May 5, 1942. H. W. GABBERT 2,282,126

FOLDING AND STACKING MACHINE

Filed June 24, 1940 5 Sheets-Sheet 1

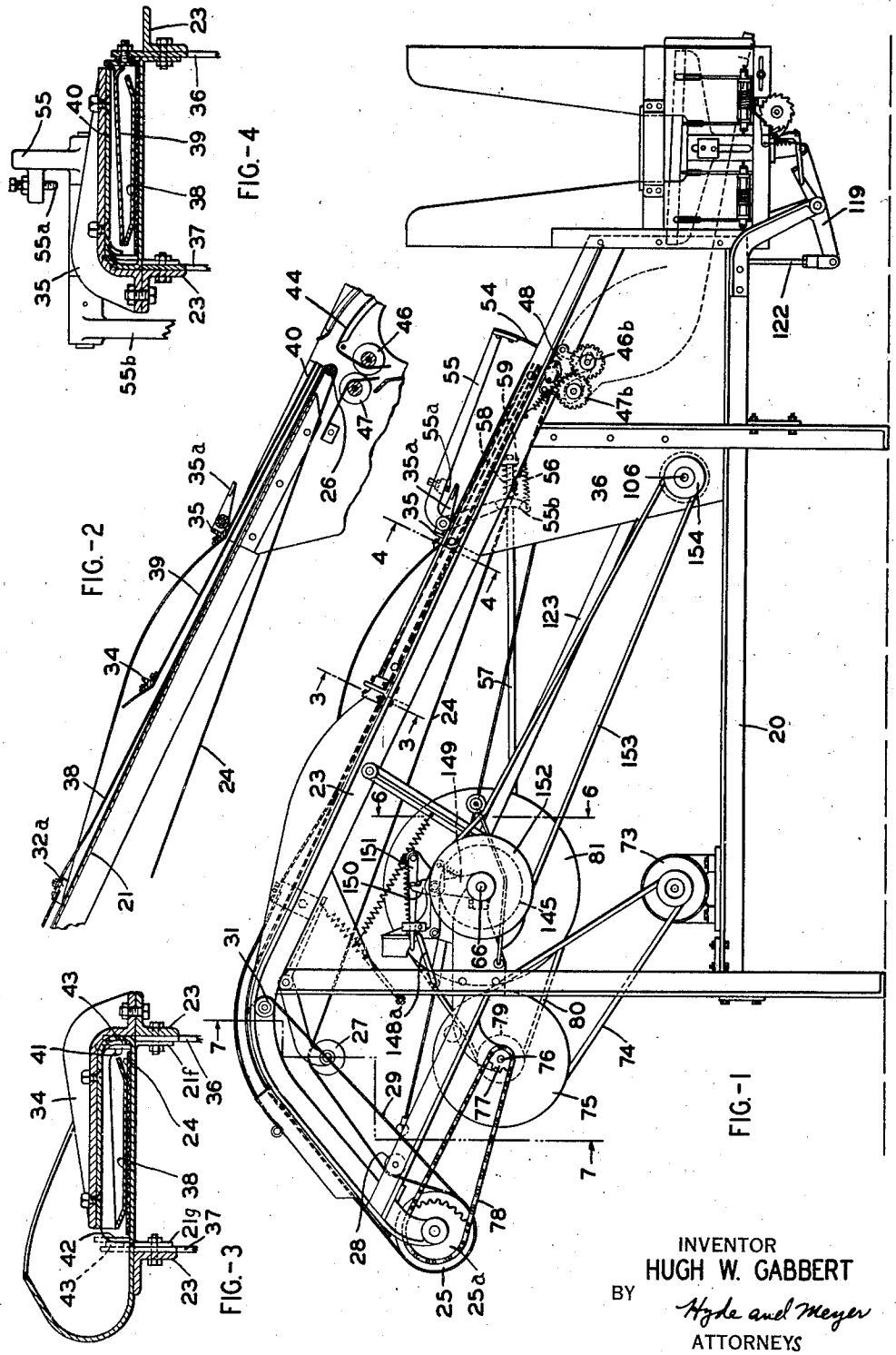


FIG.-1

FIG.-2

FIG.-3

FIG.-4

INVENTOR
HUGH W. GABBERT
BY Hyde and Meyer
ATTORNEYS

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FOLDING AND STACKING MACHINE

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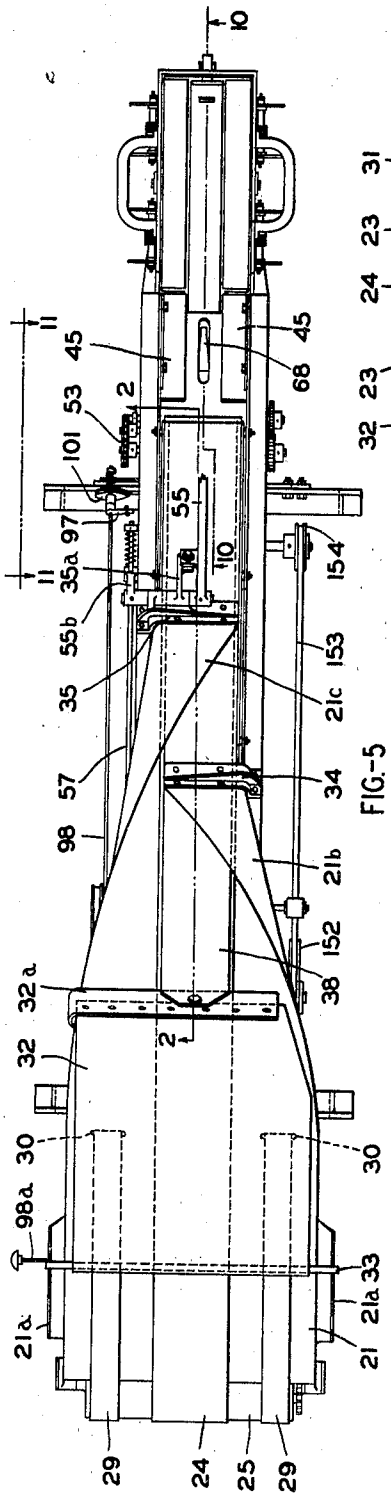


