

Oct. 24, 1939.

E. N. NECKEL

2,177,262

FOLDING MACHINE

Filed Nov. 27, 1936

5 Sheets-Sheet 1

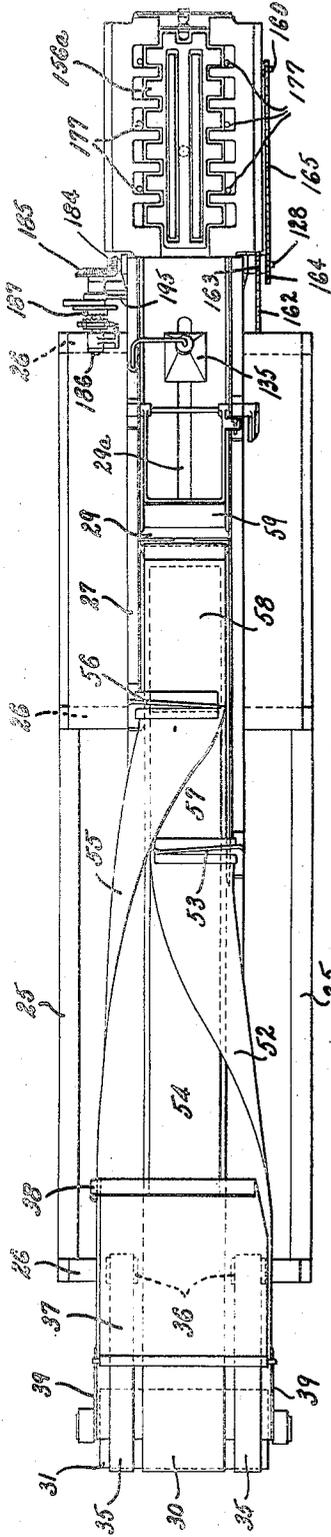


FIG. - 1

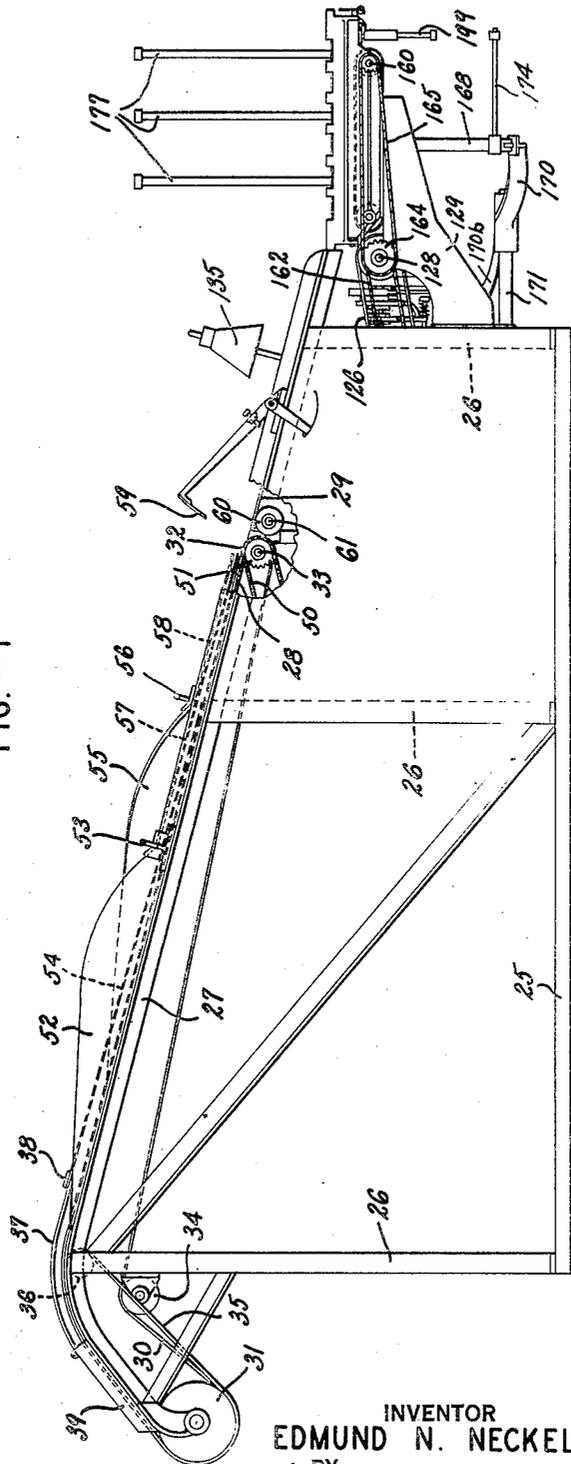


FIG. - 2

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5 Sheets-Sheet 2

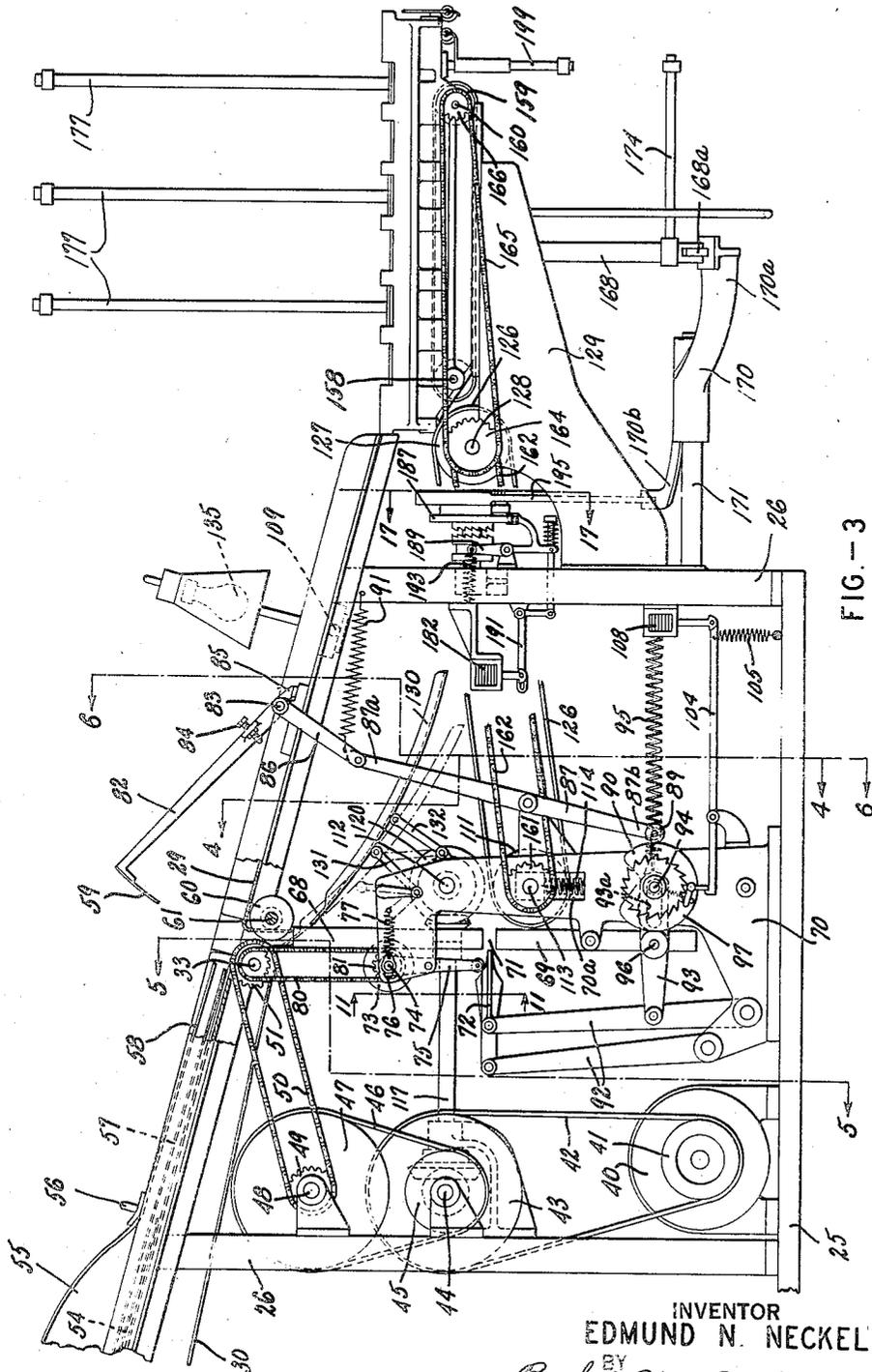


FIG. -3

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5 Sheets-Sheet 3

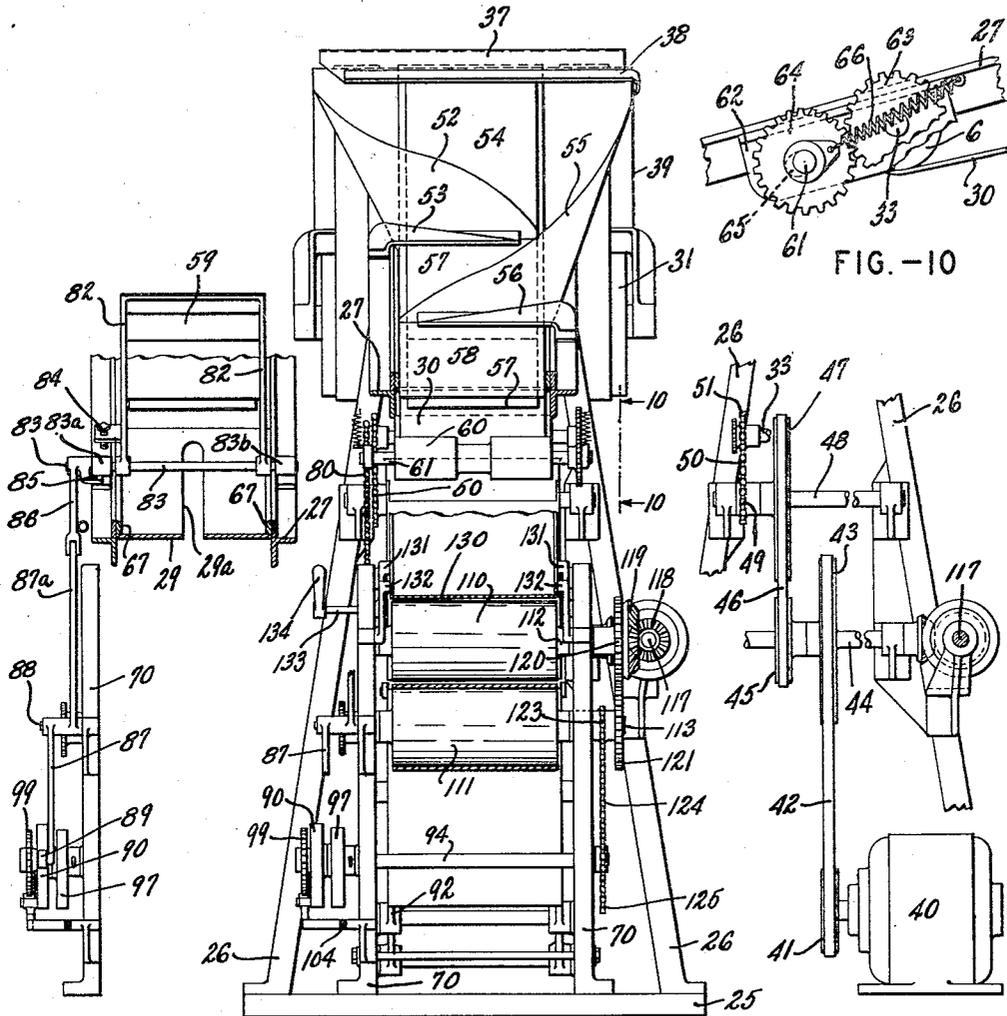


FIG. -6

FIG. -4

FIG. -5

