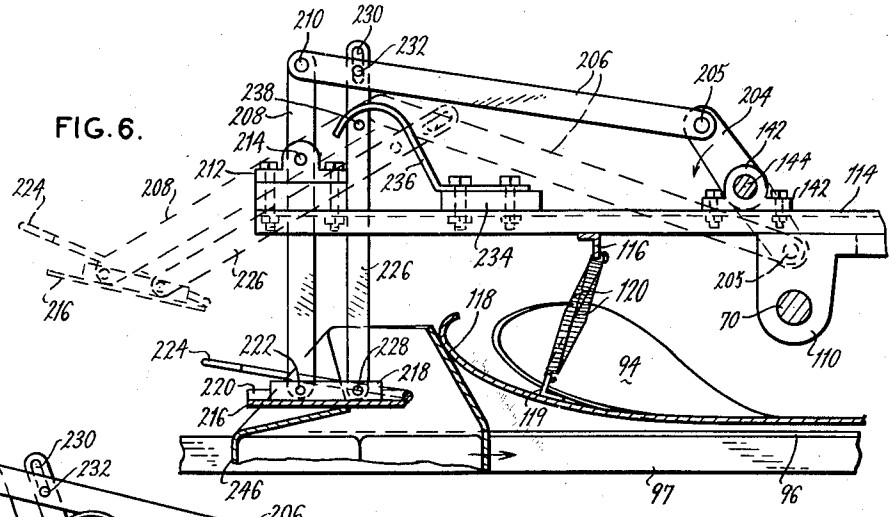
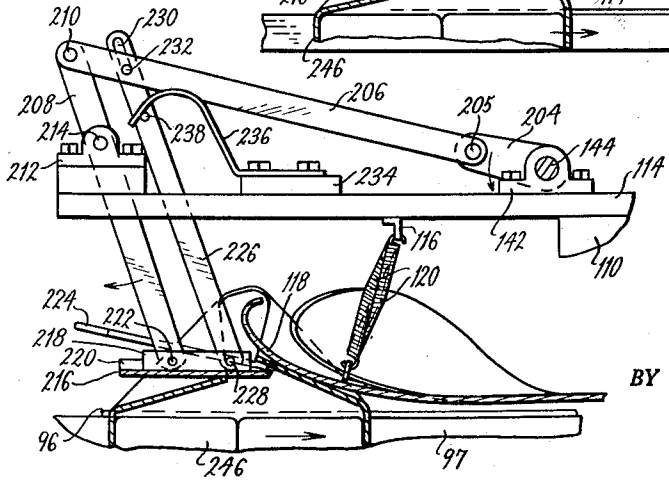


FIG. 7.



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FOLDING AND SEALING MACHINES

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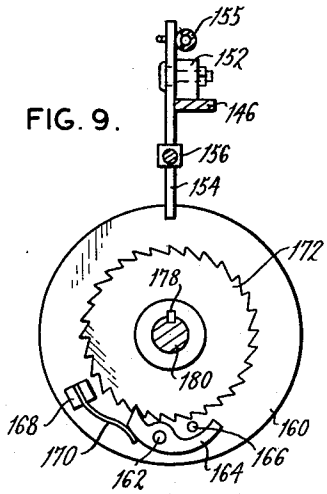


FIG. 9.

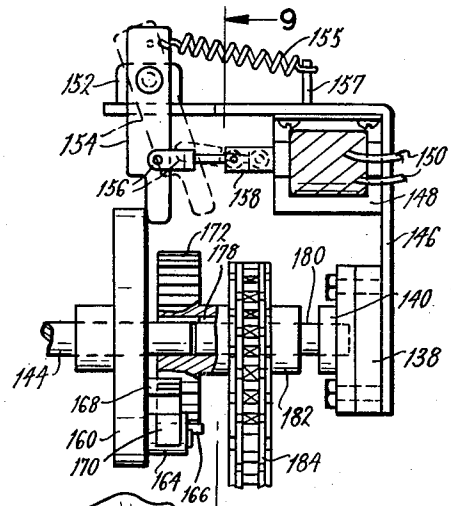


FIG. 8.

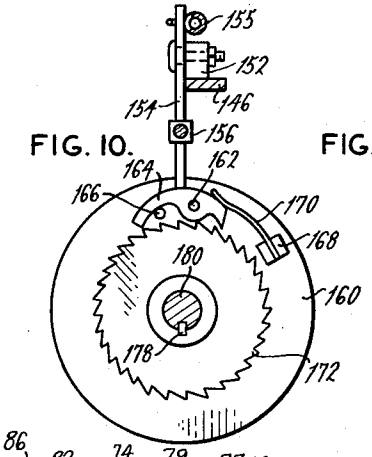


FIG. 10.



FIG. 14.

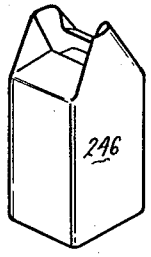


FIG. 15.

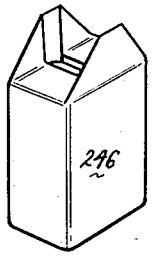


FIG. 16.

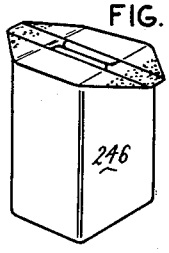


FIG. 17.

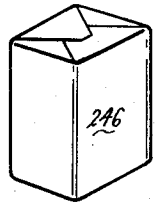


FIG. 18.

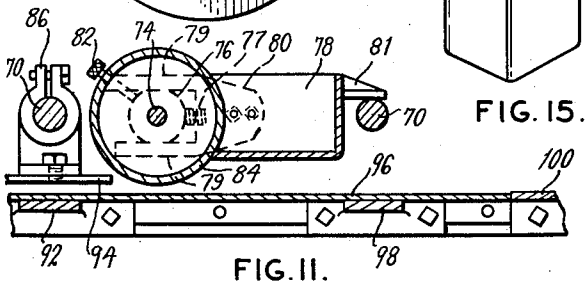


FIG. 11.