FIG.-5

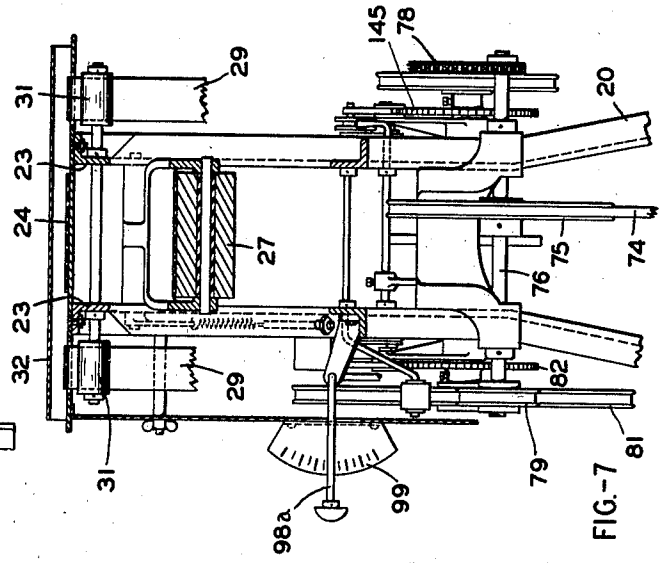


FIG.-7

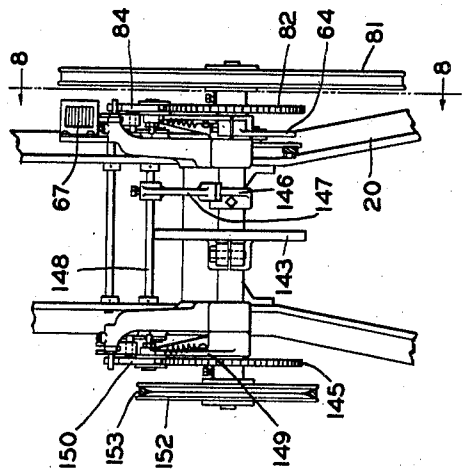


FIG.-6

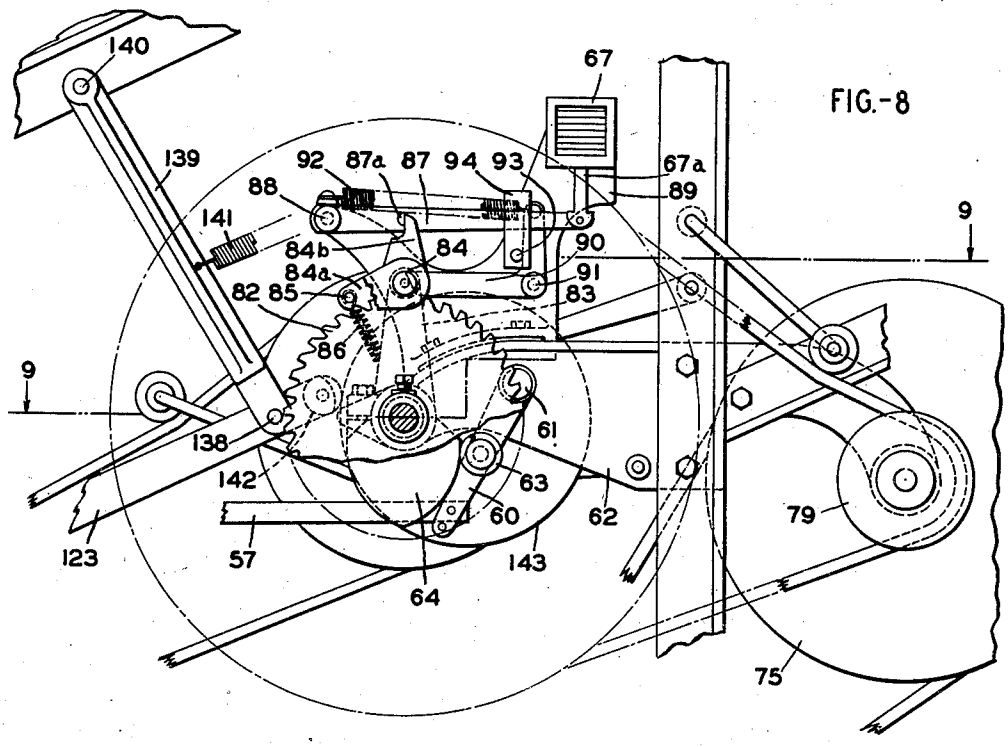
INVENTOR
HUGH W. GABBERT
BY Hyde and Mezger
ATTORNEYS

