

June 1, 1937.

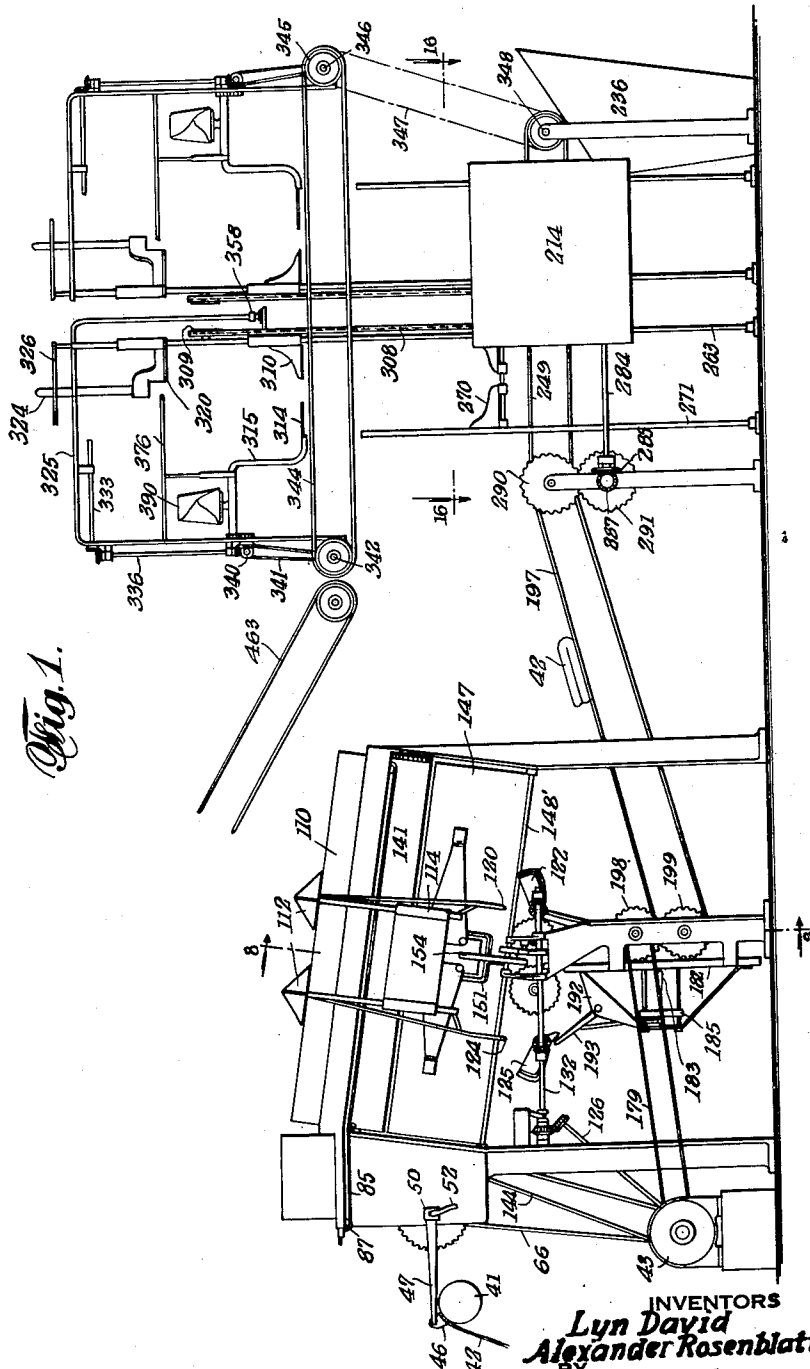
L. DAVID ET AL

2,082,243

LAUNDRY FINISHING MACHINE

Filed Feb. 4, 1935

11 Sheets-Sheet 1



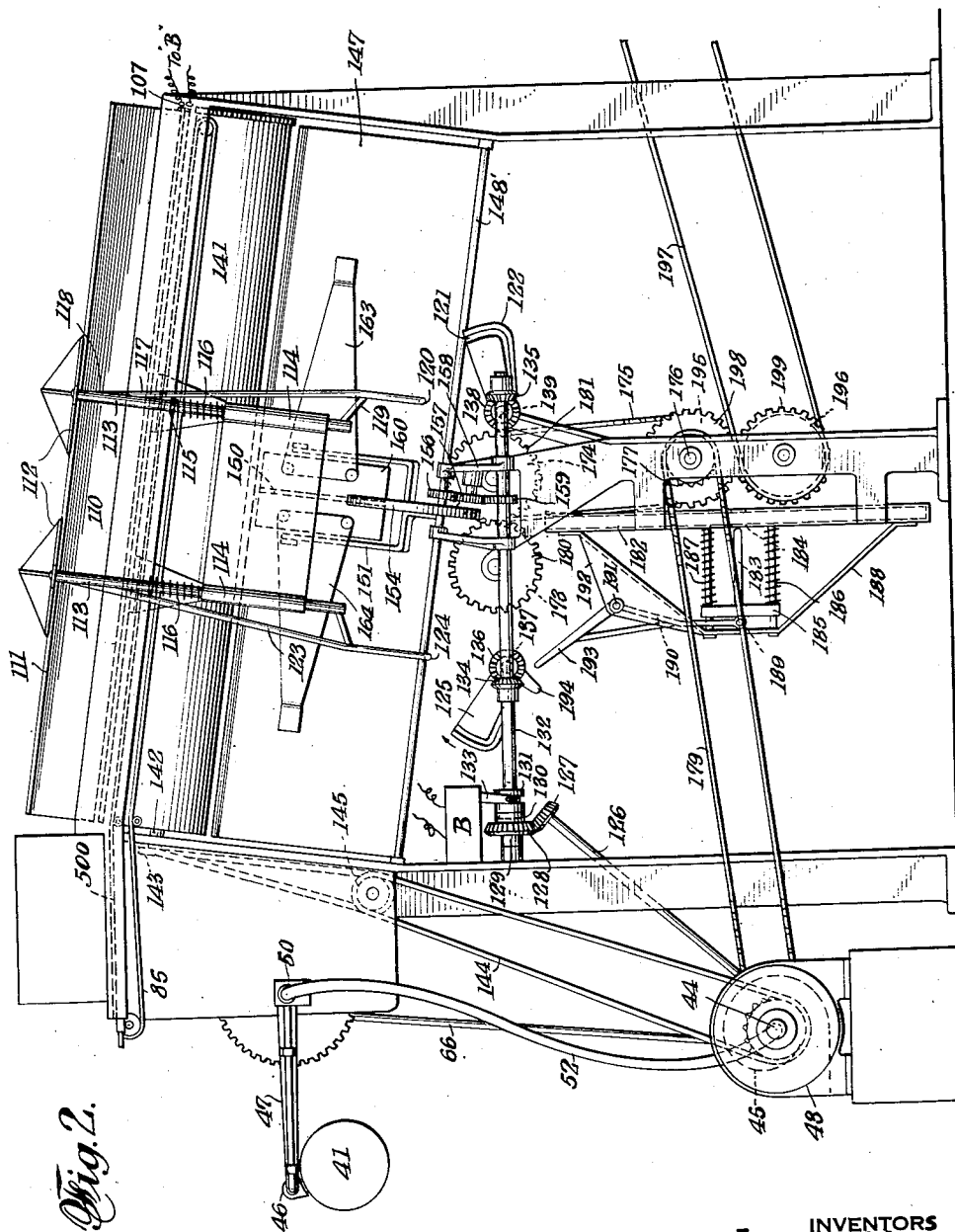
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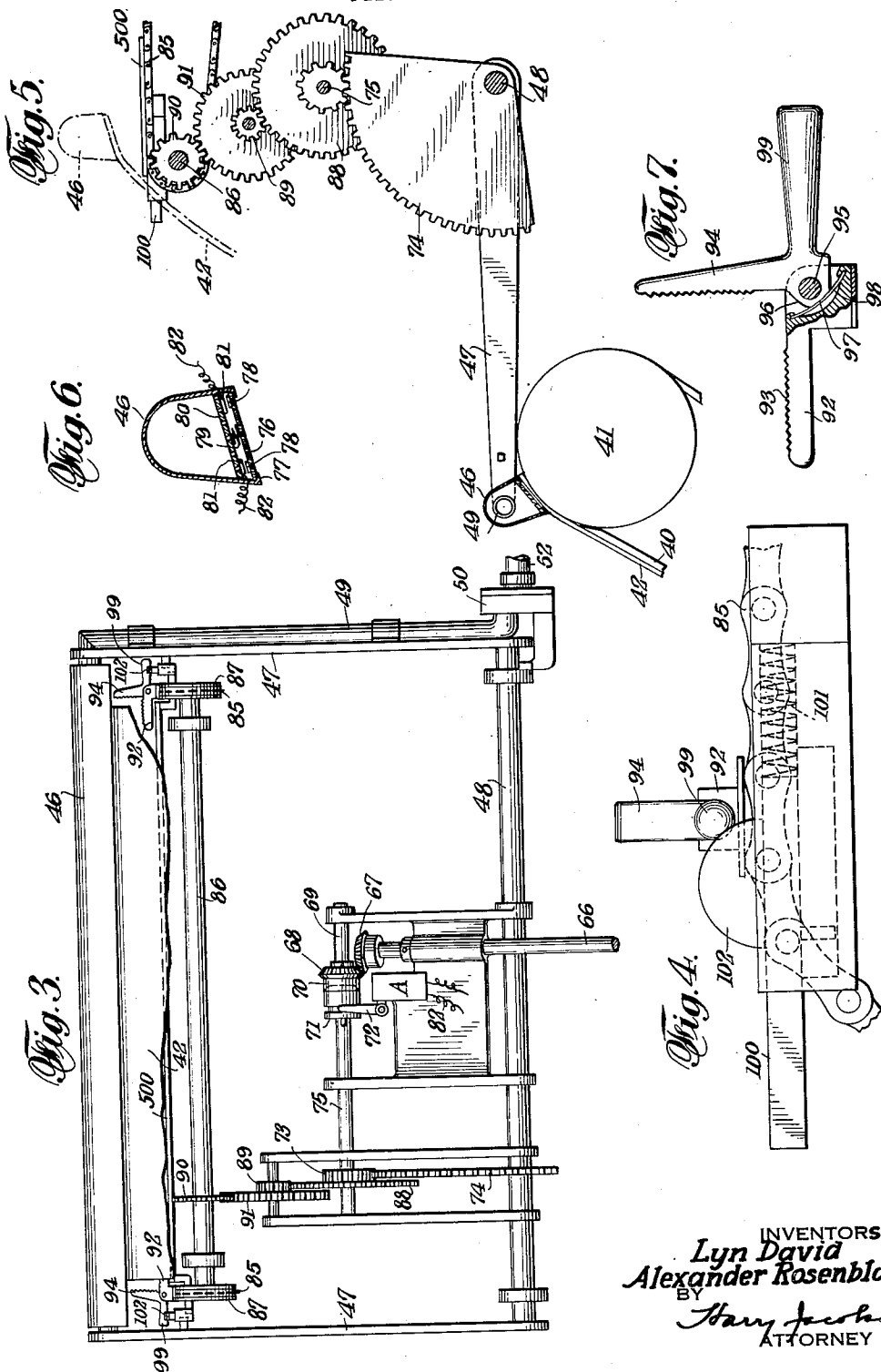
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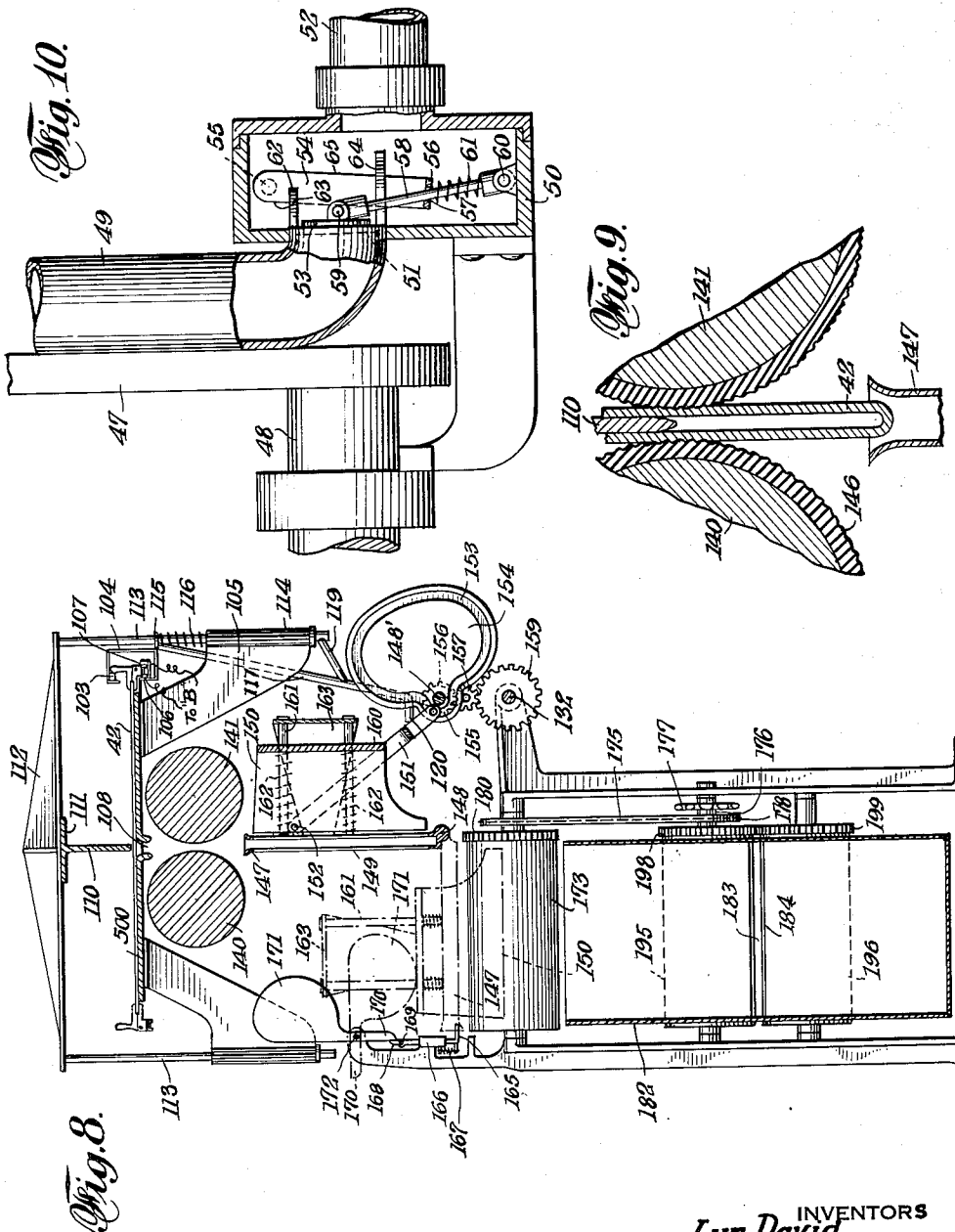
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Fig. 11.