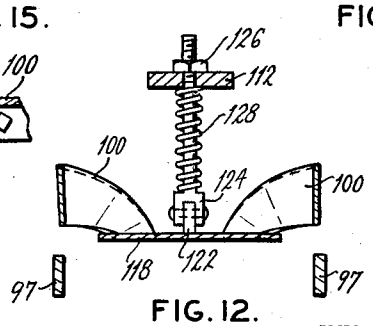


FIG. 12.

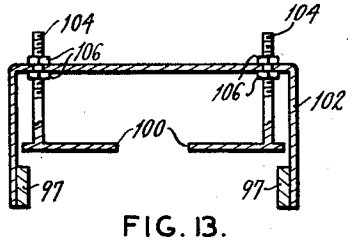


FIG. 13.

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2,909,875

FOLDING AND SEALING MACHINES

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Application May 14, 1953, Serial No. 355,110

8 Claims. (Cl. 53—76)

This invention relates to improvements in folding and sealing machines. More particularly, the present invention relates to improvements in machines that fold and seal paper sacks and bags.

It is therefore an object of the present invention to provide an improved folding and sealing machine for paper sacks and bags.

For a number of years it has been customary to pack form-retaining articles in cartons and boxes for purposes of shipment. However, the cost of boxes and cartons has increased greatly, and the cost of shipping articles has increased to the point where the weight of cartons and boxes makes their use unduly expensive. Accordingly, in many instances it has been found desirable to substitute paper sacks and bags for the boxes and cartons. This substitution has made it necessary to fold and seal paper sacks or bags rapidly because many articles are packed on production lines. The problem of folding and sealing paper sacks and bags is more difficult than is the problem of folding boxes or cartons because the boxes and cartons customarily have pre-formed fold or crease lines. Consequently, it is a simple matter to apply forces to the flaps of boxes or cartons and attain proper folding and sealing of those flaps. With paper sacks and bags, on the other hand, there are usually no pre-formed crease or fold lines in the walls of the bags or sacks, and thus it is necessary to form those fold lines at the time the sacks or bags are being folded and sealed.

The problem of folding and sealing paper sacks and bags is additionally complicated because the sacks and bags are not self supporting but instead depend upon the articles within them for rigidity. Since those articles may vary somewhat in height, the folding and sealing machine must accommodate sacks and containers with contents of varying height. The present invention provides such a folding and sealing machine by utilizing a folding surface which is resiliently mounted for vertical movement. That folding surface is normally below the level of the articles within the sacks and bags to be folded, and thus it can press the upper portions of the walls of the sacks or bags downwardly against the articles within those sacks or bags; and it will then be raised upwardly by those articles to permit the folded sack or bag to pass beneath it. Such a surface forces the upper portions of the sacks or bags into intimate engagement with the contents of the sacks or bags. Moreover, that surface holds the upper portions of the sacks or bags tightly against those contents until the other portions of the sacks or bags can be sealed in position. It is therefore an object of the present invention to provide a yieldably mounted surface for a folding and sealing machine which forces the upper portions of sacks and bags downwardly into intimate engagement with the contents of those sacks or bags.

The folding surface provided by the present invention has a wide flat leading edge and that leading edge is inclined. As a result, the surface can receive oncoming bags or sacks and apply bending forces to the upper portions of those bags along a wide area and thus attain a fully folded edge at the top of the contents of the bags or sacks. Such a surface avoids ripples or crinkles in the folded portions of the sacks or bags and thus facilitates a tight sealing of the upper ends of the sacks or bags. It is therefore an object of the present invention to provide a folding surface for a folding and sealing machine that has a wide flat leading edge which is inclined.

The folding surface provided by the present invention has tapered side edges. These edges facilitate the folding of parts of the side walls inwardly at the same time the end walls are being folded inwardly. Specifically, those edges fold the portions of the sides, which are adjacent the corners, inwardly; and thus those edges provide smooth horizontal surfaces and smooth vertical surfaces and smooth folding lines therebetween. Thus, the folding surface prepares the side portions of the bag for folding outwardly into engagement with adhesive-applying rollers and for subsequent inward folding during the sealing step.

The folding and sealing machine of the present invention has a second folding surface which is normally out of the path of the bags or sacks moved through the machine but which is selectively movable into engagement with the rear portions of the sacks or bags to fold them downwardly. This second folding surface moves more rapidly than does the conveyor which carries the sacks or bags through the machine, and it can thus fold the rear portions of those sacks or bags downwardly while those bags or sacks are being moved through the machine by the conveyor. This is desirable since it does not require any slowing down of the movement of the bags through the machine. It is therefore an object of the present invention to provide a folding surface for bag folding and sealing machines which moves into engagement with the rear portions of the bags or sacks passing through the machine and which moves faster than the conveyor which carries the bags or sacks through the machine.

The second folding surface provided by the present invention has a wide flat bottom and a wide blunt leading edge. As a result, the second folding surface provided by the present invention is able to provide a smooth uncrinkled fold at the top of the contents of the bags or sacks.

The second folding surface provided by the present invention has outwardly and upwardly inclined edges which extend rearwardly from the leading edge of that surface. These outwardly and upwardly inclined edges force parts of the side walls of the bags and sacks to move inwardly when the rear walls of those sacks or bags are folded inwardly. Specifically, those edges fold the portions of the sides, which are adjacent the corners inwardly; and thus those edges provide smooth horizontal surfaces and smooth vertical surfaces and smooth folding lines therebetween. Thus, the second folding surface helps prepare the sides of the sacks or bags for outward and then inward folding.

The second folding surface provided by the present invention is supported on an arm by a pivot. The surface can engage the upper portions of sacks or bags and act on those portions and force them downwardly; but those portions can act to rotate that surface upwardly about the pivot. This interaction between the surface, the pivot and the portions of the sacks or bags engaged by the surface enables that surface to provide a yielding force on the sacks or bags. This yielding force effects the desired folding of the sacks or bags but does not tear or crimp those bags. It is therefore an object of the present invention to provide a second folding surface for a folding and sealing machine which is pivoted to

an arm and which can be pivoted by the sacks or bags which it folds.