May 5, 1942. H. W. GABBERT 2,282,126

FOLDING AND STACKING MACHINE

Filed June 24, 1940 5 Sheets-Sheet 3

FIG.-8



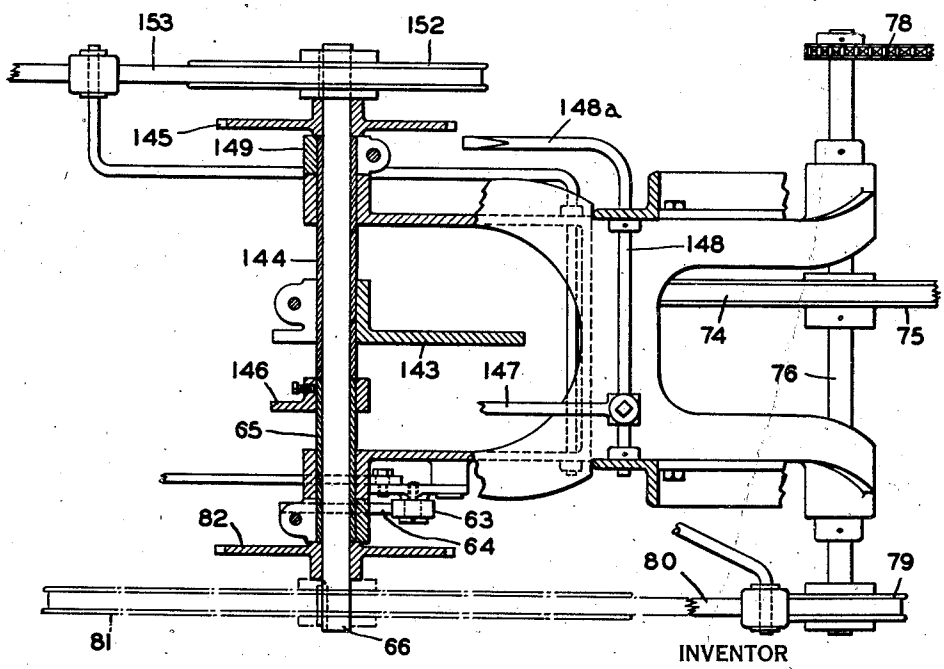


FIG.-9

INVENTOR
HUGH W. GABBERT
BY Hyde and Meyer
ATTORNEYS

May 5, 1942. H. W. GABBERT 2,282,126

FOLDING AND STACKING MACHINE

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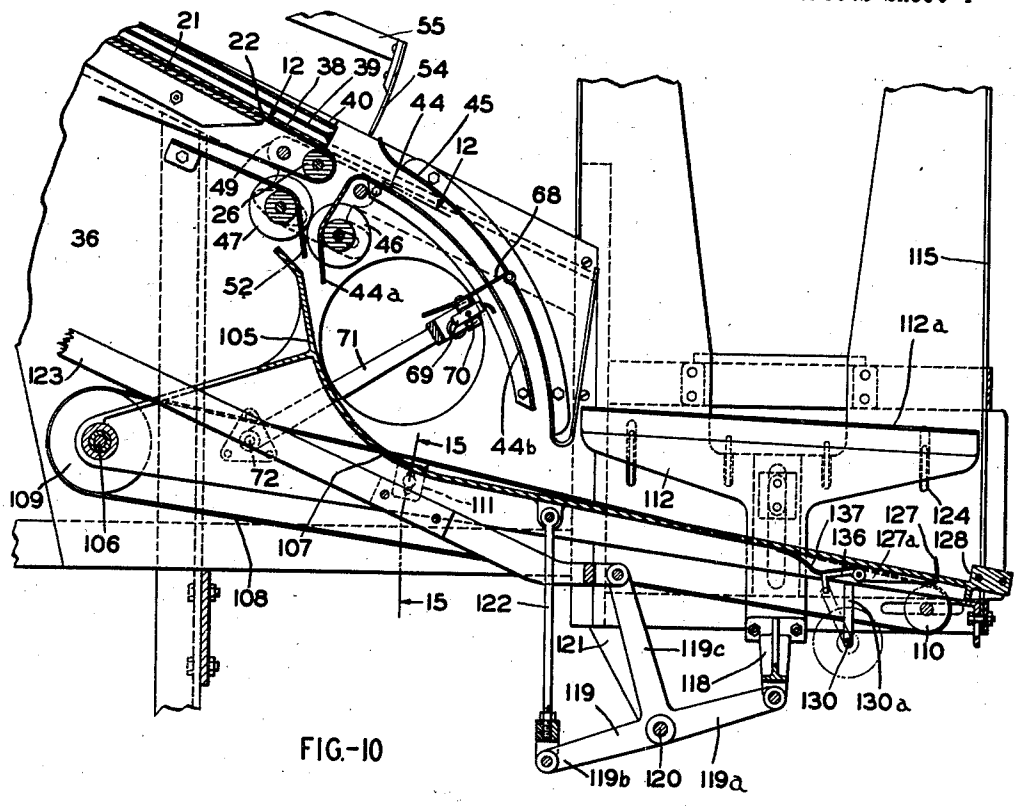


FIG.-10

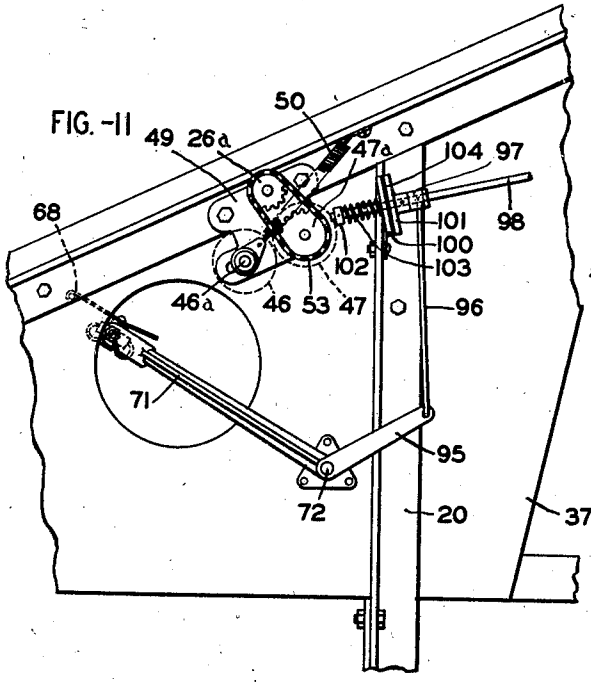
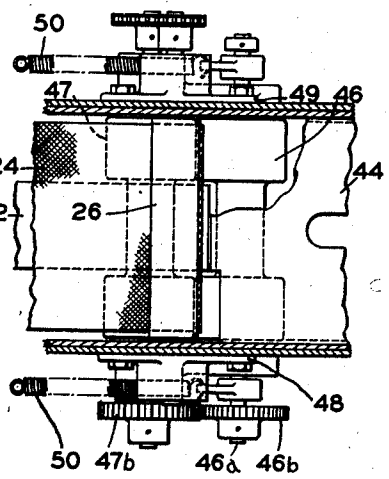