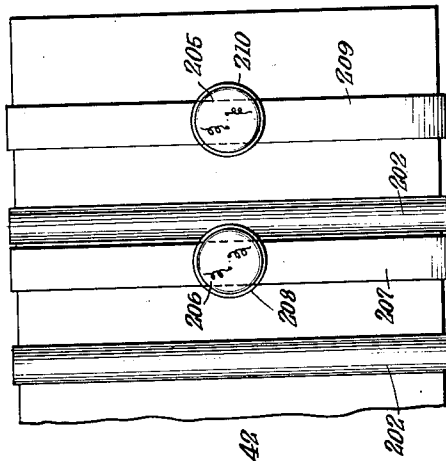


Fig. 12.

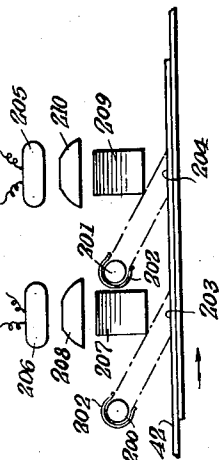


Fig. 14.

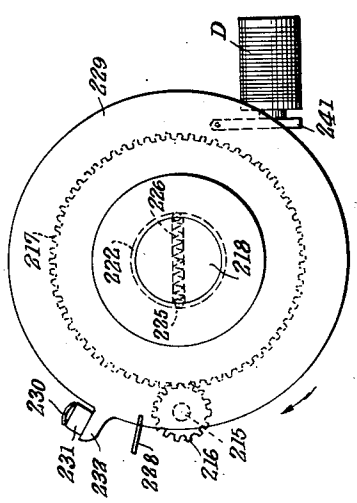
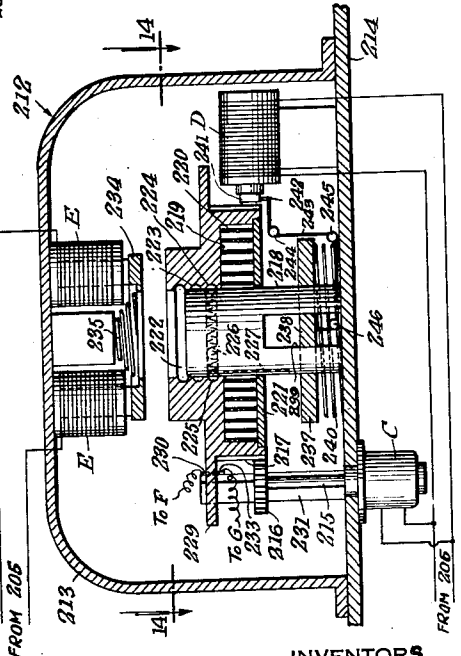


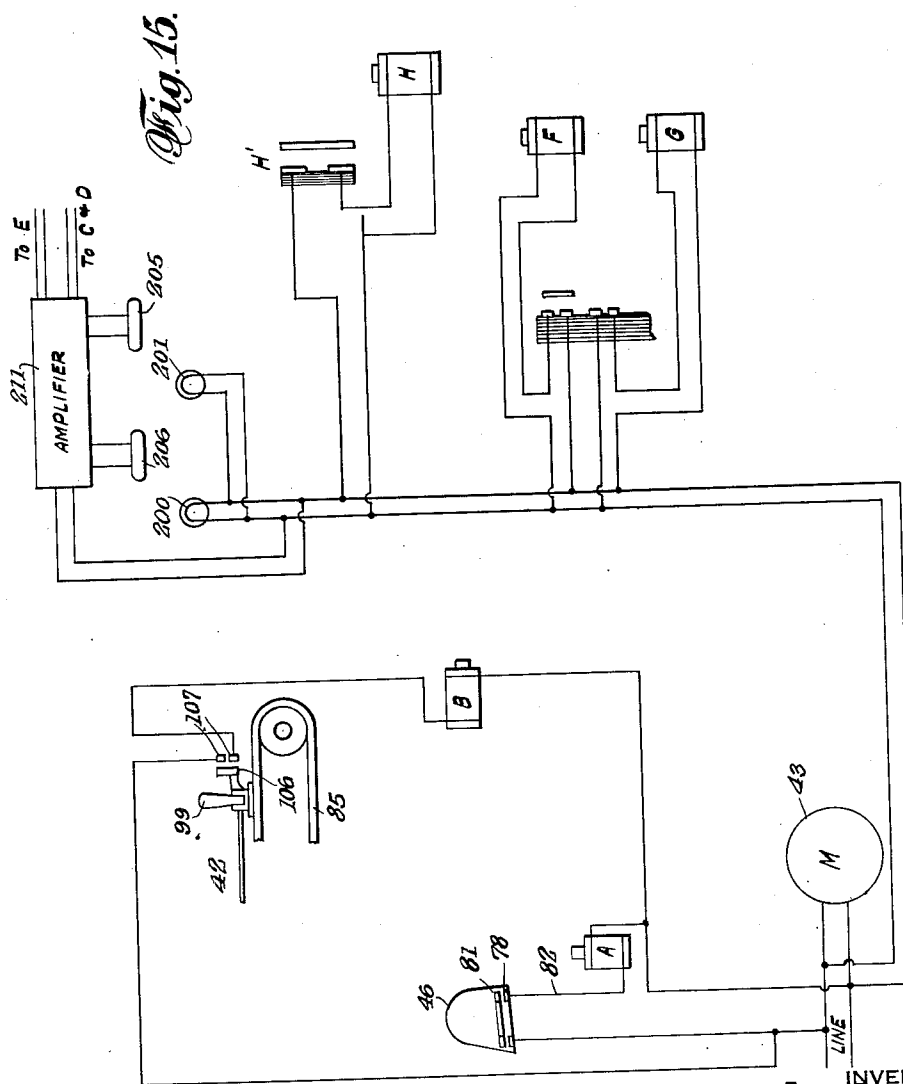
Fig. 13.



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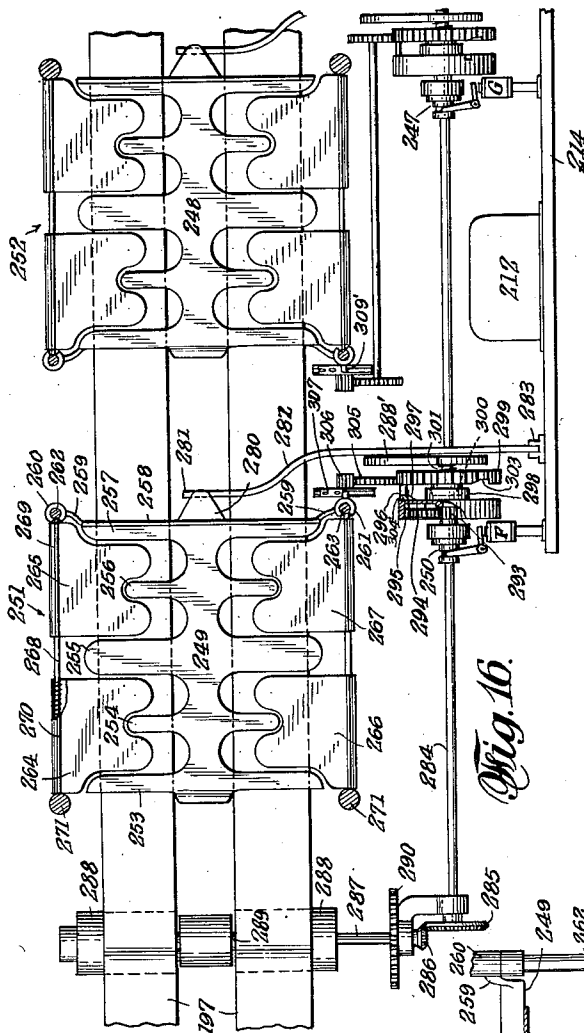


Fig. 16.

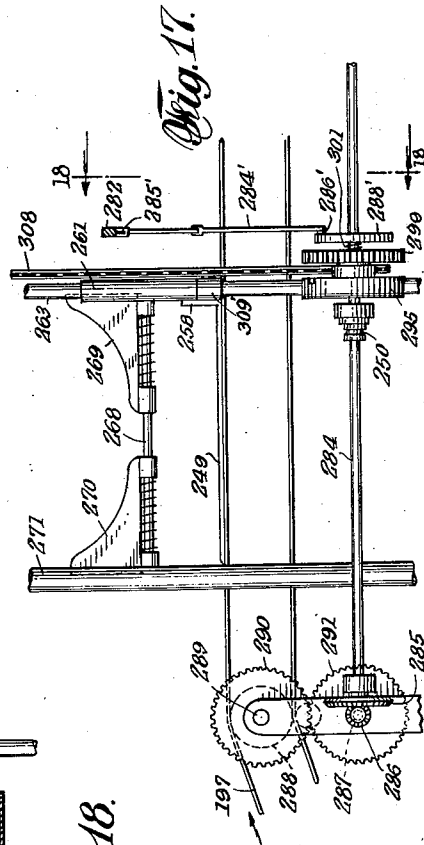


Fig. 17.

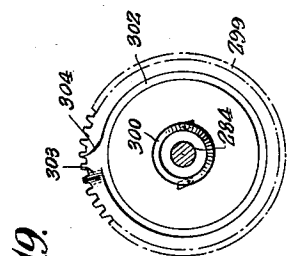


Fig. 19.

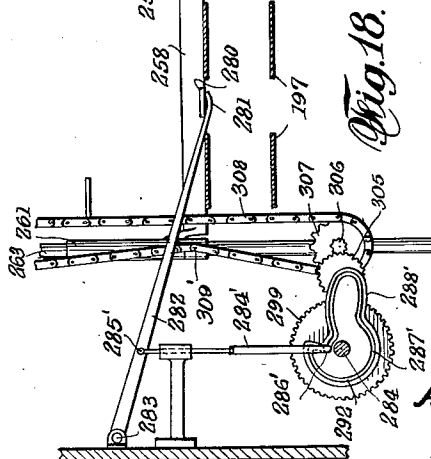


Fig. 18.