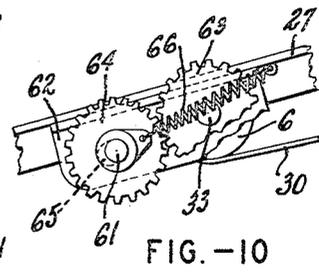


FIG. -10

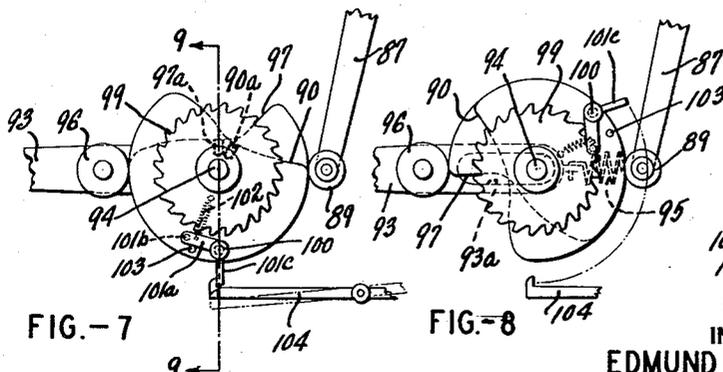


FIG. -7

FIG. -8

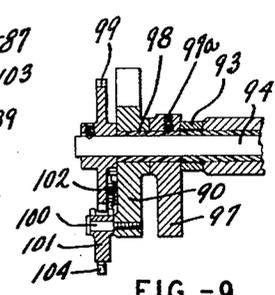


FIG. -9

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5 Sheets-Sheet 4

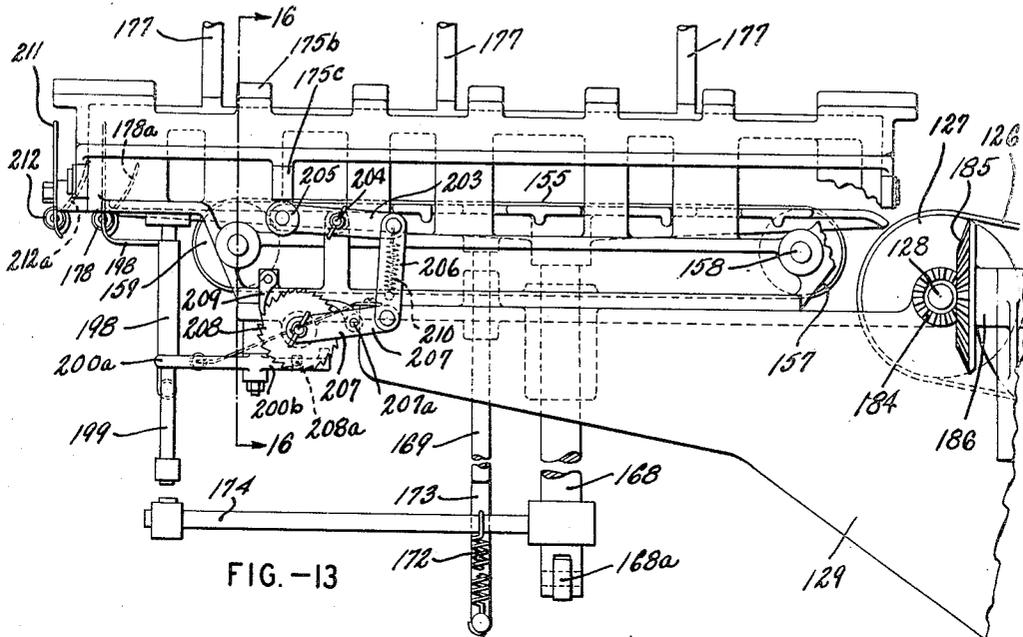


FIG. -13

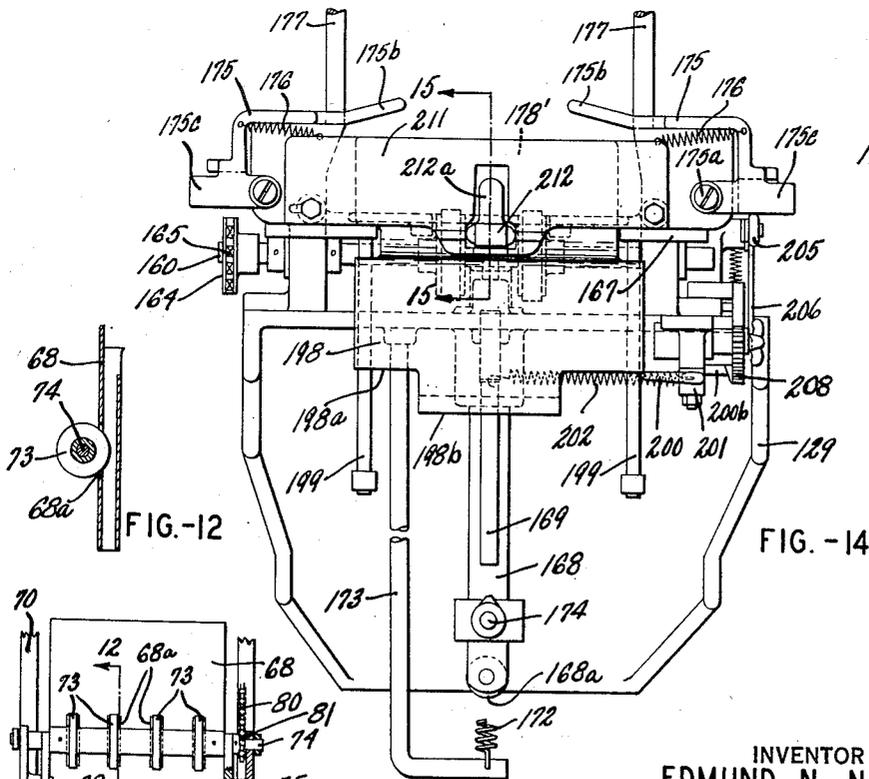


FIG. -14

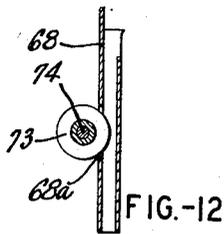


FIG. -12

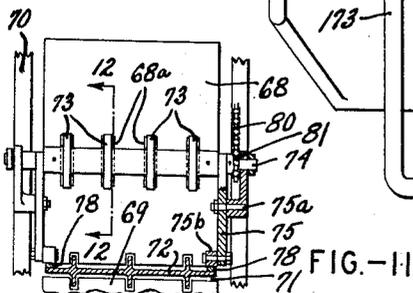


FIG. -11

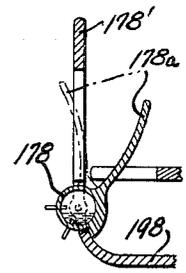


FIG. -15

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UNITED STATES PATENT OFFICE

2,177,262

FOLDING MACHINE

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Application November 27, 1936, Serial No. 113,046

7 Claims. (Cl. 270—66)

This invention relates to improvements in folding machines and deals more particularly with the type of machine for folding fabric articles such as towels, pillow slips, and the like.