FIG.-11

FIG.-12



INVENTOR
HUGH W. GABBERT
BY
Hyde and Meyer
ATTORNEYS

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FOLDING AND STACKING MACHINE

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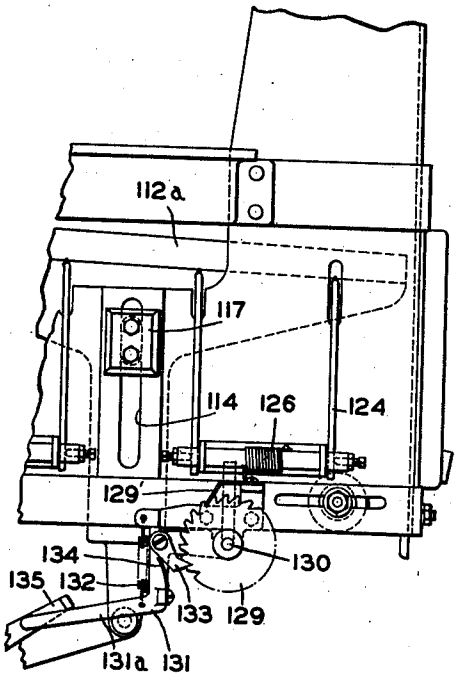


FIG.-14

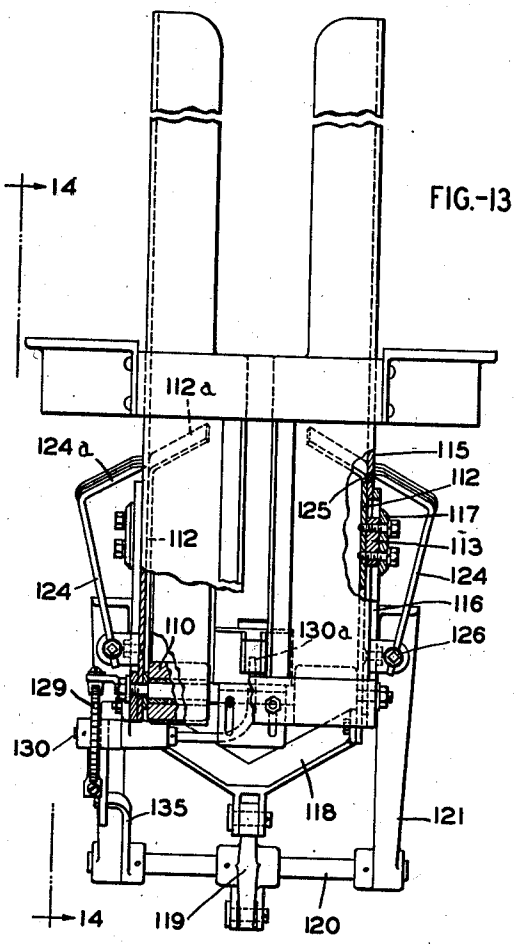


FIG.-13

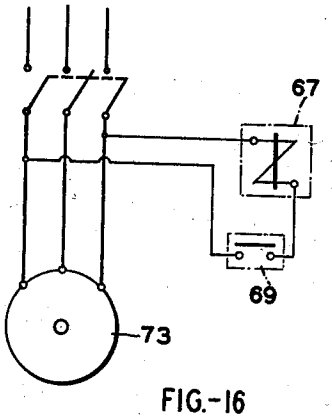


FIG.-16

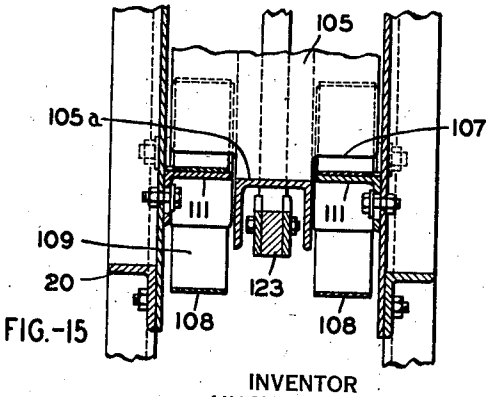


FIG.-15

INVENTOR
HUGH W. GABBERT
BY Hyde and Meyer
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,282,126

FOLDING AND STACKING MACHINE

Hugh W. Gabbert, Norwood, Ohio, assignor to The American Laundry Machinery Company, Norwood, Ohio, a corporation of Ohio

Application June 24, 1940, Serial No. 342,045

6 Claims. (Cl. 270—66)

This invention relates to improvements in machines for folding, stacking and counting fabric articles.

One of the objects of the present invention is to provide in the minimum space a machine for folding an article longitudinally by folding wings which act upon the article as it moves through the machine. To this end certain improvements have been made in the path of travel of the article and improvements in the conveying means for feeding the article along that path.

Another object of the present invention is to provide means for longitudinally folding the article as it moves along a path, together with special arrangements of plates for folding and separating various layers of the article so that the same is delivered in a more exact and precisely folded condition.

Another object of the present invention is the provision of novel apparatus for controlling the cross folding of an article which has already been folded longitudinally.

Other objects include novel mechanism for stacking and counting the folded articles and improvements in the drive means for the folding and stacking mechanism whereby the article is acted upon in the desired sequence by apparatus which acts only when an article is passing through the machine.