Other and further objects and advantages of the present invention should become apparent from an examination of the drawing and accompanying description.

In the drawing and accompanying description of a preferred embodiment of the present invention is shown and described, but it is to be understood that the drawing and accompanying description are for the purposes of illustration only and do not limit the invention and that the invention will be defined by the appended claims.

In the drawing, Fig. 1 is a side elevational view of the folding and sealing portion of a folding and sealing machine that is made in accordance with the principles and teachings of the present invention.

Fig. 2–A is a sectional view in plan of a portion of the folding and sealing section of the machine of Fig. 1, and it is taken along the plane indicated by the line 2—2 in Fig. 1.

Fig. 2–B is a sectional view in plan of the rest of the folding and sealing section of the machine of Fig. 1, and it is taken along the plane indicated by the line 2—2 in Fig. 1.

Fig. 3 is a sectional end view of the conveyor of the machine of Fig. 1, and it is taken along the plane indicated by the line 3—3 in Fig. 1.

Fig. 4 is a sectional end view of another portion of the machine of Fig. 1, and it is taken along the plane indicated by the line 4—4 in Fig. 1.

Fig. 5 is another sectional end view of the machine of Fig. 1, and it is taken along the plane indicated by the line 5—5 in Fig. 1.

Fig. 6 is a sectional side view of the machine of Fig. 1, and it is taken along the plane indicated by the line 6—6 in Fig. 5.

Fig. 7 is another view of the elements shown in Fig. 6, and it is taken along the plane indicated by the line 6—6 in Fig. 5, but it shows the parts after they have been rotated to a different angular position.

Fig. 8 is an enlarged, partially sectioned view of the ratchet wheel and pawl and actuating mechanism therefor used in the machine of Fig. 1.

Fig. 9 is a partially sectioned side view of the ratchet wheel, pawl and actuating mechanism of Fig. 8, and it is taken along the plane indicated by the line 9—9 of Fig. 8.

Fig. 10 is a sectional side view similar to Fig. 9, but it shows the parts after they have been rotated through a predetermined angle.

Fig. 11 is a sectional side view of the adhesive-applying roller of the machine of Fig. 1, and it is taken along the plane indicated by the line 11—11 in Fig. 2–B.

Fig. 12 is a sectional end view of a portion of the machine of Fig. 1, and it is taken along the plane indicated by the line 12—12 of Fig. 1.

Fig. 13 is a sectional end view of a portion of the machine of Fig. 1, and it is taken along the plane indicated by the line 13—13 of Fig. 1.

Fig. 14 is a perspective view of a paper container which has had the leading or front wall thereof folded inwardly.

Fig. 15 is a perspective view of the container of Fig. 14 after the rear wall thereof has been folded part way toward the contents of the container.

Fig. 16 is a perspective view of the container of Figs. 14 and 15 after the rear wall of that container has been folded flat.

Fig. 17 is a perspective view of the container of Figs. 14 and 16 after the side walls of that container have been folded flat to receive adhesive, and

Fig. 18 is a perspective view of the container of Figs. 14 and 17 as that container is sealed.

Referring to the drawing in detail, the numeral 30 denotes the legs at the opposite ends of the folding and sealing portion of a folding and sealing machine. A casting 32 is provided at each side of the folding and sealing machine, and thus each of the legs 30 will be disposed on opposite sides of a casting 32. Channels 34 extend between and are secured to the legs 30 and the castings 32. The channels 34 may be secured to the legs 30 and to the castings 32 by bolts or other suitable devices. Tie rods 31 extend between the legs 30, and tie rods 36 extend between the channels 34. The channels 34, the legs 30, the tie rods 31, and the tie rods 36 form a sturdy and rigid base for the folding and sealing machine provided by the present invention.

A plurality of rod-supporting brackets 38 are mounted on each of the tie rods 36. Each of the brackets 38 has a sleeve which telescopes over the rod 36 and each of those brackets has a set screw which enables the bracket 38 to be fixedly secured to the tie rod 36. In addition, each of the brackets 38 has a vertically-directed sleeve which receives a rod 40. The rods 40 are rigidly held by the brackets 38, and those rods support a section of roller conveyor 42. This section of roll conveyor is thus fixedly supported above the base of the folding and sealing machine. Bearing blocks 44 are mounted on the right hand legs 30 of Fig. 1 and those blocks support a rotatable shaft 46. A wide-faced pulley 48 is mounted on the shaft 46 and will rotate with that shaft. A sprocket wheel 50 is fixedly secured to the shaft 46 and will drive that shaft and the pulley 48 mounted thereon. A wide endless belt 52 extends around the pulley 48 and has one half of the length thereof resting on the rollers of the section of roller conveyor 42. The other one half of the endless belt 52 extends below the section of roller conveyor 42. An idler pulley 53 supports the second one half of the belt 52 and that idler pulley can be adjusted vertically to keep the belt 52 taut. The belt 52 will receive support throughout its length from the rollers of the section of roller conveyor 42 and will move sacks or bags through the folding and sealing machine.

The castings 32 have sockets 54 in the upper portions thereof and those sockets hold supporting rods 56. The upper ends of the rods 56 are secured by bridge castings 58. The castings 32, the rods 56, and the bridge castings 58 form rigid and sturdy supports at opposite sides of the folding and sealing machine. Tie rods 60 extend between and are secured to the bridge castings 58 and positively maintain the bridge castings 58 in rigidly spaced relation. Two saddles 62 are provided for the folding and sealing machine of the present invention, and each of those saddles has openings 64 therethrough to receive the rods 56. The openings 64 will permit the saddle 62 to move up and down along the lengths of the rods 56 but will hold those saddles in precise relation with those rods. Adjusting screws 68 are provided for the saddles 62, and those screws have polygonal heads which can be acted upon by wrenchs. The adjusting screws 68 are mounted in threaded openings 66 in the saddles 62, and are also mounted in the bridge castings 58. Rotation of the adjusting screws 68, as by the application of a wrench to the heads of those screws, will cause the saddles 62 to move upwardly or downwardly relative to the rods 56. By rotating the two adjusting screws 68 the same amount, it is possible to maintain the saddles 62 at the same identical level.