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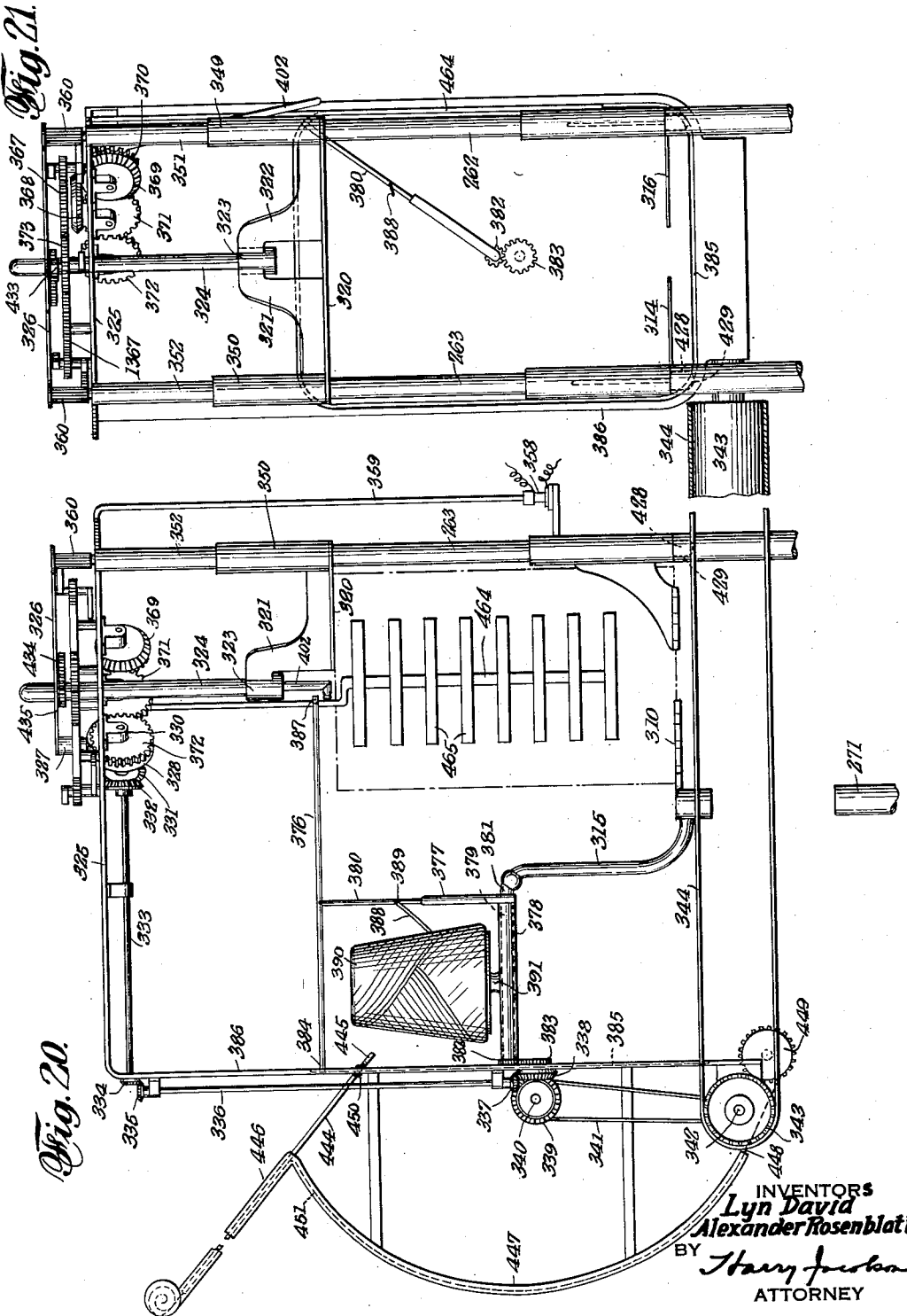
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Fig. 23.

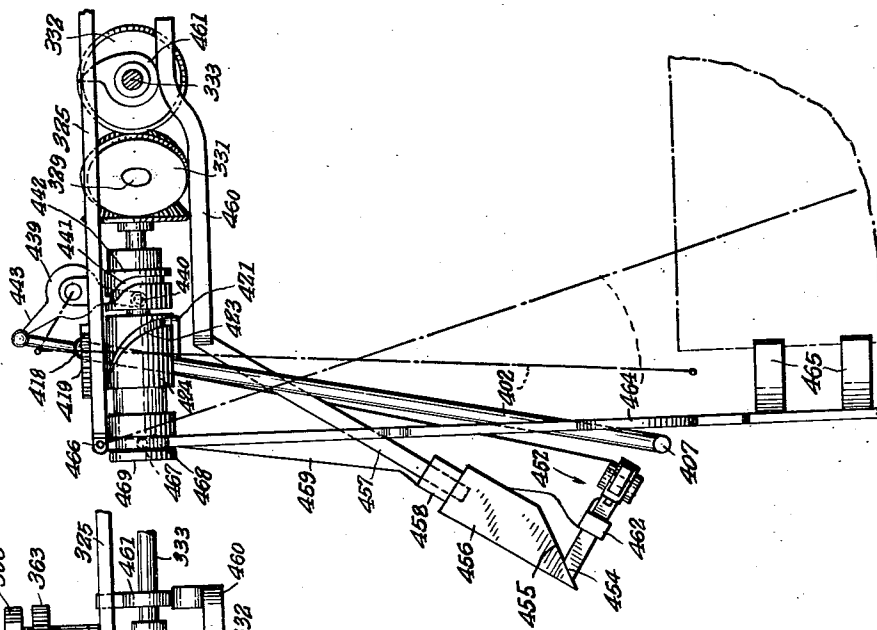


Fig. 22.

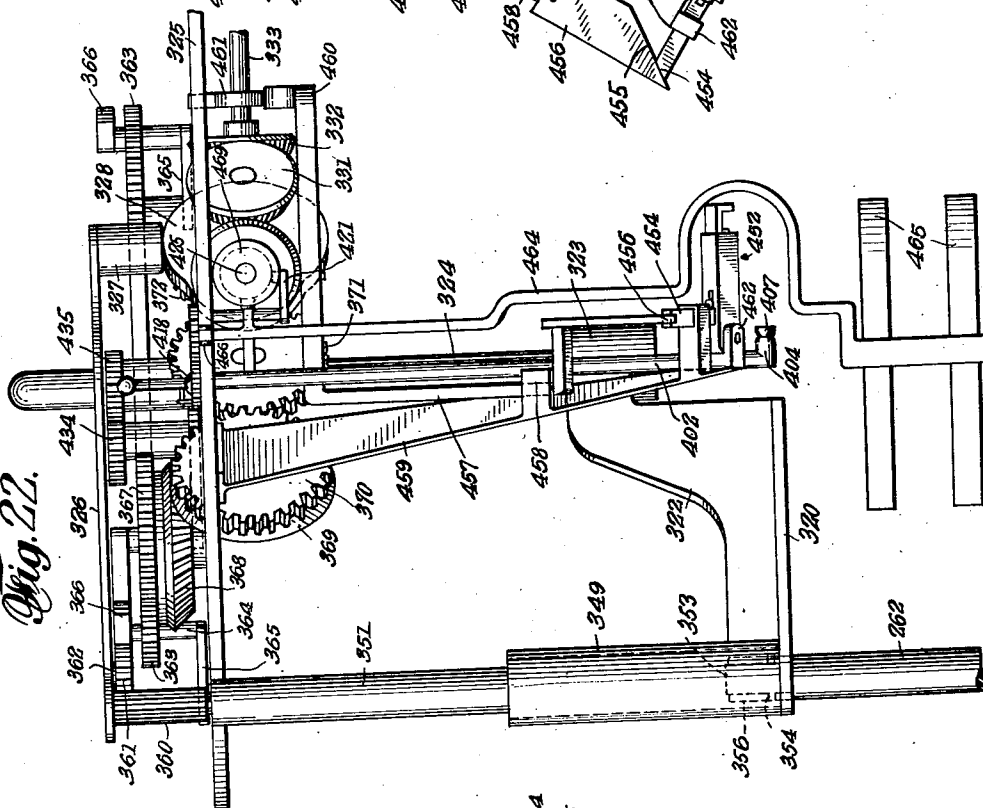
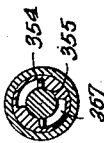


Fig. 24.



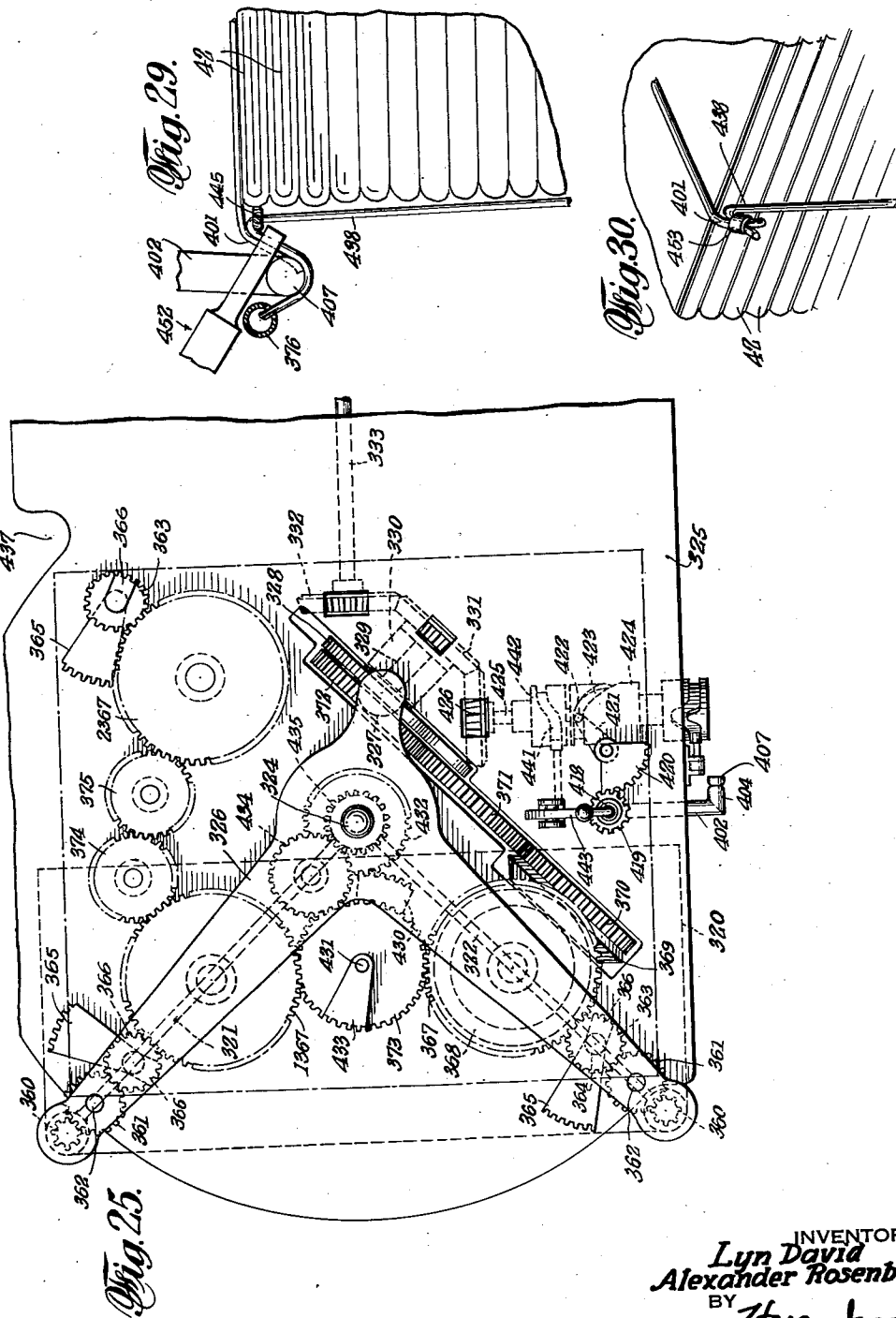
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Fig. 26.

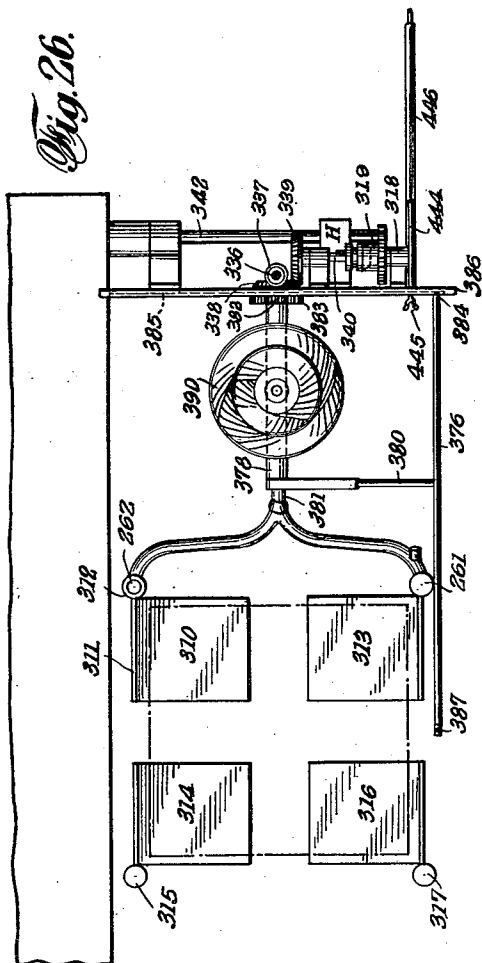


Fig. 31.

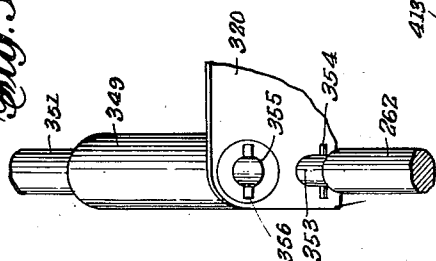


Fig. 28.