5 One of the objects of the present invention is to provide novel folding apparatus for producing a plurality of folds in an article passing through the machine.

Another object of the present invention is to provide mechanism for producing a plurality of folds which occur in timed relation to the passage of the article through the machine and in which the initiation of the operation of the folding mechanisms occurs simultaneously and automatically upon a portion of the article passing a certain point in its travel through the machine.

15 My invention also includes novel operating and control mechanisms for producing the novel results above set forth, including novel arrangements of the folding blades and actuating mechanisms therefor, novel adjusting means for adapting the mechanism to handle various length articles, novel guiding and speed controlling means operable upon the article as it passes through the machine, all as described in the specification and illustrated in the drawings and defined in the appended claims.

20 My invention also includes novel features in a stacking mechanism for receiving articles from the folding machine and arranging them in stacked relation, but claims to this stacking mechanism will be found in a divisional application.

In the drawings, Fig. 1 is a plan view of a machine embodying my folding and stacking mechanisms;

Fig. 2 is a side elevation of the machine of Fig. 1;

Fig. 3 is an enlarged fragmental side elevation, the side panels of the housing being removed to expose the driving mechanism;

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a fragmental transverse section taken on the line 5—5 of Fig. 3, showing the arrangement of the drive;

Fig. 6 is a fragmental section taken on the line 6—6 of Fig. 3, showing a portion of the folding blade operating mechanism;

Fig. 7 is an enlarged fragmental side elevation of the mechanism for controlling the cross folding operations, the mechanism here being shown in inoperative position;

Fig. 8 is a view similar to Fig. 7 showing the

mechanism during operation and just prior to the production of the second cross fold;

Fig. 9 is a sectional view on the line 9—9 of Fig. 7;

Fig. 10 is an enlarged fragmental detail view of the drive for the first cross fold rollers taken from a position indicated by the line 10—10 of Fig. 4;

Fig. 11 is a fragmental view in elevation taken on the line 11—11 of Fig. 3, certain parts being shown in section;

Fig. 12 is a sectional view on the line 12—12 of Fig. 11;

Fig. 13 is an enlarged side elevation of a stacking mechanism showing the side opposite to that shown in Fig. 3;

Fig. 14 is a rear elevation of the stacking mechanism;

Fig. 15 is an enlarged fragmental sectional view of one of the mercury switches and its associated parts taken on the line 15—15 of Fig. 14;

Fig. 16 is a sectional view of the stacking mechanism taken on the line 16—16 of Fig. 13;

Fig. 17 is an enlarged sectional view taken on the line 17—17 of Fig. 3;

Fig. 18 is a view taken from the left side of the mechanism of Fig. 17, parts of the mechanism being shown in section;

Fig. 19 is a sectional view taken on the line 19—19 of Fig. 18;

Fig. 20 is a profile of the teeth of the clutch members; and

Fig. 21 is a diagram of the wiring circuit for the machine.

The machine illustrated comprises a general framework having longitudinally extending base members 25, uprights 26, and top longitudinally extending frame members 27 which slope downwardly from the feed end of the machine at an angle of approximately 15° to the horizontal. All of these are rigidly fastened together and suitably cross braced to form a supporting structure for the rest of the mechanism. Supported on the members 27 are table plates 28 and 29 along which an article to be folded is adapted to slide. The portion of table plate 28 toward the front or feed end of the machine overhangs the forward end of the framework where it slopes downwardly toward the operator to provide for easier feeding operations.

Conveyor belts assist in the feeding of articles to the folding machine and in the conveyance of the article over the table plate 28. These belts comprise a central belt 30 passing around an idler pulley 31 suitably supported at the feed

end of the machine and at its other end passing about a roller 32 rigidly mounted on shaft 33 by which the roller is driven so as to drive belt 30. The lower run of belt 30 is supported on an idler pulley 34. Side conveyor belts 35 pass about the pulley or roller 31 and along the upper surface of the forward sloping portion of plate 28 until they reach the crown of the conveyor, at which point these belts pass down through slots in plate 28 and about idler rollers 36 from whence they return to roller 31. The crown portion of the conveyor has a cover plate 37 for guiding articles over the crown and for preventing them falling back on the downwardly sloping forward portion of the feed belts. This crown plate is supported at one end on bracket 38 secured to the frame and at its forward end rests on the side guide and shield plates 39.

The drive for shaft 33 and roller 32 is best seen in Figs. 3 and 5. Motor 40 mounted in the lower part of the frame drives pulley 41 which by means of belt 42 drives a pulley 43 on cross shaft 44. This latter shaft is suitably supported in brackets on the frame. Another pulley 45 rotatable with shaft 44 is connected by means of belt 46 with pulley 47 which is rigidly fastened to shaft 48 which is a second cross shaft suitably journaled in brackets on the frame. A sprocket 49 rotatable with shaft 48 is connected by drive chain 50 with sprocket 51 on shaft 33. As an article is carried by belt 30 downwardly along plate 28, the right hand longitudinally extending side edge as viewed in Fig. 1 is first engaged by a folding plate 52, supported by bracket 53, which folds the right longitudinal third of the article over upon the central third thereof. This fold is prevented from engaging the central third of the article by being folded over upon a separating plate 54 which is secured to bracket 38 and rides at its other end upon the article moving along the conveyor belt. As the article progresses along the conveyor the left hand longitudinal edge as viewed in Fig. 1 engages folding plate 55 which is formed in such a manner as to fold the left longitudinal third of the article over upon the already once folded article. Folding plate 55 is supported by bracket 56. Plate 54 ends substantially at bracket 56 permitting the two lower layers of the article to come in contact. A second separating plate 57 supported at one end by bracket 53 extends downwardly along the conveyor in position to rest upon the two lower layers of the article and to hold the upper or left third of the article out of contact with the two lower layers until the article reaches roll 32. A third plate 58 in the nature of a riding plate is connected at its upper end to bracket 56 and at its lower end rides upon the twice folded article. These plates 54, 57 and 58 also serve to maintain the article in frictional contact with belt 30 during the passage over plate 28.