The numeral 70 denotes cross rods which extend between and connect the saddles 62. These cross rods coact with the saddles 62 to provide a rigid support that can be moved upwardly and downwardly relative to the rods 56. Bearing blocks 72 are mounted on the inner faces of the saddles 62, and those bearing blocks 72 are in register with each other. A rotatable shaft 74 extends between the bearing blocks 72 and is held for rotation by those blocks. Sleeve bearings 76 are mounted on the shaft 74, and those bearings can be held stationary while the shaft 74 rotates. The sleeve bearings 76 are spaced apart along the length of the shaft 74, and each of those bearings is held by projections 79 on the glue pots 78. Brackets 80 carry the projections 79, and those brackets

are suitably secured to the sides of the glue pots **78** by bolts or the like. The brackets **80** carry set screws **77** which hold the sleeve bearings **76** relative to the brackets **80**. Adjusting screws **82** extend through the upper projections **79** and keep the glue pots **78** from being separated from the sleeve bearings **76**. The projections **79** coact with the sleeve bearings **76** and the set screws **77** and **82** to support one end of the glue pots **78**. The other ends of the glue pots **78** are held by projections **81** on the glue pots which rest upon the right hand cross rods **70**, as those rods are viewed in Fig. 11. Adhesive-applying rollers **84** are mounted on the shaft **74** and are in direct register with the glue pots **78**. The rollers **84** constitute the left hand walls of the glue pots **78**, as those rollers and glue pots are viewed in Fig. 11, and the adhesive in the glue pots **78** will directly contact the rollers **84**. The set screws **82** can be adjusted to vary the spacing between the rollers **84** and the bottoms of the glue pots **78**, to provide such a small gap that the adhesive cannot leak through that gap. The rotation of the rollers **84** in a counter clockwise direction will enable those rollers to carry adhesive on their surfaces and into engagement with portions of sacks or bags which pass below but in engagement with those rollers.

A number of hangers **86** are mounted on the left hand cross rod **70**, as those rods are viewed in Fig. 1, and those hangers have short, horizontally-directed arms thereon. Hangers **88** are also mounted on the left hand cross rod **70**, as the rods are viewed in Fig. 1, and those hangers have short, horizontally-directed arms **90** thereon and have longer horizontally-directed arms **92** thereon. The arms **92** have L-shaped flanges at the free ends thereof. The long arms **92** are disposed below the short arms **90** of the hangers **88**. The short arms **90** of the hangers **88** are at the same level with and are in register with the short arms on the hangers **86**. Cam surfaces **94** are bolted to the arms on the hangers **86** and to the short arms **90** of the hangers **88**. Rear portions of the cam surfaces **94** are flat and are horizontal, but the front portions of those surfaces are close to the vertical. The portions of the cam surfaces **94** between the front and rear portions thereof are smoothly curved and incline progressively toward the horizontal. These cam surfaces will receive the side wall portions of paper bags and containers and bend those side wall portions outwardly and downwardly to horizontal position. Elongated supporting plates **96** are disposed below the level of the cam surfaces **94**, and those supporting plates are secured to and carried by the long arms **92** of the hangers **88**. The cam surfaces **94** and the supporting plates **96** define a narrow slot in which the upper portions of the side walls of paper bags and containers can move toward the rollers **84** of the glue pots **78**. As indicated particularly in Fig. 11, the cam surfaces **94** terminate adjacent the rollers **84** and those rollers will apply adhesive to the upper portions of the side walls of paper sacks and bags which have been folded to the horizontal position by the cam surfaces **94**. The supporting plates **96** extend forwardly of the leading edges of the cam surfaces **94** and they extend rearwardly of the trailing edges of those cam surfaces. The rearwardly extending portions of the supporting plates **96** are carried by hangers **98**. These hangers have long supporting arms similar to the arms **92** of the hangers **88**. The arms of the hangers **98** and the arms **92** of the hangers **88** also support elongated bars **97**. These bars are sturdy and stiff and they keep the supporting plates **96** rigid.