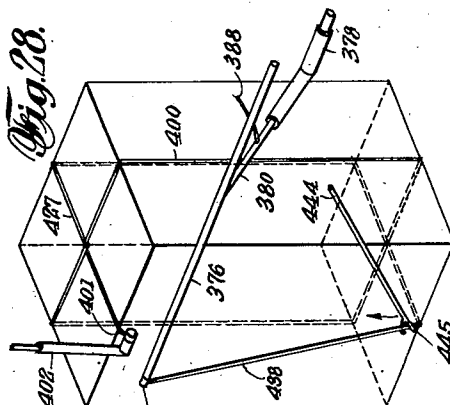


Fig. 27.

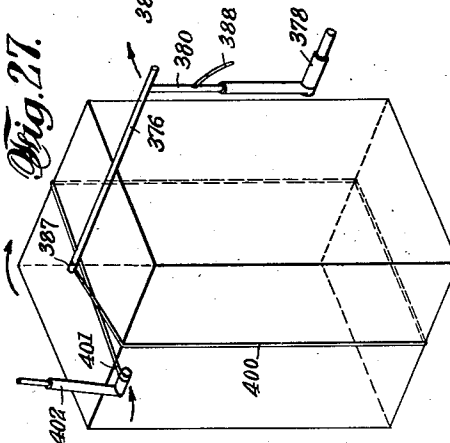
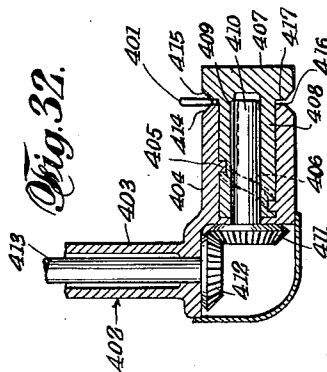


Fig. 32.



UNITED STATES PATENT OFFICE

2,082,243

LAUNDRY FINISHING MACHINE

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New York, N. Y.

Application February 4, 1935, Serial No. 4,754

27 Claims. (Cl. 270—62)

This invention relates to flat work laundry finishing machines.

Particularly in large cities, laundries frequently launder large quantities of articles of substantially the same type and size such as for example, hand towels, pillow cases, barbers' shaving cloths, restaurant napkins and table cloths and the like, in connection with a linen supply service to office buildings, barber shops, restaurants, doctors, dentists and others. Such service includes the selection and discarding of damaged articles, the folding of the articles, the stacking of the articles in bundles, and the tying up of such bundles for economical handling and distribution.

Our invention contemplates the provision of means for automatically operating upon flat-work linen of the type above-mentioned to finish such flat-work, including means for selecting and sorting substantially perfect or grade A articles from slightly imperfect or grade B articles, discarding articles damaged beyond a predetermined limit, folding the articles, stacking them into bundles, tying up the bundles, and ejecting the tied bundles.

Our invention further contemplates the provision of a machine intended to receive the flat work from a mangle, and to automatically finish the work, the machine including means for sorting and grading the work, folding the work, stacking the work into graded bundles, tying the bundles, ejecting the bundled articles, discarding the damaged and unuseable articles, and performing the operations mentioned at high speed and economically.

The various objects of our invention will be clear from the description which follows, and from the drawings, in which,

Fig. 1 is a side elevation of our new machine, the selecting and folding mechanism being shown at the left of the figure and the sorting, stacking and tying mechanism at the right.

Fig. 2 is a similar elevation on an enlarged scale of the selecting and folding portion of the machine.

Fig. 3 is a front elevation of the means for engaging the work as it comes from a mangle, and for advancing the work into the machine.

Fig. 4 is a fragmentary side elevation of the work advancing means.

Fig. 5 is a fragmentary side elevation of Fig. 3.

Fig. 6 is a vertical section of the suction means for first engaging and advancing the work.

Fig. 7 is a front elevation of the gripping means for advancing the work delivered thereto by the work-engaging suction head.

Fig. 8 is a substantially vertical section of the machine, taken on the line 8—8 of Fig. 1.

Fig. 9 is a vertical section of the work advancing rolls for delivering the folded article to the work advancing chute.

Fig. 10 is a fragmentary enlarged front view and partial section of the lower end of the suction arm shown in Figs. 3 and 5.

Fig. 11 is a partial top plan view of the photo-electric cells and lenses used for the selecting operation.

Fig. 12 is a front elevation of the same.

Fig. 13 is a vertical section of the mechanism actuated by the photo-electric cells and controlling the selecting and stacking mechanism.

Fig. 14 is a horizontal section of the same, taken on the line 14—14 of Fig. 13.

Fig. 15 is a wiring diagram of the various electrical instrumentalities.

Fig. 16 is a top plan view of the stacking and counting means and of the operating mechanism associated therewith.

Fig. 17 is a side view of the same.

Fig. 18 is a vertical section and rear view of the same, taken on the line 18—18 of Fig. 17.

Fig. 19 is a front view of the gear means for raising the stack of articles after a predetermined number of articles have been stacked.

Fig. 20 is a side view of the mechanism for tying the bundle or stack.

Fig. 21 is a rear view of the same.

Fig. 22 is a side view of the upper part of the tying mechanism, taken from the side opposite that from which Fig. 20 is taken.

Fig. 23 is a front view of the same.

Fig. 24 is a horizontal section of the guide sleeve for the presser foot of the tying mechanism.

Fig. 25 is a top plan view of the mechanism for swinging the stack into the various tying positions thereof.

Fig. 26 is a similar view of the tying platform, the tying needle and the operating parts thereof.

Fig. 27 is a perspective view of the stack or bundle of work showing the tying needle and the twine gripper in the positions assumed thereby after the first loop has been made around the stack or bundle.

Fig. 28 is a similar view of the same, showing the parts in the positions assumed thereby as the second loop is made around the stack or bundle.

Fig. 29 is a vertical section of the stack showing a portion of the needle, and the string or

twine gripper as well as the staple for tying the ends of the string or twine together.

Fig. 30 is a perspective view of the portion of the completely tied bundle showing the staple for holding the severed ends of the tying string.

Fig. 31 is a perspective view of the post for supporting the presser plate, showing the bayonet lock between the parts thereof.

Fig. 32 is a vertical section of the string or twine gripper.

For the purpose of clarity and simplicity in the description of what follows, the work operated on by the machine hereinbefore referred to as "flat" work, will be termed "towels", particularly in view of the fact that articles such as towels form the greater part of such work.

In that embodiment of our invention which we have illustrated and are about to describe in detail, the machine consists of a number of sub-mechanisms for performing various operations. In general, the machine begins its operation on the towel delivered by the last roll of a mangle.

A suction arm lifts the towel from the mangle roll and transfers it to a conveyor, the suction arm being provided with means for preventing operation of the sorting mechanism unless and until a towel is transferred thereby. Grippers on the conveyor forward the towel along a suitable plate on which light is thrown by suitable illuminating means. If the towel is damaged or defective, a lesser degree of light will be reflected therefrom than from a perfect or nearly perfect towel. The towels are sorted by the machine into two graded stacks. The more perfect towels will be designated as "grade A" towels and do not have any spots or defects therein totalling more than about one-half square inch in area. Those towels having spots or defects greater than one-half square inch in area and totalling up to about one square inch in area will be designated as "grade B" towels. Those having defects totalling over a square inch in area are defective towels and are discarded by the machine.

Means for sorting the towels into grade A and grade B stacks and for discarding the damaged towels is controlled by a set of photo-electric cells. These cells operate the stacking mechanism to stack the grade A towels at one point in the machine and to stack grade B towels at another point while permitting the damaged towels to pass through the machine into a suitable receptacle therefor.

Prior to the stacking of the towels in graded stacks, each towel is folded three times.

When the number of towels in the stack, either grade A or grade B, reaches a predetermined number, the stack is tied into a bundle and the thus tied bundle discharged from the machine.

The sub-mechanisms for performing each of the operations above-mentioned will now be described in detail.

Receiving and transfer mechanism

Referring to Figs. 1 to 6 inclusive, the towel 42 as it leaves the mangle rests on the inclined belt 40 (Figs. 1 and 5) passing around the last roll 41 of the mangle, it being understood that our machine is arranged in position to remove said towel from the belt 40 for automatic transfer into the machine. Power is supplied to the machine by a suitable motor 43 through various belts and other driving means on and operated by the motor shaft 44 (Figs. 1 and 2). On said shaft is also mounted a suitable rotary suction pump 45 designed to exhaust air from the suction head 46

carried at the end of the transfer arm 47. Said arm is mounted on the arm shaft 48 for rotation therewith and carries the pipe 49 (Figs. 3 and 5) which communicates at its outer end with the suction head. At its inner end, a bent portion of the pipe 49 is inserted through a suitable opening in the suction casing 50 (Figs. 1, 2 and 10), the opening 51 in the pipe being normally open to permit the pump 45 to exhaust the air from the pipe 49 and the suction head 46 through the pipe connection 52 which communicates with the casing 50.

At the proper time, however, the suction opening 51 is closed by means of the valve 53 (Fig. 10) which is operated by a suitable toggle.

Said toggle consists of the member 54, pivoted to the casing 50 as at 55, and terminating in a flange 56 having an opening 57 through which is passed the rod 58. The rod 58 is pivoted to the valve 53 at one end as at 59 and is pivoted to the casing at its other end 60. A spring 61 coiled about the rod serves to maintain the rod and the valve 53 to which it is connected in the particular position into which the rod is set, until moved from said position by the toggle operating means. Said operating means comprises the lug 62 projecting from the pipe 49, said lug being suitably shaped to act as a cam and to engage one end 63 of the member 54 to swing said member. On the rotation of the arm 47 into its lowermost or substantially horizontal position shown in Figs. 1 and 5, said lug 62 engages the edge 63, and owing to its properly bevelled shape, by its cam action swings the member 54 about its pivot in a counter-clockwise direction as viewed in Fig. 10. Such swinging of the member 54 causes the rod 58 to swing about its pivot 60 in a clockwise direction and thereby to remove the valve 53 from the opening 51 and to permit exhaustion of the air from the pipe 49 and from the suction head 46.

On the transfer movement of the arm 47 into substantially upright position, the lug 64 projecting from the pipe 49 and bevelled similarly to the lug 62 is brought into engagement with the opposite edge 65 of the member 54 and serves to swing said member into valve closing position, thereby to cut off the suction from the suction head and to release the towel transferred by said head. The means for swinging the arm 47 will now be described.

The shaft 66 (Figs. 2 and 3) is rotated by the motor shaft 44 through suitable means such as gearing at its lower end not necessary to be shown or described, as for example, any suitable and well-known bevel gearing. At its upper end, the shaft 66 carries the bevel gear 67 meshing with the bevel gear 68 on the shaft 69. Said gear 68 is connected to one part 70 of a suitable clutch, the other cooperating part 71 of said clutch being slidably mounted on the shaft 75 aligned with the shaft 69. The clutch part 71 is operated by the clutch operating arm 72 carried and operated by the solenoid A (Figs. 3 and 15), said solenoid being energized immediately after the head 46 has come into engagement with the towel 42 on the belt 40, and in a manner soon to be described.

On the shaft 75 is mounted the gear 73 meshing with the gear segment 74, said segment being in turn fixed to the shaft 48 and subtending an angle slightly less than 90°. Consequently, on the energization of the solenoid A, the continuously rotating shaft 66 rotates the shaft 69 and through the clutch 70, 71, rotates the shaft 75 and the gear 73, and thereby rotates the segment 75

74 to turn the shaft 48 and the arm 47 carries thereby through an angle slightly less than 90° to carry the towel engaged by the suction head upwardly on to a suitable scanning plate to be later described.

When the suction on the towel is released through the closing of the valve 53, energization of the solenoid A occurs simultaneously. The solenoid when thus energized releases its armature which is connected to and in turn releases the clutch operating arm 72. Said arm thereby swings to the left as viewed in Fig. 3 to disengage the clutch and to free the shaft 75 from its operative engagement with the shaft 69.

Due to the weight of the arm 47 and the parts carried thereby, said arm now drops back by gravity to its horizontal position shown in Fig. 5, to carry the suction head 46 to a position on to the mandrel roll 41, to reengage the next towel, and to permit the repetition of the towel advancing operation.

The suction head 46 is open at its bottom, (Fig. 6), at which is arranged the perforated plate 76 resting on the inwardly projecting flange 77 and carrying a pair of contact points 78, the plate being vertically movable but normally maintained against the flange 77 by the spring 79. A second perforated plate 80 is fixed in the interior of the suction head in parallel spaced relation to the plate 76, and carries the contact point 81 connected by the conductors 82 to the solenoid A. It will therefore be understood that when the plate 76 is in engagement with the towel, suction in the head 46 carries the towel against the perforated plate 76 to close the perforations in said plate, and permits the suction to move said plate off the flange 77 to carry the contact points 78 and 81 into contact. The circuit to the solenoid A is thereby closed and causes re-engagement and operation of the clutch parts 70 and 71 and the rotation of the arm 47 to the dotted line position of Fig. 5, wherein the towel is carried into position for delivery to the scanning plate 500.

When the valve 53 closes the pipe opening 51, the suction in the pipe 49 and in the suction head 46 is cut off, thereby permitting the spring 78 to move the plate 76 down on to the flange 77 and to open the circuit between and to separate the contact points 78 and 81. When the suction is thus cut off, as hereinbefore explained, the shaft 75 ceases its rotation and the arm 47 drops by gravity to the position shown in Fig. 5, rotating the shaft 48 as it does so in the opposite direction from its previous rotation and through the segment 24 and the gear 73 on the shafts 48 and 75 respectively, causes rotation of the shaft 75 in the direction opposite to that given to it by the shaft 69.