Other objects and advantages of the present invention will be apparent from the accompanying drawings and specification and the essential features thereof will be set forth in the claims.

In the drawings, Fig. 1 is a side elevation of a combined folding and stacking machine embodying my invention; Fig. 2 is a fragmental sectional view taken along the longitudinal center line 2—2 of Fig. 5; Fig. 3 is an enlarged detail sectional view taken on the line 3—3 of Fig. 1; Fig. 4 is an enlarged detail sectional view taken on the line 4—4 of Fig. 1; Fig. 5 is a plan view of the machine of Fig. 1; Fig. 6 is an enlarged fragmental view of the clutch mechanism of Figs. 1 and 5, looking in the direction of the arrows 6—6 of Fig. 1; Fig. 7 is an enlarged fragmental detail view looking in the direction of the arrows 7—7 of Fig. 1; Fig. 8 is an enlarged fragmental detail view of the clutch mechanism taken substantially in the position of the line 8—8 of Fig. 6; Fig. 9 is a partial sectional view taken on the line 9—9 of Fig. 8; Fig. 10 is an enlarged sectional elevation taken on the line 10—10 of Fig. 5; Fig. 11 is an enlarged fragmental elevational view looking in the direction of the arrows 11—11 of Fig. 5; Fig. 12 is a partial sectional view taken on the line 12—12 of Fig. 10; Fig. 13 is an enlarged rear end elevation of the machine showing the stacking device; Fig. 14 is a detail view looking in the direction of the arrows 14—14 of Fig. 13; Fig. 15 is an enlarged detail sectional view of a conveyor belt adjusting mechanism taken along the line 15—15 of Fig. 10; while Fig. 16 is a wiring circuit diagram.

In the embodiment of my invention here illustrated, the entire folding and stacking mechanism is supported on the general framework 20. This framework supports a table along which the article is moved for the longitudinal folding operation and which comprises in general a plate 21 which extends from the front of the machine to the point 22 (Fig. 10) toward the rear of the machine near the cross folding apparatus. This plate or table is supported at either side by angle members 23. As best seen in Fig. 1, this table extends first upwardly at a rather steep angle to provide the necessary elevation and thereafter downwardly past the wings which produce the longitudinal folds in the article, which operation is more efficiently performed because of the steeper inclination of this portion of the machine. A conveyor belt 24 serves to carry the article through the longitudinal folding portion of the machine. This conveyor belt passes around a drive roller 25 at the front of the machine, thence over the surface of the table 21, over the roller 26 at the rear of the machine and returns over the idler rollers 27 and 28 near the front of the machine. To aid in feeding the article up the steep incline at the front of the machine, a pair of side conveyor belts 29 are provided also driven by the roller 25 passing over the surface of table 21 to the high point of the table where they pass through slots 30 to the lower side of the table and thence over rollers 31 for the return run of the conveyors. A cover plate 32 is provided to prevent the articles turning up as they pass over the peak of the table. This cover plate has a curled front edge through which passes a bar 33 which rests upon upturned wings 21*a* which are integral with or secured to the table 21.

The table or plate 21 is folded over to provide the longitudinal folding wings 21*b* and 21*c*. The wing 21*c* begins at a point midway of the wing 21*b* so that viewed from the front of the machine the action of these wings is to first fold the right side of the article over upon the center and to later fold the left side of the article over upon the first fold. The wing 21*b* is secured at its rear end to the bracket 34 and the wing 21*c* is supported at its rear end on the bracket 35. As

best seen in Figs. 3 and 4, the right-hand edge of plate 21 is bent downwardly at 21f from bracket 34 to the rear end of the machine and is bolted to a supporting plate 36 and to the angle 23 on that side of the machine channel. The left edge of plate 21 from bracket 35 to the rear end of the plate is bent downwardly as at 21g and is bolted to a supporting plate 37 and to the angle 23 on that side of the machine channel.

Riding plates are provided for separating, guiding and more securely folding the various layers of the article as it passes along the conveyor 24. Riding plate 38 is secured at its forward end to the bracket 32a which carries one end of the cover plate 32. The free end of this riding plate rests upon the central portion of the article which is engaged with the conveyor. A second riding plate 39 is secured at its forward end to the bracket 34 and rests on top of the fold formed by the wing 21b. A third riding plate 40 is secured at its forward end to the bracket 35 and rests upon the fold formed by the wing 21c. These plates extend slightly beyond the point 22 (Fig. 10) and to the point where the cross folding operation takes place. Referring again to Figs. 3 and 4, it will be seen that special form has been given the riding plates to secure the more exact folding of the article. The plate 38 has its opposite side edges bent upwardly so that this plate is of trough form. Plate 39 has its right edge bent downwardly so as to partially embrace the right-hand folded edge of the article. The plate 40 has its left edge bent downwardly so as to partly embrace the left-hand folded edge of the article.

Other plates are provided along the longitudinally folded edges of the article to closely confine it until it reaches the point where the cross folding operation takes place at which point the machine channel is widened. This keeps the article in the desired longitudinally folded position until the cross fold takes place at which time room is provided for the necessary flattening and widening of the article as the cross fold is made. The plates provided for this purpose are parallel vertical plates 41 on the right side of the machine viewed from the front and 42 on the left side of the machine. These plates are spaced properly by spacer members 43 which in turn are secured to the supporting plates 36 and 37 which define in general the channel of this portion of the machine.

At the rear end of the machine beyond the point where the cross fold is made the table for supporting the longitudinally folded article is arranged in a novel manner to conserve space and to accurately control the cross fold. As best seen in Fig. 10, at this point an auxiliary table 44 is provided between the plates 36 and 37. This plate is substantially a continuation of the table 21 and the surface of the conveyor belt 24 and curves from the point of cross fold arcuately downward toward the rear of the machine. Above the side edges of this auxiliary table are provided guide plates 45 which lie above the folded article.