A pair of cam surfaces **100** are secured to the bars **97** adjacent the rearmost edges of the supporting plates **96**, and those cam surfaces will receive the under sides of the outwardly bent wall portions of the paper bags or sacks and will raise those wall portions upwardly and fold them inwardly against the front and rear portions of the walls of those sacks or containers. The leading edges of the cam surfaces **100** are close to the horizontal, and the trailing edges of those cam surfaces are substantially horizontal. The portions of the cam surfaces **100** between the leading and trailing edges are inclined at various angles to the vertical and they raise the side wall portions of sacks or containers up through the vertical and then inwardly and down to the horizontal. A C-shaped support **102** is secured to the right hand end of the rods **97**. This support **102** carries threaded rods **104** which extend through openings in the horizontal portion of the support **102**. Nuts **106** are secured to the threaded rods **104** and can be rotated into tight engagement with that horizontal portion of the support **102** to lock the trailing edges of the cam surfaces **100** in position. Suitable adjustment of the nuts **106** can move the trailing edges of the cam surfaces **100** up or down as desired. A hanger **108** is secured to the right hand cross rod **70**, as those rods are viewed in Fig. 1, and that hanger supports the right hand end of a bar **112**. That hanger also helps support the right hand end of a channel **114**. The left hand end of the bar **112**, and the center of the channel **114**, are supported by a hanger **110** which is secured to the left hand cross rod **70**, as those rods are viewed in Fig. 1. An angle **116** is secured to the bottom of the channel **114**, and that channel and angle support a pair of helical springs **120**. The springs **120** have the upper ends thereof secured to the angle **116** at spaced points. The lower ends of the springs **120** are secured to a cleat **119** of L-shaped cross section, and that cleat in turn is secured to a folding surface **118**. The folding surface **118** has a wide flat leading edge which is arcuate and is inclined upwardly from the horizontal. The sides of the surface **118** taper outwardly from the leading edge to about the width of containers passing through the machine. The springs **120** are secured to the cleat **119** at points which are spaced apart. The springs are inclined toward each other and cross each other. Thus, the springs define an X and are resistant to transverse movement of the folding surface **118**. Thus, the springs **120** tend to keep the folding surface **118** centered of the folding and sealing machine, while permitting that surface to move up and down vertically. The trailing edge of the folding surface **118** has a stud **122** thereon and a forked link **124** is pivoted to the stud **122**. The upper end of the link **124** extends through an opening in the bar **112**. A nut **126** is threaded onto the upper end of the link **124**, and that nut can be adjusted to determine the normal position of the trailing edge of the folding surface **118**. A spring **128** encircles the link **124** and forces that link and the trailing edge of the folding surface **118** downwardly. However, that spring is yieldable to permit the trailing edge of the folding surface **118** to move upwardly. The springs **120** and the spring **128** permit the folding surface **118** to move upwardly whenever a paper sack or bag passes along the belt **52**. The leading edge of the folding surface **118** will normally be below the top of such a bag and will be below the top of the contents within that bag. However, the inclined leading edge of the folding surface **118** can be raised upwardly by the contents of the bag or sack and permit the bag or sack to move along the belt **52**. Those sacks or bags will be carried by the belt **52** to a belt **132** that extends around and is supported by a section of roller conveyor **130**. This belt will be suitably driven and will carry sacks or bags from the belt **52** to a suitable loading or storing area. A section of roller conveyor **134** is mounted above the section of roller conveyor **130**, and a belt **136** extends around that section of roller conveyor. This belt **136** will bear against the folded and sealed top of the sacks or bags and will apply pressure to those tops as the sacks or bags are moved along the belt **132**.

A vertically extended plate **138** is directed longitudinally along the right hand saddle **62**, as the saddles are viewed in Fig. 5. That plate supports a bearing block

140; and the bearing block 140 is in register with a bearing block 142 mounted on the channel 114. A shaft 144 has one end thereof mounted in the bearing block 142 and it has its other end extending toward but terminating short of the bearing block 140. An L-shaped bracket 146 is secured to the plate 138, and that bracket extends upwardly and to one side of that plate. A solenoid 148 is secured to the bracket 146, and that solenoid has leads 150 extending therefrom. A stud 152 is provided on the bracket 146 and a stop 154 is pivoted to the stud 152 on the bracket 146. A spring 155 has one end thereof secured to the stop 154 and has the other end thereof secured to a pin 157 secured to the bracket 146. The spring 155 biases the stop 154 for rotation about the stud 152 in a clockwise direction. A yoke 156 is pivoted to the stop 154 adjacent the lower end of that stop, and that yoke is pivoted to the armature 158 of the solenoid 148. Whenever the solenoid 148 is energized, the armature 158 of that solenoid will act through the yoke 156 to rotate the stop 154 in opposition to the spring 155. However, when the solenoid 148 is deenergized, the spring 155 will pull the stop 154 into the vertical position shown particularly in Fig. 5.

A disc 160 is mounted on the shaft 144 adjacent the right hand end of that shaft, as that shaft is viewed in Fig. 5. The disc 160 will rotate with the shaft 144. A pivot 162 is mounted on the disc 160, and that pivot carries a pawl 164. One end of the pawl 164 is sharp and the other end of the pawl is arcuate and smoothly rounded. The disc 160 also carries a pin 166 which serves as a stop for the pawl 164. A block 168 is also carried by the disc 160, and that block supports a leaf spring 170. The spring 170 normally urges the sharp end of the pawl 164 inwardly toward the center of the disc 160.

A ratchet wheel 172 is adjacent the disc 160 and that wheel has a central opening which receives the right hand end of the shaft 144 and acts as a bearing for that end of that shaft. The hub of the ratchet wheel 172 is mounted on the left hand end of the shaft 180, and the right hand end of that shaft is mounted in the bearing block 140. The ratchet wheel will rotate with the shaft 180 and the disc 160 will rotate with the shaft 144; and whenever the pawl 164 engages the teeth of the ratchet wheel 172, the ratchet wheel 172 may drive the disc 160 and the shaft 144. The ratchet wheel 172 is suitably secured to the shaft 180 by a key 173. The key 173 is short enough that it will not engage the shaft 144 when it is fully seated in the shaft 180.

A sprocket wheel 182 is mounted on the shaft 180 and will drive that shaft. A sprocket chain 184 extends around the sprocket wheel 182 and also extends around a sprocket wheel 186 on the shaft 74. The sprocket chain 184 is driven by the sprocket wheel 186 and in turn drives the sprocket wheel 182. A second sprocket wheel 188 is mounted on the shaft 74 and that sprocket wheel is driven by the sprocket chain 190. The chain 190 extends around a sprocket wheel 192 on the output shaft of a gear box 194. The input shaft of the gear box 194 has a flexible coupling 196 mounted on it, and that flexible coupling is connected to the shaft of a motor 198. A second sprocket wheel 200 is mounted on the output shaft of the gear box 194, and that sprocket wheel drives the sprocket chain 202 which in turn drives the sprocket wheel 50 on the shaft 46. The motor 198 drives the output shaft of the gear box 194 and thus drives the two sprocket wheels 192 and 200. Sprocket wheel 192 drives the sprocket chain 190 which drives the sprocket wheel 188 on the shaft 74. Thus, the sprocket chain 190 drives the adhesive-applying rollers 84 on the shaft 74. In addition, the sprocket chain 190 drives the sprocket wheel 186 through the medium of the shaft 74 and the sprocket wheel 186 drives the chain 184 which in turn drives the sprocket wheel 182. The sprocket wheel 182 drives the shaft 180 which in turn drives the ratchet wheel 172. The motor 198 also drives the pulley 48 and thus drives the belt 52 through the sprocket wheel 50 and through the sprocket chain 202.