The alternate rotation of the shaft 75, first in one direction and then in the other, causes similar movement of the towel forwarding chain 85, first in the towel forwarding direction and then back to its original or initial position. A pair of such chains 85 are carried at the ends of the gripper shaft 86, being each mounted on a pair of suitable sprocket wheels 87. The chain and gripper shaft 86 is operatively connected to the shaft 75 for rotation therewith but at a higher speed by the train of gears 88, 89, 90 and 91 (Fig. 3).

Secured to each of the chains 85 in position to have the leading edge of the towel laid thereon and released by the suction head is a stationary jaw 92 of the towel gripper (Figs. 3, 4 and 7). Said jaw is preferably serrated as at 93 and carries

the movable jaw 94 pivoted thereto as at 95. The movable jaw is provided with an extension 99 and with flat edges as 96 and 97 arranged angularly relatively to each other and engaged by the spring 98 to maintain the movable jaw in the position in which it is set, and to assist in the opening and closing movements of the jaws.

Slidably mounted in a stationary part of the machine frame is the slide 100 (Fig. 4) urged outwardly by the spring 101, and carrying the cam 102 of suitable shape to engage the extension 99 and to quickly move said extension upwardly when the slide moves inwardly and thereby, assisted by the spring 98, to rotate the movable jaw 94 into towel gripping position. The slide 100 is interposed in the path of the arm 47 or a lug extending therefrom whereby, when said arm reaches the limit of its upward movement, the slide 100 is forced inwardly to close the jaws together and to cause the towel to be gripped simultaneously with the closing of the suction opening 51 by the valve 53. It being understood that the shaft 86 is rotated in a direction opposite to the rotation of the shaft 48, the towel grippers are brought to their most forward position at the time that the arm 47 is brought to its most rearward or uppermost position so that transfer of the towel from the suction head 46 to the grippers may be properly effected.

As the chains 85 are moved rearwardly of the machine, the grippers draw the towel rearwardly on to the stationary scanning plate 500. While the plate as shown is inclined downwardly for the purpose of saving space, it may be horizontal if desired or even inclined upwardly. Said plate is preferably colored black or some dark color along an area of slightly less width than that of the towel, there being a white longitudinal area at each edge of the plate of about 1½ inches in width to take care of any slightly narrower towels which may be used in the machine. The area outside of the white strip remains black. The purpose of the coloration of the plate 500 will be described hereinafter in connection with the scanning means for determining damaged areas in the towels and for grading the towels into grade A and grade B stacks. It need merely be said at this time that the scanning area is preferably limited to about five inches in length. The plate, therefore, is preferably unmutlated and continuous with the width and length of the scanning area but past said area, the plate is provided with a slot to permit the folding operation soon to be described.

When the chains 85 reach their limit of rearward movement, the movable gripper jaw 94 is rotated in the proper direction to open the jaws and to release the towel at the same time that the folding mechanism engages the towel. Said movable jaw is opened by means of the stationary cam 103 supported by a suitable bracket 104 extending from the stationary bracket 105 (Fig. 8). The cam 103 is shaped similarly to the cam 102 but extends horizontally instead of vertically. To insure gripping of the towel by the folding mechanism at the same time or just before the gripping jaws are opened, the stationary jaw 92 carries a bridging member 106 which closes the circuit between a pair of suitably stationary spaced contact members 107 in the most rearward position of the chains and just before the cam 103 engages the handle 99 of the movable jaw to open said jaw. It will be understood that the spaced contacts 107 are suitably insulated from each other and from the frame of the machine and may be

carried by the stationary member such as the bracket 104 (Fig. 8). Suitable conductors lead from the spaced contact members 107 to a suitable solenoid B, which solenoid is energized to operate the folding mechanism as the grippers are opened to release the towel.

First fold mechanism

The towel having been arranged on the plate 500 over the longitudinal slot 108 in said plate, and at the time that it is released by the gripping jaws or just prior thereto, the means for operating the first towel folding mechanism is set into action. The folding mechanism comprises the vertical blade 110 (Figs. 2 and 8) provided with a backing or stiffening member 111. A pair of similar actuating members engage the surface 111 and move the blade downwardly through the slot 108 to fold the towel along its longitudinal center line and to reduce the width thereof in half. The actuating members being similar in construction, a description of one will suffice for both.

The actuating member consists of a frame 112 engaging the backing member 111 and mounted on posts 113 passing through the stationary sleeves 114 on the brackets 105. Interposed between a suitable collar 115 on one set of the posts and the upper ends of the corresponding sleeves 114 are the springs 116 which urge the posts and consequently urge the blade 110 toward its uppermost position. A suitable rod 117 connected at its upper end as at 118 to the post 113, and suitably braced to the lower end of the post as by means of the brace 119, is provided with a bent end 120 adapted to enter the groove 121 of a suitable cam 122 (Fig. 2) whereby rotation of the cam engages the end 120 of the rod and pulls the post 113 down through the sleeve 114 against the action of the spring 116. Similarly, the rod 123 is connected to another post 113 and is provided with a bent end 124 designed to enter the groove of the cam 125 which is similar to the cam 122. The grooves in the cams 122 and 125 are open at both ends so that the respective bent ends 120 and 124 of the rods 117 and 123 may pass through the groove and then be released ready for the re-engagement of said bent ends by the cams on the next revolution thereof.

Suitable means are provided for rotating the cams. As illustrated, said means takes the form of an actuating shaft 126 suitably geared to the motor shaft 44 at its lower end and provided with the bevel gear 127 at its upper end. Said gear 127 meshes with the cooperating bevel gear 128 fixed on the hollow shaft 129. Operatively connected to the gear 128 is one relatively fixed member 130 of a one revolution clutch. The other movable member 131 of said clutch is mounted on the one revolution shaft 132. Said clutch member 131 is engaged by the arm 133 which is in turn secured to the armature of the solenoid B. It will thus be seen that when the solenoid B is energized, the clutch members 131 and 130 are engaged and while the shaft 129 rotates continuously, the shaft 132 is given a single revolution, the arm 133 disengaging the clutch after the revolution and when the solenoid B is deenergized. On the shaft 132 are the bevel gears 134, 135 meshing respectively with the bevel gear 136 on the shaft 137, and the bevel gear 138 on the shaft 139. On the shaft 137 is mounted the cam 125 while on the shaft 139 is mounted the cam 122.

It will thus be seen that on the energization of the solenoid B, the cams 122 and 125 are rotated to engage the rod ends 120 and 124 respectively and to pull down the blade 110 to fold the towel lengthwise and to force the thus folded towel through the slot 108 into engagement with the towel forwarding rollers 140, 141 (Figs. 2, 8 and 9).

Each of the rollers is mounted on a suitable shaft supported in the frame of the machine, the roller 141 being mounted on the shaft 142 (Fig. 2) carrying the sprocket wheel 143 and driven from the motor shaft 44 by means of a suitable chain belt 144 passing about the idler pulley 145 which twists the belt to the proper angle.

Said rollers 140 and 141 are spaced apart a sufficient distance to permit the passage of the folded towel, the surfaces 146 of said rollers being preferably made of roughened crepe rubber designed to yield on the insertion of the blade 110 therebetween and to suitably grip and forward the towel into the first receiving chute 147 (Figs. 2 and 9). The rollers are rotated in unison in opposite directions by means of suitable inter-engaging gear wheels on their respective shafts. Said chute 147 is hinged at its lower end as on the pivot rod 148 and is provided with a central slot 149 for the passage of the second fold blade 150.

After the folded towel has dropped to the bottom of the chute 147, the chute is rotated into the horizontal position shown by the dotted lines in Fig. 8. The means for so rotating the chute comprises the forked arm 151 (Figs. 2 and 8) pivoted at one end to suitable projections on the chute as at 152 and at the other end, being provided with a pin entering the groove 153 of the cam 154. Said groove is provided with a circular portion 155 to maintain the chute in its upright position at the time that the towel is being forwarded by the rollers 140, 141 into said chute. Part of the remainder of the cam is shaped to rapidly rotate the chute into horizontal position after the towel has dropped to the bottom, then to maintain the chute in horizontal position while the second fold is taking place and then to raise the chute rapidly into its upright position.

The means for rotating the cam 154 comprises the gear 156 on the shaft 148', which gear meshes with the intermediate gear 157 supported by the bracket 158. Said intermediate gear in turn meshes with the gear 159 on the shaft 132 (Figs. 2 and 8).

Second fold mechanism

The second fold blade 150 is provided with a back 160 slidably mounted on the posts 161, there being four such posts. On each post, a suitable spring as 162 is interposed between the back 160 and the chute to urge the blade into its outermost position. The posts 161 are secured at each of their ends to the chute and at their outer ends, are braced in pairs by the post brackets 163, 164.

On the swinging of the chute 147 into the dotted line horizontal position of Fig. 8, said chute engages and lowers the slide 165 mounted in and passing through the sleeve 166 and normally pulled upwardly in said sleeve by the spring 167. At its upper end, the slide 165 carries the spring-pressed trigger 168 pivoted to the slide as at 169 and normally held in engagement with the lower end 170 of the pivoted weight 171. As the slide 165 is engaged and moved by the chute 147 on

the movement of said chute into its horizontal position, the trigger 168 is removed from the end of the weight, thereby releasing the weight and permitting said weight to drop rapidly about its pivot 172 and to strike the back 160 of the blade 150 and forcing said blade through the slot 149 of the chute and to cause the towel to be folded into quarters as well as to forward the thus folded towel in between the forwarding rollers 173, 174. The roller 174 is mounted on a suitable shaft provided with a sprocket wheel driven by the chain 175 (Fig. 8) passing about a sprocket wheel 178 which is mounted on the shaft 176. On the same shaft is the sprocket wheel 177 driven by the chain 179 (Fig. 2) from a suitable sprocket wheel on the motor shaft 44. Interengaging gears 180, 181 on the shafts for the rollers 173, 174 cause rotation of said rollers in unison in opposite directions. The operation and construction of the rollers being similar to the rollers 140, 141, no further description thereof is deemed necessary. Suffice it to say that the rollers 173, 174 forward the towel, which has now been folded into quarters, into the second chute 182.

Third fold mechanism

Said chute is provided with a central slot 184 for the passage of the third folding blade 183 to again fold the towel this time into eighths in the same manner as the folding hereinbefore described but by somewhat different mechanism, which will now be described. The blade 183 is provided with a back 185 slidably mounted on the posts 186 and pressed outwardly by the springs 187. The inner ends of said posts are secured to the chute while the outer ends thereof are supported by the brackets 188.

Pivoted to the back 185 as at 189 is the lever 190 which is also pivoted as at 191 to the frame 192, and which is provided with an arm 193 extending toward the shaft 132. Said arm 193 is made of sufficient length to extend into the path of a rotatable arm 194 mounted on the shaft 137, whereby the arm 193 is engaged by the arm 194 at the proper time to cause oscillation of the lever 190 in the proper direction and thereby to force the blade 183 through the slot 184 and to fold the towel and forward it between the towel-forwarding rollers 195, 196. The rollers in turn forward the thus folded towel on to the moving conveyor belt 197. One of the rollers 195 is mounted on the shaft 176, which is rotated in the manner hereinbefore described through the sprocket 177 and chain 179, said shaft 176 carrying the gear 198. The other roller 196 is provided with a gear 199 engaging the gear 198 on the shaft 176 whereby the rollers are rotated in unison in opposite directions to effect the forwarding movement of the towel on to the belt 197. Said belt passes about a suitable pulley mounted coaxially of the gear 199, and serves to advance the folded towel to the sorting and stacking mechanism.

Sorting or selecting mechanism

The towel, having been folded into eighths or other suitable size by the folding mechanism hereinbefore described, the folded towel is now conveyed by the belt 197 into that part of the machine which stacks the towels into piles of the same grade, such as grade A and grade B towels, and discards the towels which are so damaged as to make them unfit for further use. In the stacking mechanism, the towels are separated

preferably into bundles of fifty of the same grade whereafter the bundle is tied and discharged from the machine.

The means for separating or sorting the towels will now be described.

As shown particularly in Figs. 11 and 12, the control device for the sorting means consists preferably of a pair of photo-electric cells, each of which is responsive to light and becomes operative to energize other devices when a sufficient amount of light is thrown thereon. The light is produced by the lamps 200, 201 (Fig. 12) each provided with a suitable reflector 202 to focus the light on a transverse band of the towel of predetermined width, the illuminated towel areas or bands as 203, 204 being preferably directly underneath the means for transmitting the light to the photo-electric cell. One cell 205 is comparatively insensitive while the other cell 206 is comparatively sensitive. That is, the cell 205 is responsive only to a considerable amount of light.

Therefore, this cell is adapted to operate the mechanism for selecting towels having small damages or spots since such a towel reflects a greater amount of light than the towel having large spots or damaged areas.