For forming the first cross fold in the article it is fed past roller 32 onto table plate 29 and thereafter a folding blade 59 engages the article at a point determined by a previous manual setting and feeds a portion of the article downwardly between roll 32 and roll 60 which is parallel thereto and driven at the same speed. This roll 60 is carried by shaft 61 which, together with shaft 33, is mounted in suitable bearing brackets 62, that on the far side of the machine being shown in Fig. 10. Gear 63 rigid with shaft 33 engages gear 64 rigid with shaft 61 and the teeth of these gears are arranged to permit a

slight amount of relative separating movement between them while retaining the teeth in mesh. This relative separating movement is necessary to accommodate a folded article passing between rollers 32 and 60. To permit such movement shaft 61 is movable in a slot 65 in bracket 62. Shaft 61 is biased toward shaft 33 by a spring 66 secured to a collar on shaft 61 at one end and to the frame of the machine at its other end. As best seen in Fig. 6, longitudinally extending guide strips 67 are secured to the side portions of the frame just above plate 29 to limit the width of the longitudinally folded article. After the article has passed between rollers 32 and 60 it is flattened out to the desired dimension.

After the article leaves the first set of cross folding rollers 32 and 60 it passes into a pair of vertically alined chutes 68 and 69 which are held in position by suitable frame members 70. These chutes are spaced to provide an opening between them at 71 where the article may be engaged by a second cross fold blade 72 when it reaches the proper position.

Means is provided for controlling the speed and position of the article moving through chute 68 so that it reaches the opening 71 at substantially a definitely timed period after leaving the first set of cross folding rollers. It is obvious that the article would fall rapidly through the chute 68 unless its passage therethrough were retarded and in so doing the article might get out of vertical position or might become wrinkled or distorted. The means provided at this point is best illustrated in Figs. 3, 11 and 12. A set of rollers 73 is rigidly mounted on a shaft 74 which is supported at its opposite ends in a pair of levers 75 which are pivotally mounted at 75a in the frame members 70. Shaft 74 is guided for substantially horizontal movement in slots 76 in the frame members 70 and is biased toward chute 68 by springs 77, one end of which is secured to collars on shaft 74 and the other end secured to the frame. The rollers 73 normally enter through slots 78a in the front wall of chute 68 as shown in Fig. 12 so as to engage an article passing through the chute and hold it against the rear wall of the chute. Shaft 74 may be oscillated to relieve the pressure of rollers 73 against an article in the chute in timed relation to the movement of blade 72. To this end blade 72 as shown in Fig. 11 is provided with blocks 78 which are adapted to engage rollers 75b on the lower end of levers 75 as blade 72 moves in fold producing direction. This causes the upper end of levers 75 to move in a counterclockwise direction as viewed in Fig. 3 and temporarily holds the rollers 73 out of engagement with the article in chute 68. Rollers 73 are given the same peripheral speed as the conveyor belt has passing over roller 32. This is accomplished by arranging a suitable drive sprocket 79 on shaft 33 which is connected by drive chain 80 with sprocket 81 on shaft 74.

Each of the cross folding blades 59 and 72 is biased in folding direction by spring means and the operation of these blades during their folding action is controlled by a pair of cams arranged to produce operation of blade 72 a predetermined time after blade 59 depending upon the setting of the cams by the operator. The cams are adapted to be connected to a constantly rotating shaft by means of a one-revolution clutch device and the operation of the clutch device is initiated upon the leading edge of the

article passing along table 29 passing a suitable trip device. This mechanism will now be described.

Blade 59 is supported on arms 82 (Figs. 3 and 6) which are fixed to shaft 83 suitably mounted on bearings 83a and 83b. An adjusting screw 84 limits the movement of blade 59 toward the bite of the rolls and a projection 85 limits the movement of the blade away from the rolls. Rigid with shaft 83 is an arm 86 which is pivotally connected to the arm 87a of a lever 87 which is pivotally mounted on the frame at 88. The arm 87b of this lever carries a follower 89 which is adapted to engage a cam 90. Spring 91 connected between lever 86 and the frame biases blade 59 toward the folding rolls and biases follower 89 toward the cam 90.

Folding blade 72 is supported by arms 92 in what is substantially a parallel ruler arrangement so as to give blade 72 substantially a horizontal movement. Pivotally connected to one of the arms 92 is a link 93 having a slotted portion 93a through which passes shaft 94 so that this shaft guides the movement of link 93. A spring 95 secured between the end of link 93 and the frame biases link 93 toward the right as viewed in Fig. 3. Rotatably mounted on link 93 is a follower 96 which engages cam 97 and is held in such engagement by spring 95.

Referring now to Figs. 7, 8 and 9 in connection with Fig. 3, the operation of the cams will be described. The shaft 94 is constantly rotated by means hereinafter described and a one revolution clutch arrangement is provided for coupling the cams for rotation with shaft 94 for a single rotation whenever an article passing through the machine is to be folded. Rotatably mounted on shaft 94 is a bushing 98 to which cams 90 and 97 are rigidly secured by set screws 90a and 97a so that the two cams are rotatable as a unit but may be adjusted relative to each other to accommodate articles of various length in the machine. Rigidly secured to the end of shaft 94 is a ratchet gear 99. Projecting from the outer face of cam 90 is a pin 100 on which is rotatably mounted a pawl 101 having one arm 101a carrying a projection 101b adapted to engage the teeth of ratchet gear 99. This arm 101a is biased toward gear 99 by a spring 102, one end of which is fixed to cam 90 and the other end of which is fixed to arm 101a. A pin 103 limits the movement of this arm in an outward direction. The pawl has an arm 101c by which the pawl is normally held out of engagement with gear 99 when the pawl is engaged with a shoulder on lever 104 as shown in full lines in Fig. 7. This lever is pivotally mounted on the frame intermediate its ends and normally held in the full line position of Fig. 7 by a spring 105. A solenoid 108 when actuated moves the lever 104 to the dot-dash position of Fig. 7. The control for solenoid 108 is a light-sensitive cell 109 positioned adjacent table plate 29, the operation of which will be later described.