A crank arm 204 is mounted on the left hand end of the shaft 144. A pivot 205 is secured to the outer end of the crank arm 204 and that pivot carries a connecting rod 206. The other end of the connecting rod 206 is connected to a lever 208 by a pivot 210. The lever 208 is secured intermediate the ends thereof to a pivot block 212 by a pivot 214. The pivot block is mounted on the channel 114. Rotation of the crank arm 204 will cause the lever 208 to rotate about the pivot 214. A folding surface 216 in the form of a flat plate has an upstanding angle 218 secured to the top thereof. The upstanding angle bears a pivot 222 and that pivot secures the lever 208 to that folding surface. The surface 216 has upwardly extending rims 220 at the sides thereof to stiffen that surface. The surface 216 has outwardly and upwardly extending side edges 224 in the form of a stiff wire. This wire extends across the leading edge of the surface 216 and then extends rearwardly from that leading edge. As indicated particularly in Fig. 2–A, the edges 224 incline outwardly from the body of the surface 216. A lever 226 is secured to the angle 218 by a pivot 228. The upper end of the lever 226 has a slot 230 therein and that slot telescopes over a pin 232 carried by the connecting rod 206. A cam block 234 is secured to the channel 114 at a point to the right of the bearing block 212, as those blocks are viewed in Fig. 6. A cam 236 is secured to the cam block 234 and that cam is in the path of movement of a cam follower 238 carried by the lever 226. The cam follower 238 has the form of a pin and it will be guided by the cam 236.

The weight of the folding surface 216 will normally act to cause that surface to rotate in a clockwise direction, and that rotation will be facilitated by the slot 230 in the upper end of lever 226. The closed upper end of the slot 230 will limit that clockwise rotation. When the folding surface 216 engages the wall of a paper sack or bag, that surface will meet resistance and if that resistance is great enough the surface can be lifted upwardly; the slot 230 in the lever 226 permitting that upward movement. However, the upward movement of the lever 226 will be limited by the engagement between the cam follower 238 and the cam 236. Thus, a yielding force is applied to the folding surface 216 and within limits the surface can respond to the resistance of the paper sacks or bags to yield and avoid tearing or crinkling of the paper sacks or bags.

Springy guides 240 are mounted on the ends of the bars 97, and those guides extend to the left of the machine shown in Fig. 1. Those guides have the ends thereof bowed outwardly to receive containers that are tilting slightly to one side or the other and to move those containers to vertical position and guide them between the bars 97. The bars 97 will then maintain the containers, which will be paper sacks or bags, as they move through the machine.

A normally open switch 242 is mounted on an arm 241 which is supported by the right hand bar 97, as those bars are viewed in Fig. 4. This switch has an actuator that will be acted upon by sacks or bags moving along the belt 52. A normally closed switch 244 is mounted on an arm 243 which is also secured to the right hand bar 97, as those bars are viewed in Fig. 4, and that switch has an actuator which will be acted upon by sacks or bags moved by the belt 52. The switches 242 and 244 are close to each other and the sacks or bags which move along with the belt 52 will quickly close the switch 242 and then open the switch 244. The switches 242 and 244 are connected in series with each other and with the solenoid 148. Thus, when a container is moved along by the belt 52, that container will energize the solenoid 148 by closing the switch 242 and will then promptly deenergize the solenoid 148 by opening the switch 244.

After the container has moved out of engagement with the actuators of the switches 242 and 244, the switch 242 will again open and the switch 244 will again close. The numeral 246 denotes a container which can be moved along the belt 52. That container will preferably be a sack or bag of stiff paper.

The belt 52 will have its left hand end extending adjacent a feeding device for containers 246 which have had articles placed within it. While a number of different articles could be placed within the containers 246, it has been found that a number of filled bags or sacks can readily be placed in the containers 246 and then sealed within that container by the folding and sealing machine of the present invention. The top of the container 246 will be open and the upper portions of the front and rear and side walls of the container will extend upwardly above the top of the contents of that container. The belt 52 will move the container along and the springy guides 240 will receive the container and hold it squarely upright as it reaches those guides. The guides 240 will direct the container between the spaced bars 97, and those bars will hold the containers upright. The folding surface 216 will normally occupy the position indicated by dotted lines in Fig. 6, and in such a position that surface is out of register with the upper portions of containers moved by the belt 52. Hence, those containers will move underneath that folding surface without engaging it. The upper portions of the front wall of the container 246 will engage the folding surface 118 and will be bent rearwardly and downwardly by that surface. The folding surface will normally be disposed a slight distance below the top of the contents of the containers 246, and it will force the upper portions of the front walls of the containers 246 downwardly into intimate engagement with those contents; and those contents will thereafter raise the folding surface 118 upwardly. The mounting of that plate is resilient and thus it will be able to move upwardly under the action of the contents of the containers 246. The resilient mounting of the folding plate 118 will also enable that plate to move slightly if the upper portions if the front walls of the containers 246 offer much resistance to folding or bending. However, the usual container 246 will have upper portions of the front wall that will readily fold downwardly.