The photo-electric cell 206 is affected by slight variations in the amount of light thrown thereon. Therefore, this cell is responsive to small defects. In other words, it requires less change in light to affect the cell 206 than it does to affect the cell 205. Both cells 205 and 206 are affected by damages of comparatively large area in the towel but only the cell 206 is affected by damages of comparatively small area. The cell 206 will therefore be designated hereinafter as the "fine" cell while the cell 205 will be designated as the "coarse" cell. The lamps 200, 201 may be of the long filament type or they may be vapor tubes or Cooper Hewitt lamps or any other suitable source of lighting means.

The light thrown on the towel by the lamps is reflected from the undamaged parts of the towel. If the towel is spotted or is torn or has holes therein, the light is not reflected from the thus damaged areas and thereby causes variation in the amount of light energy accumulated by the photo-electric cells. The light from the towel band 203, which is about one inch in length, is condensed by a suitable elongated lens 207, the light being again re-condensed by the smaller lens 208 and focussed or projected on to the cell 206. Similarly, the light reflected from the band 204 is condensed by the elongated lens 209 and is focussed by the smaller lens 210 on to the coarse cell 205.

As shown in the wiring diagram (Fig. 15), conductors lead from each of the cells 205, 206 to a suitable amplifier 211. The conductors from the coarse cell 205 lead from the amplifier to the motor C and to the solenoid D (Fig. 13). From the fine cell 206, the conductors lead to another solenoid E.

Said motor C and solenoids D and E control the circuit-making and breaking mechanism leading to a solenoid F (Fig. 16) for operating the stacking mechanism for the grade B towels. The motor C and solenoids D and E also control the mechanism for making and breaking the circuit to the solenoid G which controls the stacking of the grade A towels.

The circuit-making and breaking mechanism will now be described. Said mechanism is designated generally by the numeral 212 (Figs. 13 and 16) and includes a casing 213 mounted on a base

214 forming part of the machine frame. The motor C is provided with a motor shaft 215 carrying the pinion 216. Said pinion meshes with the gear 217 loosely mounted on the shaft 218, and is recessed as at 219 for the reception of the clock spring 220. A suitable plate as 221 maintains the spring in its recess. The gear 217 is provided with a series of vertically spaced circumferential or annular grooves 222, 223 and 224 adapted to receive the ball 225 urged into said groove by a suitable spring 226.

The gear 217 further has a sliding connection with the shaft 218 consisting for example, of the key and slot connection 227. The contact-making member 228 is carried by the flange 229 projecting from the gear 217 and is designed to make contact with either of the bowed spring contact members 230 or 233 carried in spaced relation by the fixed insulated post 231. Projecting from the flange 229 is the lug 232, the gear 217 being urged by the clock spring 220 to rotate in the proper direction to carry the lug 232 into engagement with the fixed insulated post 231, and thereby normally maintaining the members 228 and 230 (or 233) out of contact, to deenergize the motor C and the solenoids D and E.

Means are provided for shifting the gear 217 along the shaft 218 to the proper height so that on rotation of said gear, the contact member 228 may be carried into contact either with the contact member 230 or with the contact member 233 or with neither of said members. Said means comprises the solenoid E and its armature 234 normally pressed downwardly toward the gear 217 by the spring 235 and retracted into the position shown in Fig. 13 by the solenoid E when said solenoid is energized by the coarse photo-electric cell 205. The spring 235 is of sufficient strength to cause the comparatively heavy armature 234 to deliver a blow to the gear 217 and thereby to shift said gear downwardly into one of the two positions determined by the entrance of the spring-pressed ball 225 in one of the grooves 223 or 222, it being understood that the gear 217 is normally in its highest or initial position wherein the ball enters the groove 224. In other words, when the solenoid E is deenergized, the spring 235 becomes operative to shift the gear 217 downwardly along the shaft 218 and thereby to arrange the contact member 228 on the gear in position to contact with the lower contact member 233, or in a position below said contact member whereby rotation of the gear will not close any circuit to the solenoids F or G. In the normal or highest position of the gear 217, the contact member 228 is in position to engage the contact member 230 from which conductors lead to the solenoid F, thereby operating the stacking mechanism for the stacking of grade A towels.

In the next lower position of the gear wherein the ball 225 enters the groove 223, the member 228 is arranged at the proper level to engage the contact member 233 from which conductors lead to the solenoid G whereby on rotation of the gear, the circuit is closed to said solenoid G. In the lowest position of the gear wherein the balls 225 enter the groove 222, the contact member 228 is arranged below both of the contact members 230 and 233, and neither of the solenoids F and G are energized, whereby neither of the stacking mechanisms become operative and the towel moves on the belt 197 without being stacked and is discharged into the receptacle 236 (Fig. 1) for damaged and discarded towels.

To slide the gear 217 upwardly along the shaft 218 to the proper level to cause selection of the solenoid F or G, as the case may be, a vertically slidable hammer as 237 is provided and formed with a tongue 238 slidable in the slot 239 of the shaft 218. Said hammer is normally urged upwardly by the spring 240 which is of greater strength than the spring 235, so that when the armature 234 and the hammer 237 are both released by the operating solenoids therefor, the gear 217 is nevertheless moved along its shaft to its highest position. To retract the hammer 237 to its lowermost position shown in Fig. 13 on the energization of the solenoid D by the fine cell 206, the armature 241 of the solenoid D is provided with a projection 242 secured to the cable 243 passing over the rollers 244, 245 and 246 and secured to the hammer 237. When the solenoid D is energized, the armature 241 is retracted to pull the cable and thereby to draw the hammer 237 downwardly against the action of the spring 240.

The operation of the means for making and breaking the circuits to the grading solenoids F and G will now be described. It being understood that there is provided a slight gap between successive towels fed onto the plate 500, the black part of the plate is exposed to the cells, therefore reflecting to said cells 205 and 206 insufficient light to energize the solenoids D and E. The armatures of said solenoids are thereby released, permitting the springs 240 and 235 to operate the hammer 238 and the armature 234 respectively. Since the spring 240 is of greater strength than the spring 235, the gear 217 is thereby shifted by the hammer 237 along the shaft 218 to its uppermost position shown in Fig. 13, wherein the ball 225 enters the groove 224 and the contact member 228 is in position to contact with the upper contact member 230.

Taking now the case where the towel passing beneath the cells 205, 206 is substantially perfect, that is, if the spots or damages thereon total less than about one-half square inch in area, whereby the towel may be classed as a grade A towel, then sufficient light reaches both of the cells 205 and 206 for the former to energize the solenoid E and the latter to energize the motor C and the solenoid D. On the rotation of the motor C, the pinion 216 is rotated, causing counter-clockwise rotation of the gear 217, as viewed in Fig. 14, against the action of the clock spring 220 and thereby carrying the contact member 228 around toward the contact post 231. Since the fine cell 206 has been energized, the solenoid D is also energized, thereby pulling upon the cable 243 and releasing any pressure upon the gear which might be caused by the hammer 237 or spring 240. Similarly, the solenoid E having been energized by the coarse cell 205, the armature 234 is retracted against the action of the spring 235 to remove any pressure from the gear 217.

The gear now being in its highest position as indicated in Fig. 13, and the motor C having been energized at the same time through the photo-electric cells, and the gear 217 having been rotated in a counter-clockwise direction, the contact member 228 is brought into contact with the upper stationary contact member 230, thereby closing the circuit to the solenoid F. Said solenoid thereupon becomes operative to throw the clutch 250 (Fig. 16) and thereby operating the mechanism for lowering the movable stacker plate 249 on to the belt 197 into the path of the

oncoming towel. Thereby the towel is arranged in the proper position for stacking in the grade A stack.

Taking now the case where there is a small spot in the towel having an area larger than one-half square inch and less than one square inch, then insufficient light is reflected from the band 204, which includes the spot, on to the coarse cell 205 to cause energization of the solenoid E. The solenoid E therefore is unable to maintain the armature 234 retracted, thereby releasing said armature to the action of the spring 235 which projects the armature against the gear wheel 217 and moves said wheel downwardly through the distance between grooves. The ball 225 thereby enters the groove 223. At the same time, however, the fine cell 206 which operates under a lesser amount of light than the cell 205 receives sufficient light to energize the motor C and the solenoid D. The hammer 237 is thereby maintained in its retracted position, permitting the armature 234 to effect the downward shifting movement of the gear. The motor C is also operated to cause the member 228 to make contact with the lower contact member 233 (the gear 217 having been shifted as above described to the proper position for this purpose), and thereby to energize the solenoid B and to throw the one revolution clutch 247 and to interpose the central movable plate 248 into the path of the oncoming towel on the conveyor belt. The towel is thereby arranged in the stacking mechanism for the grade B towels, said mechanism being arranged at the right as shown in Fig. 16, while the duplicate grade A stacking mechanism is arranged at the left of said figure.

Should there be more than one spot (for example, two spots) in the towel between one-half square inch and one square inch in area, to total more than one square inch, then the light from the scanned band of the towel including the spots is insufficient to cause continued operation of the cell 205 and the operation of said cell is interrupted twice, once for each spot. The armature 234 is thereby released twice by the solenoid E and is operated twice by the spring 235 to shift the gear wheel 217 downwardly twice or through two grooves, that is, to arrange the ball 225 in the highest groove 222. The contact member 228 is thereby arranged at a level below either the contact members 230 or 233 and rotation of the gear wheel cannot close the circuit to either the solenoid G or the solenoid F. Neither of the plates 248 nor 249 are lowered into the path of the towel and therefore, said towel continues its movement with the belt 197 until discarded and discharged into the discard receptacle 236.

Considering now the case where there are spots on the towel over one square inch, then insufficient light reaches both of the cells 205 and 206 to maintain them in operation (or to maintain the armature 234 and hammer 237 retracted or to energize either the motor C or the solenoid D and E), whereby no contact is made between the member 228 and either of the members 230 or 233 and neither of the stack plates 248 or 249 is lowered, and the towel is discarded into the discard receptacle 236.

As has been hereinbefore indicated, when the towel has been scanned, the black area on the plate 500 is exposed to the calls whereby the solenoids D and E are deenergized as is the motor C, and the spring 240 becomes effective to raise the gear 217 to its uppermost position, being stronger than the spring 235, and the parts are

positioned ready for the repetition of the operation, it being understood that when the motor C is inoperative, the clock spring 220 rotates the gear 217 in a clockwise direction to carry the lug 232 against the stationary post 231.

Stacking mechanism

The stacking mechanism for grade A towels is designated generally by the numeral 251 (Fig. 16) while the substantially identical mechanism for grade B towels is designated by the numeral 252. The central plate 249 of the grade A stacking device, as has been hereinbefore explained, is first lowered sufficiently by the selecting mechanism to be interposed in the path of a grade A towel to receive said towel thereon as the preliminary step in the stacking operation. Said plate is then raised to deposit the selected towel underneath a stack of such towels until a predetermined number of towels is arranged in the stack, whereafter the stack is tied into a bundle and discharged from the machine.

The stacking mechanism 251 will now be described and the description will suffice for the substantial identical mechanism 252. The plate 249 is comparatively narrow along its central portion and is provided with transverse projections 253, 254, 255, 256, 257 symmetrical about the center line of the plate and of sufficient width to extend over the belts 197 and thereby to support a towel throughout the entire width of the towel. Assuming now that the plate 249 has been lowered on to the belts 197, the towel is moved by said belts on to said plate. The mechanism later to be described for operating the plate then raises the plate 249 with the towel thereon.

Said plate 249 terminates in a backing member 258 (Figs. 16 and 17) provided with a side lug 259 and with a pair of sleeves 260, 261. Said sleeves are slidably mounted on the respective stationary posts 262 and 263. A series of hinged side plates 264, 265, 266 and 267 are provided to hold the stack of towels while the plate 249 reciprocates to receive and lift the towel from the belt 197. The hinge plates 264 and 265 are each mounted for swinging movement on the rod 268, there being a spring at the hinge for each of the plates tending to urge the plates into their respective horizontal positions. The pivot rod 268 is mounted in suitable bearings carried by the plates 269, 270, which bearings are in turn secured to the posts 262 and 271 respectively. The sleeve 260 is provided with a longitudinal slot to permit said sleeve to pass the plate 269 during the reciprocation of the sleeve and of the plate 249.

It will be seen that as the plate 249 is raised into towel-stacking position, the towel thereon which extends across the projections 253, 254, 255 and 256 engages the plates 264, 265, 266 and 267 and swings said plates upwardly about their respective pivot rods.

When the towel has passed the hinge plates, said plates are freed from further upward pressure and are automatically returned to their horizontal positions by the springs thereof. The towel having been raised by the plate 249 past the horizontal plates, downward movement of the center plate 249 causes the towel to be deposited on the now horizontal upper surfaces of the hinge plates and underneath whatever towels have been previously arranged on said plates. The center plate 249 having deposited the towel at the bottom of the stack is now ready to receive another towel and to repeat the operation.

The means for operating the center plate 249 will now be described.