Upon the movement of lever 104 to the dot-dash position of Fig. 7, pawl 101 is released whereupon it moves under the bias of spring 102 in a clockwise direction engaging the projection 101b with one of the teeth of the rotating gear 99, thereupon the cams 90 and 97 rotate in unison with the shaft 94. Follower 89 almost immediately passes along the depressed portion of cam 99 permitting oscillation of lever 87 and arms 86 and 82 in a direction to produce folding action of blade 59 under the influence of spring 91. Upon completion of this folding operation cam 90 again

returns the parts to the position shown in Figs. 3 and 7. The rotation of shaft 94 and the two cams in Figs. 7 and 8 is in a clockwise direction. When the parts have moved from the position of Fig. 7 to that of Fig. 8 follower 96 is just ready to engage the depressed portion of cam 97 permitting link 93 to be moved toward the right as viewed in Fig. 3 under the influence of its spring 95. This will cause folding action of blade 72. The setting of the cams illustrated in Figs. 7 and 8 is for the maximum length article accommodated on the machine. Since the energization of solenoid 108 is instantaneous as will later appear, lever 104 returns to the position of Fig. 8 almost at once so that arm 101c engages against lever 104 upon completion of one revolution of the cams thus causing counterclockwise movement of pawl 101, disengaging projection 101b from gear 99.

The operation of the blade 72 moves the article in gap 71 between the folding rollers 110 and 111. These rollers are rigid with shafts 112 and 113, respectively, which are suitably journaled in frame members 70. The bearings for shaft 113 are slidable in slots 70a and biased upwardly by springs 114. The drive for these rollers is best illustrated in Figs. 3, 4 and 5. On shaft 44 a beveled gear 115 engages beveled gear 116 on shaft 117 which extends longitudinally of the frame. At the other end of this shaft a beveled gear 118 engages beveled gear 119 which is rigid with a spur gear 120 on shaft 112. Gear 120 meshes with gear 121 on shaft 113.

The drive for shaft 94 is shown in Fig. 4 as comprising a sprocket 123 on shaft 113 connected by drive chain 124 with sprocket 125 on shaft 94.

Means is provided for conducting an article folded between rollers 110 and 111 out of the machine and to a stacking device if desired. This means comprises a belt 126 passing about roller 111 at the one end and about roller 127 at the other end. This roller is rotatably mounted on shaft 128 which is carried in brackets 129 at the stacking end of the machine.

Means is provided for diverting an article cross folded once between rollers 32 and 60 directly onto the conveyor belt 126 when desired. This comprises a bypass chute 130 carried on arms 131 and 132 which in turn are pivotally mounted on frame members 70. Arms 131 are rigid with shaft 133 which is provided with a handle 134 by which the chute 130 may be moved from full line position of Fig. 3 to the dot-dash position thereof. In the dot-dash position the chute 130 enters within the walls of chute 63 as shown and will conduct an article directly from the first cross folding rollers to the conveyor 126. When in its full line position, however, the bypass chute is clear of the chute 63 at the one end and provides clearance above conveyor belt 126 to permit articles to pass thereunder.

The energization of solenoid 108 is controlled by a light sensitive cell 109 as previously mentioned. The cell 109 is located below table plate 29 and in line with a slot 29a therein. Above the table is a light source 135 adapted to play upon cell 109 through the slot 29a. This slot and the support for members 109 and 135 is arranged so that the position of these trip members may be adjusted along slot 29a to accommodate articles of different length. While folds may be produced in any desired position along the length of the article, I have chosen to illustrate my device as arranged to first cross fold the article passing over plates 28 and 29 in the middle thereof and to cross fold this article by blade 72 once again

in the middle. It will be understood, however, that other folds are possible using this machine.

The control circuit for the light sensitive cell 109 and the solenoid 108 is shown in Fig. 21. Power means L1, L2 and L3 are adapted to be connected by a switch 136 with suitable terminals of motor 40. Lines L1 and L3 are connected by wires 137 and 138 respectively to the primary of transformer 139. Light source 135 is energized from lines 137 and 138 as shown. The secondary of transformer 139 is connected to the terminals 140a of a current rectifier 140. 141 is a polarized relay having a coil 141a operating a contact member 141b. The terminal 140b of the current rectifier is connected by wire 142 with the coil of power relay 143. Wire 144 leads from this coil to the terminal 145 of the polarized relay. The terminals 140c of the current rectifier are connected by wire 146 with the terminal 147 of the polarized relay. Wire 148 connects this latter terminal with the fixed end of the contact member 141b. Light sensitive cell 109 is connected by wires 149 and 150 with the terminals for the coil of the polarized relay.

The operation of the folding machine is as follows: An article is fed onto the belts 30 and 35 at the forward end of the machine. As it passes over plate 28 it is folded by the plates 52 and 55 longitudinally of the article as previously described. So long as the cell 109 is subjected to light from the source 135 the flow of current from the cell 109 is through wire 149 to the coil 141a and through wire 150 back to the cell. This causes a deflection of the contact member 141b toward the left which connects to the dead terminal 151. When the beam of light between the cell and the light source is intercepted by the article moving over the table 29 the flow of current from the cell 109 is interrupted and contact finger 141b is moved to the right under the bias of spring 141c. A circuit is then established from contacts 140c of the current rectifier through wires 146 and 148, contact finger 141b, terminal 145, wire 144, the coil of power relay 143 and wire 142 back to the terminal 140b of the current rectifier. This energizes the power relay 143. Wire 152 supplies current from wire 137 to one of the terminals of the power relay. Wire 153 connects the other terminal of the power relay to solenoid 108, the other terminal of which is connected by wire 154 to the power line 138. Thus when the power relay 143 is energized the contact finger 143a thereof completes the circuit through solenoid 108, energizing it to trip the one-revolution clutch device previously described, thereupon the cams 90 and 97 start to rotate causing sequential operation of folding blades 59 and 72 as previously described. The setting of cam 97 is varied relative to the position of cam 90 so as to cause the operation of blade 72 at the desired time interval after the operation of blade 59, at which time the article has reached the predetermined position at the opening 71 due to the controlled travel of the article through chute 68 under the influence of rollers 73. The article after being thus twice cross-folded is carried by conveyor 126 out of the machine or to the stacking device.

The stacking mechanism is shown generally in Figs. 1 and 2 and in greater detail in Figs. 3 and 13 to 20 inclusive, and the wiring diagram of the control mechanism therefor is shown in Fig. 21.