After the front walls of the containers 246 have been folded rearwardly by the folding surface 118, the containers 246 will close the switch 242. Immediately, the solenoid 148 will act through its armature 158 to pull the stop 154 out of engagement with the pawl 164. At such time, the spring 170 will drive the sharp end of the pawl 164 into engagement with the ratchet wheel 172. At that moment, the folding surface 216 and the lever system which connects it to the shaft 144 is in an unbalanced condition and that surface and linkage will quickly move to a substantially vertical position under the influence of gravity; the pawl 164 slipping past the teeth of the ratchet wheel 172. The spring 170 will yield sufficiently to permit the pawl 164 to slip past those teeth. This downward movement of the surface 216 is quite rapid and occurs before the front wall of the container 246 has been moved out of engagement with the leading edge of the folding surface 118. As the folding surface 216 moved downwardly in an arcuate path to the position shown in solid lines Fig. 6, the lever 226 moved downwardly until its downward movement was stopped by the engagement between the upper end of the slot 230 and the pin 232 on the connecting rod 206. However, when the leading edge of the surface 216 engaged the upper portions of the rear wall of the container 246, that leading edge could be raised upwardly by the resistance of that rear wall. The upward movement of the leading edge of the surface 216 would not be unlimited because the cam follower 238 would engage the cam 236 and would be held against further upward movement. Even when the front edge of the surface 216 is moved upwardly by the resistance of the rear wall of the container 246, the weight of the surface 216 and of the lever 226 will be acting downwardly on those upper portions of that rear wall. Consequently, a continuous bias will be applied to the surface 216 and that surface will thus be able to urge the upper portions of the rear wall of the container 246 forwardly and downwardly. The cam 236 will so limit the movement of the lever 226 that the leading edge of the folding surface 216 will be below the leading edge of the folding surface 118, as shown particularly in Fig. 7. Moreover, as shown by Fig. 7, the folding surface 216 will move into close proximity to the folding surface 118.

The unbalance of the linkage which connects the surface 216 with the shaft 144 will cause the surface 216 to move to the position shown in Fig. 6, and thereafter the rotation of the ratchet wheel 172 will cause the disc 160 and the shaft 144 to rotate further in a counter clockwise direction as viewed in Fig. 10; and this will cause the surface 216 to be moved into the close proximity to the surface 118 that is shown in Fig. 7. Thereafter, further rotation of the ratchet wheel 172 will cause the crank arm 204 to rotate below the dead center position of Fig. 7 and will cause the connecting rod 206 to pull the lever 208 back to the position indicated in dotted lines in Fig. 6. When the shaft 144 reaches the position corresponding to the dotted line position of the surface 216 in Fig. 6, the pawl 164 carried by the disc 160 will strike the bottom of the stop 154 and will have its sharpened end lifted out of the path of the teeth on the ratchet wheel 172. The pin 166 will keep the rounded end of the pawl 164 from itself moving into the path of the teeth of the ratchet wheel 172. Thereupon, the disc 160 will no longer be driven by the ratchet wheel 172 and the shaft 144 and the linkage connected to the folding surface 216 will remain stationary. This condition will continue until the switch 242 is again closed by a container 246. The rotation of the shaft 180 is such that the movement of the surface 216 is much more rapid than the movement of the belt 52. As a result, the surface 216 can start from a position well to the rear of containers carried on the belt 52 and can overtake those containers and force the rear walls thereof forwardly and downwardly.

The leading edge of the surface 216 is wide and blunt and will provide a full crinkle-free fold at the rear wall of the containers 246. The side edges 224 of the surface 216 will start the side walls of the containers bending outwardly.

The movement of the folding plate 216 is controlled exclusively by the position of the containers on the belt 252 and there is no opportunity for premature or tardy movement of that plate. The solenoid 148 is not energized until the current flows from the switch 242 through the switch 244 and to the leads 150 of the solenoid 148; and shortly thereafter the switch 244 is opened and then the cycle of the disc 160 completes itself automatically.

The belt 52 will continue to move the containers 246 through the folding and sealing machine, and the forwardly folded rear wall of the container will be held down by the action of the then-overlying leading edge of the surface 118 after the folding plate 216 has been withdrawn. The rate of withdrawal of the plate 216 is slow enough that the plate 216 holds the forwardly extending portions of the rear wall of the containers 246 down sufficiently that those portions can be caught and guided further downwardly by the leading edge of the folding surface 118. The rearwardly extending trailing edge of the folding surface 118 will continue to hold the front and rear portions of the wall of the container 246 as that container is moved along by the belt 52. Meanwhile, the upper portions of the side walls of the container 246 will be bent outwardly to a horizontal position by the cam surfaces 94. The upper portions of the side walls of the container 246 will be supported by the plate

96 and they will move below but in engagement with the adhesive-applying rollers 84. Thereafter, the upper portions of the side walls of the container will be moved into engagement with the cam surfaces 100 and will then be folded upwardly and inwardly and then downwardly for sealing. The containers 246 will then pass onto the belt 132 and under the belt 136. The belts 132 and 136, and the sections of roller conveyor 130 and 134 that are used with those belts, will act to keep the containers 246 under pressure until the glue has a good hold on the upper portions of the side walls of the containers.

Whereas the drawing and accompanying description have shown and described a preferred embodiment of the present invention, it should be apparent to those skilled in the art that various changes may be made in the form of the invention without affecting the scope thereof.

What I claim is:

1. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a rear fold-forming element that is normally out of the path of said bags but is movable into engagement with the upper portions of the rear walls of said bags to bend said upper portions of said rear walls forwardly and downwardly, an electrically controlled source of power to move said rear fold-forming element, a first electric switch adjacent said conveyor, and a second electric switch adjacent said conveyor, said first electric switch being actuable by a bag to enable said source of power to cause movement of said rear fold-forming element against the upper portion of the rear wall of said bag, said second electric switch being actuable by said bag to enable said source of power to cause movement of said rear fold-forming element rearwardly and away from said folded upper portion of said rear wall of said bag, said electric switches being spaced apart to leave said rear fold-forming element in engagement with said folded upper portion of said rear wall of said bag for an appreciable period.

2. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a front fold-forming element that is intermediate the ends of said path and that is disposed above and in register with said path, said front fold-forming element being in register with the front walls of bags moved along by said conveyor, a rear fold-forming element that is adjacent said path and is movable against the rear walls of said bags, a source of power to move said rear fold-forming element, said front fold-forming element having a leading edge that receives the upper portions of the front walls of said bags to bend said upper portions of said front walls of said bags rearwardly and downwardly to partially close the upper ends of said bags, said rear fold-forming element being movable to engage the upper portions of the rear walls of said bags to bend said upper portions of said rear walls of said bags forwardly and downwardly to further close the upper ends of said bags, a first electric switch adjacent said conveyor, and a second electric switch adjacent said conveyor, said first electric switch being actuable by a bag to enable said source of power to cause movement of said rear fold-forming element against the upper portion of the rear wall of said bag, said second electric switch being actuable by said bag to enable said source of power to cause movement of said rear fold-forming element rearwardly and away from said folded upper portion of said rear wall of said bag, said electric switches being spaced apart to leave said rear fold-forming element in engagement with said folded upper portion of said rear wall of said bag until the rearwardly folded upper portion of the front wall of said bag is held above said forwardly folded upper portion of said rear wall of said bag by said leading edge of said front fold-forming element, whereby said folded upper portions of said bag can not raise upwardly and jam against said front fold-forming element.

3. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a generally horizontal pivot above and in register with said path, an arm that oscillates relative to said pivot, a rear fold-forming element, a second pivot that connects said arm and said rear fold-forming element for conjoint movement but permits relative rotation between said arm and said rear fold-forming element, said arm normally holding said rear fold-forming element spaced upwardly above and out of the path of the upper portions of bags moved along said predetermined path by said conveyor but rotating downwardly to place the leading edge of said rear fold-forming element against the upper portion of the rear wall of a bag to fold said upper portion of said rear wall forwardly and downwardly, and a source of power to rotate said arm, said second pivot permitting said leading edge of said rear fold-forming element to be raised upwardly to prevent tearing of said rear wall of said bag.

4. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a pivot, an arm that oscillates relative to said pivot, a rear fold-forming element, a second pivot that connects said arm and said rear fold-forming element for conjoint movement but permits relative rotation between said arm and said rear fold-forming element, said arm normally holding said rear fold-forming element out of the path of the upper portions of bags moved along said predetermined path by said conveyor but rotating about the first said pivot to place the leading edge of said rear fold-forming element against the upper portion of the rear wall of a bag to fold said upper portion of said rear wall forwardly and downwardly, and a source of power to rotate said arm, said second pivot permitting said leading edge to move vertically relative to the trailing edge of said fold-forming element, said leading edge of said rear fold-forming element being biased downwardly but being movable upwardly against the bias thereon.

5. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a generally horizontal pivot, a second generally horizontal pivot that is spaced from the first said pivot, an arm that rotates relative to the first said pivot, a second arm that rotates relative to said second pivot, the first said arm having a pivot adjacent the lower end thereof, said second arm having a pivot adjacent the lower end thereof, a rear fold-forming element mounted on and carried by said pivots on the lower ends of said arms, and a mechanism that translates said arms relative to each other as they rotate about the said first and said second pivots, said fold-forming element rotating about the pivots at the lower ends of said arms as said fold-forming element rotates with said arms about the said first and said second pivots and responding to the said relative translation of said arms to change the relative vertical positions of the leading and trailing edges thereof.

6. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a generally horizontal pivot, a second generally horizontal pivot that is spaced from the first said pivot, an arm that rotates relative to the first said pivot, a second arm that rotates relative to said second pivot, the first said arm having a pivot adjacent the lower end thereof, said second arm having a pivot adjacent the lower end thereof, a rear fold-forming element mounted on and carried by said pivots on the lower ends of said arms, and a mechanism that translates said arms relative to each other as they rotate about the said first and said second pivots, said relative translation of said arms enabling said rear fold-forming element to assume different angular dispositions relative to the said arms and to shift the leading edge of

said rear fold-forming element vertically relative to the trailing edge of said rear fold-forming element, said rear fold-forming element being generally horizontal as it forms the fold in the upper portion of said rear wall of said bag.

7. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a front fold-forming element that is disposed above said conveyor and in register with said path and that has a leading edge that is in register with the front walls of bags moved along said path by said conveyor and is adapted to bend the upper portions of said front walls of said bags downwardly and rearwardly, a pivot that is disposed laterally of and above the level of said front fold-forming element, an arm that is rotatable about said pivot, a second pivot adjacent the lower end of said arm, a rear fold-forming element that is movable by said arm and is rotatable relative to said arm about said second pivot, said rear fold-forming element normally being spaced above said conveyor and out of said path but being movable by said arm downwardly into said path and into engagement with the upper portions of the rear walls of said bags to bend said upper portions of said rear walls of said bags forwardly toward and beneath said leading edge of said front fold-forming element, and a source of power to rotate said arm about said first pivot, said arm rotating said rear fold-forming element into position immediately adjacent and below said leading edge of said front fold-forming element to form the fold in the rear wall of a bag moved by said conveyor and to hold the bent upper portion of said rear wall of said bag in position where it is overlain by said front fold-forming element, said rear fold-forming element remaining immediately adjacent and beneath said leading edge of said front fold-forming element until said bag has been moved by said conveyor to a position where the forwardly folded upper portion of the rear wall thereof is held against upward movement, said rear fold-forming element rotating about said second pivot and the leading edge of said rear fold-forming element translating relative to the rear edge of said rear fold-forming element as said arm moves said rear fold-forming element about said first pivot.

8. Folding apparatus for a bag folding and sealing machine that comprises a conveyor to move bags along a predetermined, generally horizontal path, a pivot, an arm that oscillates relative to said pivot, a rear fold-forming element, a second pivot that connects said arm and said rear fold-forming element for conjoint movement but permits relative rotation between said arm and said rear fold-forming element, said arm normally holding said rear fold-forming element out of the path of the upper portions of bags moved along said predetermined path by said conveyor but rotating about the first said pivot to place the leading edge of said rear fold-forming element against the upper portion of the rear wall of a bag to fold said upper portion of said rear wall forwardly and downwardly, and a source of power to rotate said arm, said second pivot permitting said leading edge to move vertically relative to the trailing edge of said rear fold-forming element, said leading edge of said rear fold-forming element being biased downwardly but being movable upwardly against the bias thereon, said rear fold-forming element having a wide and blunt leading edge and having elongated bag-engaging elements projecting outwardly and rearwardly therefrom, said leading edge of said front fold-forming element bending the upper portions of the rear walls of bags forwardly and downwardly, and said elongated bag-engaging elements urging the side walls of said bags outwardly and downwardly.

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