The means for cross folding the article comprises the folding rollers 46 and 47 which are journalled in brackets 48 and 49 carried on the machine frame. The shaft 46a of roller 46 rides in slots in the supporting brackets and springs 50 yieldingly urge roller 46 toward roller 47 so as to permit the passage of the article between the rollers. The folding rollers are of reduced diameter in the central portion thereof as best seen in Fig. 12 and guide tongues 52 and 44a best seen in Fig. 10 guide the completely folded article through and beyond the folding rollers. The guide tongue 52 is mounted on the machine frame as shown and the guide tongue 44a is bent down from the forward edge of the table plate 44 previously mentioned. The drive for the folding rollers is best seen in Figs. 1, 11 and 12. The shaft of roller 26 (which is driven by conveyor belt 24) carries a sprocket 26a which is connected by chain 53 with sprocket 47a which is secured to one end of the shaft of roller 47. On the other end of this shaft is the pinion 47b which meshes with pinion 46b carried by the shaft for roller 46 so that the folding rollers turn in unison and in opposite directions.

The means for feeding the longitudinally folded article to the cross folding rollers comprises a folding blade 54 mounted on arm 55 which is pivotally mounted on a portion of bracket 35. A projection 35a of the bracket engages an adjustable stop 55a on the folding blade arm so as to limit downward movement of the folding blade. An arm 55b rigidly connected with the shaft which forms the pivotal mounting for arm 55 extends downwardly and is connected by spring 56 with a portion of the frame so that the folding blade 54 is biased in an upward direction. Means for actuating the folding blade is connected at the forward end of rod 57 which passes through an opening in the arm 55b and motion is transmitted from rod 57 to arm 55b through a coil spring 58 which is secured between the arm and the collar 59 on the end of the rod. As best seen in Fig. 8 the rod 57 extends to the front of the machine where it is pivotally connected to the free end of an arm 60 which in turn is pivotally mounted at 61 on a bracket 62 connected with the machine frame. On an intermediate portion of the arm is mounted a roller 63 which coacts with a cam 64 which in turn is rigidly secured to a sleeve 65 (Fig. 9) which is freely rotatable on shaft 66 which in turn is journalled in the machine frame. The drive means for cam 64 and sleeve 65 is a one-revolution clutch mechanism best shown in Fig. 8 which will presently be described. The actuation of this one-revolution clutch mechanism is controlled by the armature of solenoid 67, the energization of which is accomplished by means arranged in the path of the article as it moves along the auxiliary table portion 44 toward the rear of the machine.

This mechanism for initiating the action of the cross folding blade will now be described. Through a slotted opening 44b in plate 44 extends a movable arm 68 which is adapted to tilt a mercury switch 69 about its pivotal mounting 70 on a radius arm 71 which in turn is pivotally mounted at 72 in a bracket carried by the machine frame. The point 72 is at the center of the arc formed by the plate 44.

Means is provided for controlling the position of the arm 68 along the auxiliary table 44 so as to control the point of cross fold. This means is best shown in Figs. 5, 7 and 11. On the shaft which forms the pivot point at 72 is provided an arm 95 which is connected by a link 96 with an arm 97 which in turn is rigidly mounted on rod 98 which extends toward the front of the machine and is there bent outwardly as shown at 98a to form a handle. An index plate 99 is provided adjacent the handle. By rotation of the rod 98 the arm 71 and the arm 68 are placed in any desired position. Friction means is provided so that this arm may be held in any one of a multi-

plicity of positions. This means comprises a friction disk 100 fixed to the machine frame and a disk 101 rigidly mounted on rod 98. Between disk 100 and collar 102 on the end of rod 98 is a spiral spring 103 which yieldingly urges disk 101 toward disk 100. A surface of suitable friction material 104 preferably of rubber or leather is provided between the engaging faces of disks 100 and 101.

Referring to Fig. 16, it will be seen that the closing of the mercury switch 69 completes the energization of the solenoid 67 which is in circuit with the electrical supply lines for the machine driving motor 73 so as to initiate actuation of the clutch mechanism of Fig. 8. The drive for the folding apparatus is as follows: Motor 73 which is carried by the frame of the machine is connected by driving belt 74 with a pulley 75 on shaft 76 which is suitably journalled in the frame. A sprocket 77 on shaft 76 is connected by chain 78 with a sprocket 25a on the shaft of the conveyor drive roller 25. A pulley 79 on shaft 76 is connected by belt 80 with a pulley 81 on shaft 66. Keyed or pinned on shaft 66 is the toothed wheel 82 which therefore rotates continuously. The one-revolution clutch mechanism of Fig. 8 comprises an arm 83 rigidly secured to sleeve 65 and in the present instance integral with the cam 64. A latch member 84 is pivotally connected to the free end of this arm. This latch member comprises portions 84a and 84b. 84a has a bifurcated end which supports a pin 85 adapted to engage between the teeth of wheel 82 and biased toward engagement by the spring 86. The pin 85 is normally held out of engagement with the wheel teeth by means of a stop 87a on arm 87 which engages the portion 84b of the latch member. The arm 87 is pivotally mounted at 88 on a bracket 89 which also supports the solenoid 67. The armature 67a of the solenoid is pivotally connected to the free end of arm 87. When the leading end of the longitudinal folded article actuates switch 69 and energizes solenoid 67 the armature 67a is lifted so as to disengage the stop 87a from the latch member 84 which permits the pin 85 to engage between the teeth of wheel 82. The continuously rotating wheel then carries arm 83 and cam 64 through one revolution so as to actuate the folding blade 54 through arm 60, rod 57 and arm 55b. This causes downward movement of blade 54, feeding the longitudinally folded article between the cross folding rolls. As soon as the article is moved out of engagement with the arm 68 the switch 69 is so constructed that it returns to its circuit-opening position thus deenergizing solenoid 67. The armature 67a therefore drops bringing stop 87a into the path of the latch member portion 84b so that when it has made one revolution the latch member strikes the stop and lifts the pin 85 out of engagement with the wheel 82.