Articles to be stacked are delivered to the stacker by the conveyor 126 or otherwise. Belts 155 carry the article to be stacked to proper position over the stacking plate 156. This plate has

longitudinally extending slotted openings to accommodate the belts 155. The belts pass over rollers 157 on shaft 158 and about rollers 159 on shaft 160. Shaft 160 is rotated so as to rotate rollers 159 and so drive the belts 155. This drive may be arranged in any suitable manner but in the embodiment shown a sprocket 161 on shaft 113 of the folding mechanism is connected by drive chain 162, to sprocket 163 on shaft 128. Another sprocket 164 on this shaft is connected by drive chain 165 to sprocket 166 on shaft 160. The shafts 158 and 160 are suitably journaled in brackets 167 which are secured to the main supporting bracket 129. The stacker plate is provided with a downwardly extending stem 168 which passes through a suitable bore in bracket 129. Rod 169 on plate 156 also passes through a suitable bore in the supporting bracket for the purpose of guiding the vertical movement of the stacker plate. This movement of the stacker plate is caused by roller 168a on the stem 168 engaging the arm 170a of a lever 170 which is pivotally mounted on the stub shaft 171 and operated in a manner hereinafter described.

The stacker plate is normally biased in its lowermost position by a spring 172 secured between the rod 173 connected with the frame and rod 174 which is carried by stem 168. Pivotaly mounted on the brackets 167 at 175a are the wing plates 175. These have fingers 175b which lie above and between fingers 156a of the stacker plate so that when the stacker plate is raised the fingers 156a may pass between the fingers 175b without engaging the same. In the operation of the stacker mechanism an article is carried by belts 155 over the stacker plate 156 which is actuated when the article is in proper position to lift the stacker plate, whereupon the upper surface of the article engages the fingers 175b and rotates the wing plates until the article has passed above the fingers 175b, whereupon the stacker plate descends and the wing plates return to the position shown in Figs. 14 and 16 under the bias of springs 176 whereupon the article remains above the fingers 175b. The stack is guided by the rods 177.

The actuating mechanism for operating the stacker plate is controlled by a mercury switch 178 located at the far end of the stacking machine. This switch is rotatably mounted in a stop member 178' and carries suitable electric contacts normally in circuit-breaking position as shown in full lines in Fig. 15, but rotatable to complete the circuit when the switch is moved to the dot-dash position of Fig. 15. The switch has an arm 178a which is engageable by an article moving thereagainst as will be readily understood. This completes a circuit as shown in Fig. 21 from line 138 through lines 179 and 180, switch 178 and line 181 to solenoid 182 and thence back through line 183 to line 137. The operating mechanism connected with the solenoid 182 is best seen in Figs. 13, 18, 19 and 20. Shaft 128 drives bevel gear 184 which meshes with bevel gear 185 on shaft 186. This is a short shaft suitably journaled in the frame and carrying a clutch member 187 freely rotatable thereon. A coacting clutch member 188 is mounted on shaft 186 for rotation therewith but for movement axially therealong. The mutually facing surfaces of clutch members 187 and 188 are supplied with serrated teeth as shown in Figs. 19 and 20. Clutch member 188 is oscillated by means of a clutch yoke 189 which has a downwardly extending arm 189a having a pin and slot connection 75

with a link 190 which in turn is connected by bellcrank 191 and link 192 with solenoid 182. A spring 190a engages between a collar on link 190 and the bifurcated lower end of branch 189a so as to take up the slack in the parts. A spring 193 normally biases the clutch members apart as shown in Figs. 3 and 19. A one-revolution clutch arrangement is provided as shown in Figs. 17 to 19 so as to cause one rotation of disk 187 each time solenoid 182 is energized. This mechanism will now be described. In the periphery of the disk 187 which includes one of the clutch members is a notch 187a into which is adapted to enter a roller 194 which is secured to the branch 189b of the clutch yoke member. A link 195 has a slot 195a through which the shaft 186 passes for the purpose of guiding the link. This link is pivotally connected with the branch 170b of the oscillating lever 170 previously mentioned which is a part of the actuating mechanism for lifting the stacker plate. A roller 196 is mounted on a pin carried by link 195. This roller is engaged by a cam 197 fastened to the disk 187 once during each revolution of the disk.

The operation of that part of the stacker mechanism thus far described is as follows: An article entering the stacker travels along the belts 155 until it engages the trip arm 178a of the mercury switch and further travel of the article moves this switch to the dot-dash position of Fig. 15 when the article strikes the stop 178'. As previously described this actuates solenoid 182 which causes upward movement of link 192, clockwise movement of bellcrank 191, movement of link 190 toward the left as viewed in Fig. 18, clockwise movement of clutch yoke 189 about its pivotal point which moves clutch member 188 into engagement with clutch member 187. Shaft 186 through the engaged clutch then drives disk 187 which is free to rotate as the oscillation of member 189 has already withdrawn the roller 194 from the notch 187a. The solenoid 182 does not remain energized throughout the rotation of disk 187 but the engagement of roller 194 with the outer periphery of disk 187 holds the clutch engaged for one revolution. When cam 197 engages roller 196, link 195 is moved downwardly, thus oscillating the lever 170 and causing upward movement of stem 168 and stacker plate 156. After cam 197 passes roller 196 the spring 172 returns the stacker plate to its lowermost position.

Means is provided for counting the articles stacked and varying the arrangement of the stacked pile of articles in a manner to indicate the number of articles in the pile. To this end an arrangement is provided whereby after a certain number of articles have been stacked the next article is placed in a slightly extending position so that it indicates a given number of stacked articles between each of the projecting articles. To this end means is provided for moving the stop member 178' out of the path of a moving article after a certain number of articles have been stacked, permitting the next article to move against a second stop member which actuates the stacker to place this particular article in projecting position in the stacked pile, after which the original stop member 178' returns to its position and the predetermined number of articles is stacked in the regular line previously established. This mechanism will now be described.