Referring to Figs. 16 to 19 inclusive, the backing member 258 of said plate is provided with a lug 280 under which is arranged the end 281 of the plate-operating lever 282, the lever being pivoted as at 283 to the frame part 214 of the machine (Fig. 16). It will be seen that when the end 281 of the lever is moved upwardly, the plate 249 together with the towel thereon are also raised upwardly, the sleeves 260 and 261 sliding on the posts 262 and 263. In order to swing the lever 282, a rod as 284' is pivoted to the lever intermediate its ends as at 285' (Fig. 18), the lower end 286' of said rod being provided with a cam follower inserted into the groove 287' of the grooved plate cam 288'. Said cam is mounted on the shaft 284 on which the one revolution clutches 247 and 250 are mounted. For rotating said shaft, a suitable bevel gear 285 is secured to the end of the shaft and meshes with a similar gear 286 on the roller shaft 287. (See also Fig. 1.)

The towel conveyor belt 197 passes about the pulley 288 on the shaft 289, which shaft also carries the gear wheel 290 meshing with the gear wheel 291 on the shaft 287 whereby movement of the belt causes rotation of the shaft 287 and consequently causes rotation of the shaft 284.

It will be seen that when the clutch 250 on the shaft 284 is thrown into operation by the energization of the solenoid F, the cam 288' is rotated, reciprocating the rod 284' and thereby swinging the lever 282, and by the engagement of the lever end 281 with the lug 280, raises the plate 249 the required distance to move the towel thereon past the hinge plates 264, 265, 266, 267, thereby to deposit the towel at the bottom of the stack of selected towels of the same grade. The cam groove 287' is so designed as to have a substantial rest period or dwell as at 292 whereby sufficient time is allowed between the energization of the solenoid F' through the operation of the selected mechanism, and the raising of the plate 249, to permit the folding of the towel after it passes the photoelectric cells and to permit the folded towel to be conveyed on to the plate 249.

At this point, it might be well to state that the towel is conveyed past the photo-electric cells at such speed and in about the time that it would take the gear 217 (Fig. 13) to be rotated through one revolution by the motor C so that sufficient time is allowed for the complete scanning of the towel before the solenoids F or G are energized. It thereby becomes possible to complete the scanning of the towel a sufficient time before the selected towel is stacked, to permit the folding operations hereinbefore described, particularly in view of the considerable dwell or rest provided on the cam 288'.

The cam track or groove 287' is further so designed that the plate 249 after depositing its towel at the bottom of the stack, drops down to an initial position at a point sufficiently above the conveyor belt 197 to permit the passage therepast of those folded towels which are to be stacked in the grade B stack or to be discarded. The cam track is further so designed that immediately after operation of the clutch 250, the lever end 281 is swung downwardly, permitting the plate 249 to drop on to the conveyor belt 197 to receive the oncoming towel, whereafter the plate is raised past the hinge plates, and then finally lowered to a position above the belt 197,

thus completing the cycle of operations on each revolution of the cam 288'.

Means are further provided for raising the entire stack of selected towels off the hinge plates 264, 265, 266 and 267 up on to a similar set of hinge plates preparatory to tying the stack into a bundle, when fifty towels of the same grade have been stacked. Said means includes a clutch operative after fifty revolutions of the one revolution clutch 250 to raise the plate 249 a sufficient distance past the hinge plates to deposit the entire stack of fifty towels on the upper set of hinge plates.

Referring again to Figs. 16 to 19, the pinion 293 on the shaft 284 engages the planetary gears 294 revolvably carried by the internal gear 295 and meshing therewith. Said internal gear 295 is loose on the shaft 284 and carries the pin 296 pivoted as at 304' and pressed by the spring 297 toward its horizontal position. The gears 295, 294 and 293 are so designed that on one revolution of the shaft 284, the gear 295 is rotated through one-fiftieth of a revolution, thereby carrying the pin 296 through one-fiftieth of a complete turn.

On the shaft 284 is fixed the clutch member 298 provided with an internal conical recess. Loosely mounted on the shaft 284 is the control gear 299 which carries the conical clutch member 300 adapted to enter the recess of the clutch member 298 to operatively engage the gear 299 with the shaft 284. Said clutch members 298 and 300 are urged into engagement by the spring 301. The pin 296, however, by its engagement with the surface of the gear 299 prevents the spring 301 from effecting the operative engagement of the clutch members until said pin 296 has been swung out of the way of the gear 299. The pin is so operative on every fifty turns of the internal gear 295.

To so swing the pin 296, a track or groove 302 (Fig. 19) is made in that face of the gear 299 nearest the pin. Said groove communicates with a bevelled recessed portion 303 on the face of the gear 299, the recess at its right edge being provided with a cam surface 304 leading toward the track 302. It will be seen that on each rotation of the shaft 284, the internal gear 295 rotates one-fiftieth of a turn and the pin 296 being kept at its horizontal position engages the face of the control gear 299 along an annular surface radially outside of the track 302. After forty-nine towels have been stacked, the pin 296 approaches the cam edge 304. On the fiftieth revolution of the shaft 284, and on the last fiftieth turn of the internal gear 295, the pin 296 engages the cam edge 304 and is swung about its pivot and against the action of the spring 297 to cause the end of the pin to enter the track or groove 302 and to be removed from the transverse path of bodily movement of the gear 299 along the shaft 284. The resistance of the pin to the movement of the gear 299 under the influence of the spring 301 being thus eliminated, the spring 301 moves the gear 299 toward the left as viewed in Fig. 16 to cause engagement of the clutch members 300 and 298 and thereby to permit the shaft 284 to rotate the control gear 299 at comparatively high speed. The control gear 299 is operatively connected to the plate 249 through the gears 305, 306, there being a sprocket wheel 307 mounted on the same shaft as the gear 306.

At its lower end, the chain 308 passes about the sprocket wheel 307, and at its upper end passes about the sprocket wheel 309 (Fig. 1), the

latter sprocket wheel 309 being supported by the post 263. Mounted on the post 263 is the collar 309', which is secured to the chain and which is arranged underneath the sleeve 261, whereby movement of the chain raises the collar and therethrough exerts upward pressure on the sleeve 261 to carry the plate 249 upwardly along the posts 261 and 262 past the tying platform soon to be described.

The tying platform consists preferably of four hinge plates similar to the plates 264 to 267 and operating in a similar manner (Fig. 26). For example, the hinge plate 310 is pivotally mounted by means of a suitable spring hinge on the hinge rod 311, which is in turn supported by a suitable bearing projecting from the sleeve 312 slidably mounted on the post 262. The hinge plate 313 is similarly mounted on the post 261. The hinge plate 314, however, is similarly mounted on the arm 315 carried by the frame of the machine while the similar hinge plate 316 is mounted on the arm 317. It will be understood that the plates 310, 313, 314 and 316 are spaced apart both longitudinally and transversely a sufficient distance to permit the passage of the plate 249 upwardly therepast to deposit the stack of towels thereon and downwardly therepast to free itself of said bundle in the same manner as said plate 249 deposits the towels on the hinge plates 264 to 267.

Said hinge plates 310, 313, 314 and 316 constitute the tying platform on which the stack of towels rest while being tied into a bundle. It will be understood that the hinge plate supporting portion of the arm 315 is in substantial alignment with the rear post 271 and that the similar arm 317 is in similar alignment with the front post 271, but that there is a space left between the arms 315, 317 and the upper ends of said posts 271 for a purpose which will later become obvious.

It will be understood that after the plate 249 has been raised by the chain 308 into position to deposit the stack of towels on the upper hinge plates or tying platform, the plate 249 is released and drops down by gravity until it again contacts with the lever 282 and remains in its initial position somewhat above the conveyor belt 197, ready for stacking the next fifty towels and to repeat the operation above described, it being understood that the pin 296 by its engagement with the control gear 299 permits the plate 249 to drop freely by maintaining the clutch members 298 and 300 out of engagement and against the action of the spring 301. The gear 299 and the intermediate gears 305, 306 cannot operate the chain 308 when the clutch members 298 and 300 are disengaged and the gear 299 is also freed of the shaft 284 to enable it to rotate freely when the plate 249 is released and drops. The pin 296 on the return movement of the control gear 299 moves out of the track 302 and climbs the bevel or inclined portion 303 of the gear face to a position adjacent the cam edge 304 ready to repeat the operation of controlling the lifting of the stack to the tying platform when fifty towels have accumulated on the lower hinge plates.

Bundle tying mechanism

The means for tying the stack into a bundle will now be described.

An upper clamp plate 320 (Figs. 1, 20, 21, 22, 25 and 31) is provided for the purpose of clamping the stack of towels against the hinge plates constituting the tying platform when the stack

is to be manipulated during the tying operation to tie the stack into a bundle. The upper clamp plate is in its uppermost position clear of the stack when the plate 249 moves up to deposit the stack on the tying platform. The clamp plate is then moved downwardly on to the uppermost face of the stack to clamp the stack to the tying platform, whereafter the stack may be manipulated as a unit together with the upper clamp plate and the tying platform. Said upper plate 320, as shown by the dotted lines of Fig. 25, extends somewhat less than half-way across the upper face of the stack but extends throughout the entire thickness of the stack. The plate is supported by a pair of intersecting brackets 321, 322 (Figs. 20, 21, 22, 25). At the juncture of said brackets is provided a sleeve 323 secured to the upright post 324. Said post passes loosely through the fixed horizontal portion 325 of the machine frame and carries the two-arm bracket 326 fixed thereto near the upper end of the post. The bracket 326 in turn supports suitable gearing for the purpose later to be described, and carries the lug 327 engaged by the cam 328 for raising and lowering the upper clamp plate 320, the post 324, the bracket 326 and the parts carried thereby.

Said cam 328 is mounted on the shaft 329 supported by a suitable bracket 330 carried by the frame part 325, the cam extending through a suitable slot in said frame part. At one end of the shaft 329 is the bevel gear 331 meshing with the bevel gear 332 at one end of the cross shaft 333. At the other end of said shaft 333 is the bevel gear 334 engaging the bevel gear 335 on the upright shaft 336 (Fig. 20). The bevel gear 337 at the lower end of the shaft 336 engages the bevel gear 338 which in turn meshes with the bevel gear 339 on the tying mechanism shaft 340. A shaft 318 aligned with the shaft 340 (Fig. 26) is continuously rotated through a suitable belt or chain 341 passing around a pulley or sprocket on the shaft 318 and about another suitable pulley on the shaft 342. Referring to Fig. 1, it will be seen that the shaft 342 carries a pulley 343 for operating the endless belt 344 which discharges the tied bundle from the machine in a manner to be later described. Said belt 344 also passes about the pulley 345 on the shaft 346 which is rotated in any suitable manner as by means of the belt or chain 347 passing about a suitable sprocket wheel on the shaft 346 and about another sprocket wheel on the shaft 348 which carries the pulley for the lower conveyor belt 197.

The shaft 318 carries one member 319 (Fig. 26) of a one-revolution clutch, the other member of which is slidably arranged on the tying mechanism shaft 340. When the clutch members are engaged, it will be understood that the shaft 340 will make one revolution and thereby a cycle of operations will be performed by the tying mechanism, said cycle including the raising and lowering of the upper clamping plate 320. The clutch member on the shaft 340 is operated through the medium of the solenoid H (Figs. 15 and 26), thus to cause operation of the tying and bundling mechanism.

Said solenoid H is energized by the closing of a circuit thereto as the plate 249 starts its downward movement to deposit the stack on the tying platform. Toward this end, (Fig. 1), a suitable spring switch 358 of the plunger type is carried by the arm 359 depending from the frame member 325, being interposed in the path

of the lug 280 projecting from the plate 249. Suitable wires lead from the switch 358 to the solenoid H, whereby as the plate 249 reaches the uppermost part of its movement and starts to descend, the switch 358 closes the circuit to the solenoid H and causes it to engage the clutch member 319 with its cooperating member to rotate the shaft 340 through one revolution, whereby the cam 328 moves the clamping plate 320 downwardly and other operations to complete the tying of the stack are performed.

It will thus be seen that the cam 328 through the connections just described, is rotated just before the stack is deposited on the tying platform to release the lug 327 and thereby begin lowering the upper clamp plate 320 against the top of the stack deposited on the tying platform.

To support the clamping plate 320 in its movement, there are provided at the corners thereof a pair of sleeves 349, 350 (Fig. 21) designed to slide on the upper ends of the posts 262, 263 respectively and on the respective upper removable posts 351 and 352 forming continuation of said posts 262, 263. Since the continued posts 351, 352 are at times moved upwardly away from their respective cooperating posts 262 and 263, means are provided for locking the upper post 351 to the lower post 262 at the proper time and similarly, to removably lock the upper post 352 to the lower post 263.

As shown in Figs. 22, 24, and 31, the lock between the lower end of the upper post 351 and the upper end of the post 262 comprises the reduced upper end 353 on the post 262, said reduced upper end being provided with the radial pin 354. The lower end of the post 351 is suitably bored to provide the opening 355 for the reception of the reduced end 353. The walls surrounding the opening 353 are provided with upright grooves 356 to receive the projecting ends of the pin 354. Communicating with the upper ends of the upright grooves 356 are the circumferential grooves 357 (Fig. 24) extending through an angle of approximately 90°. Thus, when the grooves 356 in the upper post 351 are aligned with the projecting ends of the pin 354, the upper post may be lowered to insert the reduced end 353 into the opening 355, while at the same time the projecting ends of the pin 354 enter the grooves 356. The post 351 is lowered until the top surface of the reduced end part 353 strikes the end wall of the opening 355, in which position the ends of the pin 354 are ready to enter the grooves 357. The post 351 is then rotated through an angle of approximately 90° to cause the end of the pin 354 to enter said grooves 357 whereby the posts 351 and 262 are locked together.