Because of the pivotal connection between the latch member 84 and the arm 83 reverse motion of arm 83 is possible which might again result in engagement of the pin 85 with the wheel 82. Means is provided to prevent this comprising a stop 90 which is pivotally mounted on the bracket 89 at the point 91. This stop is yieldingly held by a spring 92 against a limiting pin 93 which is carried by a guide 94 which guides the motion of lever 87. In this position the stop 90 lies back of the pin connection of the latch member 84 with the arm 83. As this pin connection moves in a counterclockwise direction as viewed in Fig. 8 during its one revolution, the stop 90 is free to move in a clockwise direction permitting the parts to reach the position of Fig. 8 when the stop 90 drops in the position there shown and prevents any counterclockwise movement of arm 83.

The stacker mechanism comprises a combined chute and stacker plate 105 best seen in Fig. 10 which is carried by a frame structure which is mounted to freely oscillate about the shaft 106 supported by the machine frame. The plate 105 at its forward and upper end is substantially the full width of the folding machine channel so as to receive a folded article. At the point 107 (Figs. 10 and 15) the plate narrows and from there to the rear end of the plate the portion 105a extends between a pair of conveyor belts 108. These belts at their forward ends pass around pulleys 109 which rotate with shaft 106 and at their rearward ends pass around rollers 110 which are adjustably supported in the stacker frame. The conveyor belts intersect the plane of the plate 105 at an angle, the conveyor belts lying above the plane of the plate at the point 107 and lying below the plane of the plate at the rear end of the stacker. The purpose of this arrangement is to provide a positive movement of the article as it enters the stacking apparatus and the driving force of the conveyor belts is gradually relieved as the article approaches the end of its movement along the stacking plate. Means is provided for varying the angularity of the delivery run of the belts 108 relative to the stacker plate. The means here shown comprises a pair of angles 111 adjustably mounted on the plates 36 and 37. Lifting the belts at this point extends their carrying effect farther into the stacking device. This may be desirable in the case of heavier and stiffer articles. When the articles are lighter it may be desirable to lower the belts so as to avoid any tendency to crumple the article as it moves into the stacker against the end stop.

Means is provided for supporting a pile of stacked articles above the free end of the stacker plate 105. This means comprises a pair of vertically extending plates 112 on opposite sides of the pile and mounted for vertical reciprocation. The plates 112 are guided by blocks 113 which move loosely in slots 114 which extend through the stack housing 115 and registering slots in the housing support 116. The blocks 113 have larger cover blocks 117 on their outer faces to hold the plates 112 in position.

Means to provide for reciprocating the stack holding plates 112 downwardly as the free end of stacker plate 105 moves upwardly so that the individual movement of each of these portions of the stacker device is half of that which would be required of the stacker plate if it alone were required to move the folded article to position above the supporting plates 112. To this end the plates 112 are carried by a yoke 118 which is pivotally connected at its lower end to an arm 119a of a T-shaped member 119 which is pinned to a shaft 120 which in turn is journalled in brackets 121 connected with the frame. Another arm 119b is connected by the link 122 with the stacker plate 105. A third arm 119c is pivotally connected with a rod 123 which extends to the forward end of the machine and is there connected with actuating mechanism to be later described.

To prevent oscillation of the pile of stacked

articles each time a new article is added to the bottom of the pile, I provide auxiliary stack holding arms 124 which take over the job of holding the pile of stacked articles each time the arms 112 move downwardly from their uppermost position shown in Fig. 13. It will be noted that the upper ends of the arms 112 are bent inwardly at 112a which serves several purposes. As the folded article is moved above the arm portions 112a by movement of the stacker plate the inwardly and upwardly inclined surfaces of the portions 112a guide the article smoothly past the arms 112 and into the stack. At the same time they cam the auxiliary arms 124 outwardly as will presently appear. These auxiliary arms have prongs 124a which enter through suitable openings 125 in the housing 115 so that the prongs engage against the arms 112 and are yieldingly urged inwardly by coil springs 126. Thus when the arms 112 move down the prong portions 124a slide inwardly along the arm portions 112a beneath the lowest article in the stack and remain there until the arm portions 112a again return to their uppermost position at which time the prongs 124 are again cammed outwardly and the stack is again supported by the arm portions 112a. Referring to Figs. 10 and 14, it will be noted that the upper edges of the arm portions 112a slope downwardly and toward the rear in such a fashion that they are substantially alined with the plane of the stacker plate when the plate 105 and the arm portions 112a pass each other in opposite directions at the time a new article is placed at the bottom of the stack.

Means is provided for counting the articles in the stack and marking the stacked articles in numbered groups by positioning an article out of line with the rest of the stack. To this end a stop 127 normally extends upwardly through a suitable opening in plate 105 and most of the articles are stopped against the member 127. At predetermined intervals this stop is moved downwardly permitting one article to move against the end stop 128 thus causing one article to extend beyond the normal line of the stack. The mechanism for accomplishing this is best seen in Figs. 10 and 14. A ratchet wheel 129 is rotatably mounted on the outside of the stacker frame on a shaft 130. A generally Z-shape lever 131 is mounted for free oscillation on the shaft 130 and is biased in upward position by means of spring 132. Pivotally mounted on the lever 131 is a ratchet pawl 133 urged by the flat spring 134 into engagement with the ratchet wheel. The arm 131a of the lever 131 extends into engagement with an arm 135 which is rigidly attached to shaft 120 which oscillates each time the stacker plate is reciprocated. The motion of lever 131 at each operation of the stacker is sufficient to move the ratchet wheel one tooth. A detent 129' holds the ratchet wheel against retrograde movement. The inner end of shaft 130 is bent upwardly at 130a at right angles to the portion of the shaft 130 upon which the ratchet wheel is mounted. Thus the end 130a moves in a circle by increments as the ratchet wheel advances one tooth at a time. In one position of the shaft 130 shown in dot-dash lines in Fig. 10 it lies beneath a finger 136 which is a rigid extension of the arm 127a which carries the stop 127. Thus when the shaft 130a is in the dot-dash position of Fig. 10 when the stacker plate returns to its lowermost position the finger 136 is moved in a clockwise direction against the bias of flat spring 137 causing clockwise movement of stop 127 below the top surface of plate 105 permitting one article to move beyond that point and against the stop 128. After the next stacking operation the shaft 130a has moved out of engagement with the finger 136 and the next article strikes the stop 127 as before. Thus each group of articles is counted and marked in a manner determined by the number of teeth in the ratchet wheel 129.