The stop member 178' is mounted on a support 193 which in turn is slidably mounted on vertical pins 199 which are carried by the brack-

ets 167. The member 198 is normally supported in the position shown in Figs. 13, 14 and 15 by the engagement of arm 200a of lever 200 beneath the shoulder 198a of the member 198. This lever is pivotally mounted on the frame at 201 and is held in the position illustrated in Figs. 13 and 14 by spring 202. The arm 200b of lever 200 is intermittently operated in accordance with a counting device. This counting device comprises a lever 203 pivotally mounted on the frame at 204 and carrying at one end a roller 205 adapted to be engaged by a projecting portion 175c of the stacker wing plate 175 at each operation thereof. The opposite arm of lever 203 is pivotally connected by link 206 with a ratchet lever 207 carrying the ratchet pawl 207a. A ratchet wheel 208 which is rotatably mounted on the frame carries on its periphery teeth adapted to coast with the pawl 207a. A detent 209 prevents retrograde movement of the wheel 208. A spring 210 holds the roller 205 in engagement with the projection 175c of the wing plate. On the wheel 208 is a cam 208a adapted to engage the arm 200b upon sufficient rotation of wheel 208 and thereby to cause movement of the arm 200a out of engagement with the shoulder 198a, at that time permitting the support member 198 of the stop member 178' to drop downwardly on the pins 199 so as to remove the stop member from the path of the article passing through the stacker. The cam 208a is of such dimensions and so arranged that upon the movement of one tooth on the wheel 208, the cam passes out of engagement with the arm 200b of the lever 200 so that the arm 200a is held out of supporting relation with respect to the shoulder 198a only during the rotation of wheel 208 corresponding to one tooth. Upon the following actuation of the stacker plate the projecting arm 174 engages a portion 198b of the support member 198 and returns the stop member 178' to its uppermost position.

A second stop plate 211 is provided outside of the stop plate 178' and similar thereto. This stop plate rotatably supports a mercury switch 212 in all respects similar to 178 and having a trip arm 212a adapted to be engaged by a moving article and rotated in a manner analogous to that described in connection with Fig. 15. This mercury switch 212 is connected in parallel with 178 as indicated in the wiring diagram of Fig. 21 and connected by suitable wires 213 and 214.

The operation of the last described mechanism is as follows: At each operation of the stacker plate, the wing plates 175 are oscillated and the projection 175c contacting roller 205 operates the pawl 207a to move the ratchet wheel 208 the distance of one tooth. Upon rotation of this wheel corresponding to a predetermined number of teeth, the cam 208a actuates lever 200 out of supporting position below support member 198 for the stop plate 178'. The next article moving through the stacker strikes the trip arm 212a and rotates mercury switch 212 until the article strikes the stop plate 211. This completes a circuit from line 138 through lines 179 and 214 and switch 212 and through this switch and lines 213 and 181 to the solenoid 182 which is thus energized, the circuit being completed through lines 183 and 137. The stacking mechanism is then actuated in exactly the same manner as occurs when mercury switch 178 is oscillated as previously described. After this one article has been moved into the stack in projecting position, the stop member 178' returns to the position

shown in Figs. 13, 14 and 15 and the operation of the stacker mechanism goes on as before.

In the embodiment shown, the drives for the folding machine, conveyor 126 and the stacking device are so interrelated that articles are fed to the stacker sufficiently spaced apart to permit the stacker plate to complete each stacking cycle between successive articles.

My improved combined folding and stacking apparatus may be placed at the delivery end of an ironing machine to receive ironed articles and to fold and stack the same without the intervention of an operator. Articles may be fed to the ironing machine at unequally timed intervals and will be properly folded and stacked as both the folder and stacker are controlled by the presence of the article in proper position in the apparatus.

What I claim is:

1. Folding apparatus comprising means for feeding an article along a table, there being an opening through said table extending transversely to the direction of article feed, a device operating through said opening for producing a cross-fold in said article, a second device for producing a second cross-fold in said cross-folded article, cam means controlling the sequential operation of said devices, and means controlled by one of the end edges of said article as fed along said table for controlling said cam means.

2. Folding apparatus comprising means for feeding an article along a table, there being an opening through said table extending transversely to the direction of article feed, a blade operable through said opening for producing a cross-fold in said article, a second cross-folding blade, means for feeding an article from said first blade to folding position at said second blade at a predetermined speed, rotatable cam means having operative connections with each of said blades for controlling folding operation thereof during one rotation of said cam means, a continuously rotating shaft, a one-revolution clutch for connecting said cam means with said shaft, and means controlled by an end edge of an article moving along said table for causing operation of said clutch.

3. Folding apparatus as in claim 2 in which said cam means comprises one cam for controlling each folding blade, said cams being adjustable relative to each other and rotatable as a unit.

4. Folding apparatus comprising means for

feeding an article along a table, means folding said article along a line parallel to the direction of feed by movement of said article along said table, there being an opening through said table extending transversely to the direction of article feed, a device operating through said opening for producing a cross-fold in said article, a second device for producing a second cross-fold in said cross-folded article, cam means controlling the sequential operation of said devices, and means controlled by one of the end edges of said article as fed along said table for controlling said cam means.

5. Folding apparatus comprising means for feeding an article along a path, means for forming a first fold in said article transversely to the direction of movement along said path, said last named means acting to move said article downwardly out of said path, whereupon gravity acts to conduct said folded article to a second folding point, means for controlling the speed of said gravity produced movement, means for forming a second fold in said article when it reaches said second folding position, means controlled by one of the end edges of said article moving along said path for simultaneously initiating operation of each of said folding means, and means for delaying folding action of said section folding means until the article reaches said second folding point.

6. Folding apparatus comprising means for feeding an article along a path, means for forming a first fold in said article transversely to the direction of movement along said path, said last named means acting to move said article into a substantially vertical guide, means controlling the speed of movement of said article along said guide, means for forming a second fold in said article as it passes through said guide, cam means for controlling operation of said first and second folding means, and means controlled by one of the end edges of an article moving along said path for controlling operation of said cam means, there being a geared relation between said cam means and said speed controlling means, whereby said second folding means operates in a predetermined relationship to the position of said article in said guide.

7. Folding apparatus as in claim 6, including means for rendering inoperative said speed controlling means by operation of said second fold forming means.

EDMUND N. NECKEL.

CERTIFICATE OF CORRECTION.

Patent No. 2,177,262.

October 24, 1939.

EDMUND N. NECKEL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, second column, line 28, claim 5, for the word "section" read second; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of December, A. D. 1939.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.