Mechanism is provided for actuating the stacker plate 105 and the arms 112 in timed relation to the movement of the folding blade 54 each time an article passes through the machine. Some time is consumed in the travel of the article from the cross folding rollers 46 and 47 to position in the stacking device and therefore some mechanism is required to delay the operation of the stacking device after the operation of the folding blade 54 to permit this time for article travel. Referring to Figs. 1, 8 and 9, the rod 123 which actuates the stacker mechanism extends forwardly in the machine where it is pivotally connected at 138 to an arm 139 which is pivotally supported on the machine frame at 140. A spring 141 biases the arm in a direction to return the stacker plate to its lowermost position. The arm 123 extends beyond the pivot point 138 and supports a roller 142 which coacts with a cam 143 which is rigidly mounted on the sleeve 144 (Fig. 9) which is freely rotatable on the shaft 66. Rotatable with the shaft 66 is a toothed wheel 145 which is in all respects similar to the wheel 82 previously described in connection with the folding mechanism. Rigidly fastened to the sleeve 65 is a cam 146 which is adjusted to a predetermined position relative to the cam 64 which controls the cross folding blade 54. This cam 146 actuates an arm 147 which is rigidly fastened to a shaft 148 suitably journalled in the frame. One end of this shaft at 148a is bent at right angles and is adapted to initiate the action of a one-revolution clutch mechanism in exactly the same manner as the solenoid 67 initiates the action of the mechanism shown in Fig. 8. This duplicate mechanism is best seen in Fig. 1 and comprises an arm 149 rigidly fastened to the sleeve 144 and carrying a latch mechanism 150 exactly like the latch mechanism 84 previously described. This normally engages a stop on the arm 151 which performs the same functions as the arm 87 previously described. Since the other parts of this clutch mechanism are all exactly similar to those already described in connection with Fig. 8, it is thought further description here is unnecessary. A pulley 152 rotatable with shaft 66 is connected by belt 153 with a pulley 154 on shaft 106 and serves to drive the conveyor belts in the stacker.

The operation of the stacker mechanism is as follows: The cam 146 oscillates lever 147 a predetermined time after cam 64 has caused an operation of the folding blade 54. This oscillates the portion 148a of shaft 148 causing arm 151 to remove the stop from the latch mechanism 150. This causes the latch mechanism to latch the arm 149 to the toothed wheel 145 and cause one revolution of the sleeve 144 and cam 143 which moves the rod 123 rearwardly causing oscillation of the T-shape member 119 in a clockwise direction as viewed in Fig. 10 so as to raise the stacker plate 105 and to lower the stack supporting arms 112 causing a movement of an article into the stack. Further movement of the cam 143 permits the spring 141 to return the stacker plate to its lowermost position while

moving the arms 112 to their uppermost position.

What I claim is:

1. Folding apparatus comprising an article conveyor, a folding plate arranged in the path of article movement for folding a side portion of said article over upon another portion of said article along a line substantially parallel to the path of article movement, a plate independent of the folding plate and adapted to ride upon said folded portion of the article, and said riding plate having a longitudinal edge bent to at least partially embrace said article along said fold line.

2. Folding apparatus comprising a conveyor for moving an article along a path, means for folding said article longitudinally by movement of said article, blade means located along said path and beyond said first named folding means for cross folding said article, substantially parallel walls closely engaging the longitudinal edges of said longitudinally folded article, and walls more widely spaced on the sides of said path of article movement at and beyond said blade means.

3. Combined folding and stacking apparatus comprising means for folding an article, operating means therefor including a one-revolution clutch mechanism, means for stacking a folded article positioned to receive an article from said folding means, operating means for said stacking means including a one-revolution clutch mechanism, and an operative connection between said clutch mechanism including a cam for initiating operation of said second named clutch mechanism a predetermined time after operation of said first named clutch mechanism.

4. Folding apparatus comprising an article conveyor, a plurality of article folding plates in the path of article movement for successively folding side portions of said article over upon the central portion thereof, cross folding means located along said conveyor and beyond said folding plates, and a plate adapted to ride upon the top of said article between said folding plates and said cross folding means.

5. Folding apparatus comprising a conveyor for moving an article along a path, means for folding the article longitudinally by movement of said article, table means extending beyond said conveyor and curving arcuately downward, means located beyond said longitudinal folding means for cross folding said article, means controlling said cross folding means including an arm pivoted substantially at the center of said arc and having its free end located in the path of an article moving on said table means, and means controlling said arm and extending to the feed end of said conveyor.

6. In a combined folding and stacking apparatus providing in a single unit a conveyor for moving an article along a path, providing means along that path for cross folding said article and providing means in line with that path for stacking the folded articles, the new feature of an article supporting table in said path between said cross folding means and said stacking means, said table being curved downwardly to accommodate long articles while holding the overall length of said unit to a minimum.

HUGH W. GABBERT.