The locking means to connect the post 352 and 263 being similar to that just described, the above description of one will suffice for both.

The means for rotating the posts 351 and 352 to lock them and unlock them from the corresponding lower posts will now be described (see Figs. 22 and 25).

The post 351 terminates at its upper end in the elongated pinion 360 and is secured to the bracket 326. The pinion 360 meshes with the gear wheel 361 on the shaft 362 which is carried by the bracket 326. The gear wheel 363 is mounted on the shaft 364, said shaft being supported by the fixed frame part 325 on the lower end of the same shaft 364 is the long segmental gear 365 extending radially in one direction, and at its upper end is the shorter segmental gear

366 extending radially in the opposite direction. The segment 365 is of sufficient length to engage the pinion 360 when the plate 320 is in its lowermost position, while the segment 366 is shorter, being of sufficient length to engage the gear 361 at the proper time when the plate 320 is in its lowermost position. The gear 363 meshes with the gear 367, said gear 367 carrying the bevel gear 368 which meshes with the bevel gear 369. The bevel gear 369 in turn carries the gear 370 which meshes with the gear 371. The gear 371 in turn meshes with the gear 372 carried by the cam 328 and rotatable with the tying mechanism shaft 329.

As has been hereinbefore described, the shaft 329 is rotated through the bevel gears 331 and 332 when the one revolution clutch 319 is operated by the solenoid H. Through the train of gears above described, it will be seen that on the energization of the solenoid H, the segments 365 and 366 are rotated, the segment 365 engaging the pinion 360 at one time to rotate the post 351 in the proper direction to lock the pins 354 in the grooves 357 after the lowering of the plate 320 has been completed and preparatory to certain operations soon to be described, to cause the segment 366 to engage the gear 361 to cause said gear to rotate the pinion 360 in the opposite direction and thereby to unlock the pins 354 from the grooves 357 preparatory to raising the post 351 and the plate 320 in order that a new stack or bundle may be deposited on the tying platform or the performance of other operations.

In order that the post 352 may be locked and unlocked simultaneously with the locking and unlocking of the post 351, a suitable intermediate gear 373 is interposed between the gear 367 and the gear 367, which is similar to the gear 367 and which is connected by similar gears and segments to those hereinbefore described in connection with the post 351, to the pinion for the post 352.

Since the plate 320 and the posts 351 and 352 are rotated about a vertical axis through an angle of 90° during the tying operation, it becomes advisable to supply a similar train of gears to lock and unlock the posts 351 and 352 in their new positions. Toward this end, the intermediate gears 374 and 375 are provided, operatively connecting the gear 367 to the similar gear 2367, it being understood that segments similar to the segments 365 and 366 are arranged to engage the pinion on the upper post in the new position thereof.

It will be understood that the gear 361 is moved with the bracket 326. When the upper clamp plate 320 and the parts connected thereto are raised, said gear 361, while remaining in engagement with the pinion 360, is withdrawn from the position in which it might be engaged by the segment 366, so that rotation of the shaft 364 in the raised position of the post 351 cannot effect rotation of said post. Nor can the segment 365 engage the pinion 360 in the position just described for the reason that the pinion 360 has been raised above the path of said segment. It will further be understood that the grooves 356 are arranged vertically above the locking pin 354 in the raised position of the post ready to receive the pin when the post is lowered, so that the locking action of the pin when the post is rotated may readily be accomplished.

It will be seen, therefore, that in the uppermost or normal position of the clamp plate 320, the post 351 is unlocked from and resting above

the post 262. As the clamping plate 320 completes its movement to clamp the stack to the tying platform, and after the pins 354 have entered the openings 355, the post 351 is given a rotation through the train of grooves above-described in the proper direction to lock the pins 354 in the grooves 357.

In the clamped position of the stack, it now becomes possible to perform the first tying operation consisting of passing a string of twine about the stack to form a loop thereabout.

The means for forming the loop comprises the hollow needle 376 (Figs. 20 and 21) provided with a perpendicular arm 377 comprising a pair of telescoping parts, one of said parts 380 being secured to the needle 376 and the other of said parts being mounted on the sleeve 378 carried by the shaft 381. Said shaft 381 carries the pinion 382 meshing with the gear 383 which also carries the gear 338. On the rotation of the gear 339, therefore, due to the energization of the solenoid H. and the consequent operation of the one revolution clutch 319, the gear 338 is rotated, thereby rotating the sleeve 378 through the gears 383 and 382 and consequently swinging the arm 377 and the needle 376.

One of the ends 384 of the needle 376 enters the rectangular groove 385 in the frame part 386, whereby the operative end 387 of the needle is given a substantially rectangular path conforming to the shape of the groove 385, said path being somewhat outside of the stack but conforming generally to a vertical section of the stack.

The string or twine 388 is fed into the arm 380 through an opening 389 therein and thence through the needle 376 out through the end 387. The spool 390 is mounted on the sleeve 378 by means of the bracket 391 and swings with said sleeve, thereby carrying the twine emerging from the end 387 of the needle around the stack to form the first loop thereabout, the needle at this time passing through an angle somewhat greater than 360° to form a loop 400 subtending somewhat more than a complete turn (Fig. 27).

It will be understood that in order to form the first loop 400 around the bundle, one end of the loop as 401 should be fixed in place. Toward this end, the twine gripper designated generally by the numeral 402 is provided. The twine gripper or holder comprises an outer sleeve 403 (Fig. 32) terminating in the bearing 404 at its lower end. Projecting from the inner surface of the bearing is the lug 405 entering the cylindrical cam groove 406 in the movable twine gripping jaw 407. The cam-carrying sleeve portion 408 of said jaw is arranged for sliding and rotative movement in the bearing 404, and is keyed as by means of the key 409 to the shaft 410 which is mounted within the sleeve portion 408. At the end of the shaft 410 is the bevel gear 411 meshing with the bevel gear 412 on the shaft or rod 413, said shaft passing through the sleeve 403 and emerging from the upper end thereof.

It will thus be seen that when the shaft 413 is rotated, the shaft 410 is also rotated, carrying with it the cam sleeve 408. The entire jaw 407 is thereby caused to slide relatively to the bearing 404 by means of the lug 405 operating in the cam groove 406. The bearing 404 terminates in an inclined portion 414 at the entrance to the stationary gripping jaw for the twine.

The movable jaw 407 is also provided with a similar bevelled portion 415 for the entrance of the end 401 of the twine between the adjacent

faces 416 and 417. Thus, when the jaw 407 is moved away from the bearing 404 and the faces 416 and 417 thereby separated, the twine may enter between said faces, and when the movable jaw 407 is moved back to its initial position, the end portion 401 of the twine is gripped and adequately held between said faces. The sleeve 403 terminates at its upper end below the frame part 325. On the shaft 413 which projects beyond the upper end of the sleeve is a ball 418 mounted in the ball socket formed in the pinion 419 and suitably keyed thereto for rotation therewith. The pinion 419 meshes with the gear segment 420 supported by the frame 325 and carrying the crank 421 (Fig. 25). A suitable pin 422 at the end of the crank enters the cam groove 423 in the cam 424 which is suitably mounted on the shaft 425.

On said shaft is the bevel gear 426 meshing with the bevel gear 331 and rotated thereby. The cam groove 423 is so designed as to swing the crank 421 at the proper time to alternately separate and bring together the twine gripping faces 416 and 417 through the rotation of the gears 420 and 418 and the consequent rotation of the shaft 413 and of the shaft 410. It will be understood that the end 401 of the twine is gripped between the faces 416 and 417 (Fig. 27) before the needle 376 begins its first rotation to form the loop 400.

After the first loop 400 has been made as hereinbefore described, the upper clamp plate 320 and the parts connected thereto including the posts 351 and 352 and part of the tying platform consisting of the plates 314 and 316 are raised, and the entire mechanism thus raised, including the stack, is rotated through an angle of 90° so that the next rotation of the needle may form a second loop 427 around the stack, said second loop lying in a plane at right angles to the first loop 400.

It will be understood that during the raising of the stack, the post 351 is locked to the post 262 and that the post 352 is similarly locked to the post 263. The uppermost parts of the posts 262 and 263, however, are made separable to permit the hinge plates 314 and 316 constituting part of the tying platform to move therewith when the posts 351 and 352 are raised. Toward this end, the upper portion of each of said posts 262 and 263 is separated from the remainder of each of the posts, the thus separated parts being each provided with a suitable stud 428 (Fig. 20) adapted to enter a corresponding opening 429 in the upper end of the fixed part of each of the posts 262 and 263.

When the cam 328 at the proper time in its rotation engages the lug 327 and thereby raises the bracket 326 and the post 324 and the parts carried thereby, the entire stack is raised as a unit with the clamping plates 320, 314 and 316, the stack being clamped between said plates, and the upper portions of the posts 262 and 263 becoming separated from the lower portions of said posts, the studs 428 being raised out of the openings 429. The stack is now rotated through an angle of 90°. This is done by means of the longer segment 430 mounted on the same shaft 431 as the gear 373 (Fig. 25), which segment engages the gear 432 on the post 324 at the proper time to rotate said post as well as the bracket 326 and the parts carried thereby and thereby to rotate the stack about the vertical axis of the post 324. It will be understood that after the tying operation has been completed, the stack is rotated back to its initial position through an angle of 90° by means of the second shorter segment 433 also

mounted on the shaft 431 and adapted to engage the gear 434 which in turn meshes with the gear 435 on the post 324.

After the stack has been thus raised and turned, the post 351 enters the notch 437 in the frame part 325 and is guided by the wall thereof in its movement. The stack is then lowered by the operation of the cam 328 until the hinge plate 314 rests on the hinge plate 310 and at least one of the studs 428 re-enters an opening 429. Preparatory to making the second revolution of the needle to make the second loop 427, the posts 351 and 352 are unlocked from their respective lower posts 262 and 263 by the operation of the shaft 329 and the consequent operation of the trains of gears to said posts, whereafter the cam 328 becomes operative to lift the posts and the clamping plate 320 upwardly away from the stack. The needle 376 is now given its second rotation to form the greater part of the loop 427, being rotated through an angle of less than 360°.

The last part 438 of the loop 427 is inclined from the bottom of the stack upwardly and outwardly (Fig. 29). It therefore becomes desirable to pull said part 438 inwardly to a position wherein it may be connected to the end 401 of the first loop so that the tying may be completed, and to move the twine gripper 402 inwardly toward the stack for the same purpose so that the needle becomes arranged outwardly beyond the gripper. The twine gripper is moved toward the stack by means of the crank 439 (Fig. 23) having one arm 440 provided with a follower entering the cam groove 441 of the cam 442 on the shaft 425. The other arm 443 of the crank engages the upper end of the shaft 413 and serves to swing said end in the proper direction to cause the lower twine gripping end of the twine gripper to move toward the stack at the proper time from the position shown in Fig. 23.

As has been indicated, means are provided for carrying the end part 438 of the loop 427 toward the gripper to tension the loop and to bring the end of the loop into position to be stapled. Said means includes the rod 444 terminating in the twisted fork 445 and mounted for movement into and out of the tube 446 (Fig. 20). Said tube is of sufficient length to permit the rod to reciprocate therein and to be supported thereby in all positions. Secured to the outer end of the rod 444 and passing through the tube 446 and through the bent tube 447 is the flexible cable 448, which is wound about the drum 449.

Said drum is operated by a suitable gear segment on the shaft 342 meshing with a suitable gear carried by the drum whereby the cable 448 is wound up at the proper time to pull the outermost end of the rod 444 downwardly toward the innermost end of the tube 446 and thereby to cause the fork to pass through the ball and socket pivot 450 into engagement with the lower end of the string portion 448 as shown in Fig. 28. Continued rotation of the drum 449 and consequent continued winding up of the cable 448 causes a suitable pin on the rod 444 to enter the arcuate track 451 in the bent tube 447 and thereby swings the rod downwardly in an arc and causes the fork 445 to swing upwardly and inwardly and thereby to tension the string forming the loop portion 438 and to pull said portion toward the twine gripper 402 into a position wherein the portion 438 may be secured to the end 401 inwardly of the end of the portion 438, and the outer part of the portion 438 may be reinserted into and held by the twine gripper ready for the formation of the next loop.

A suitable spring on the rod 444 pulls said rod back into the tube 446 after the tying portion has been completed. The means for securing the end 401 to the loop part 438 will now be described.

Said mechanism comprises the stapler designated generally by the numeral 452, which is operative to fasten the staple 453 about the ends 401 and 438 of the loop. It will be understood that the fork 445 carries the loop part 438 into the position shown in Fig. 29 wherein the string or twine is arranged between the jaw parts 404 and 406 of the twine gripper. As the stapler 452 is operated to fasten the staple 453 about the thus arranged adjacent parts of the loop and to cut the twine, the jaws of the twine gripper are moved apart through the mechanism previously described to permit the end of the twine emerging from the needle 376 to become positioned between the faces 416 and 417 of the twine gripper, whereafter the jaws are moved toward each other to grip the twine end preparatory to the formation of a new loop 400.

The stapler 452 comprises an anvil portion and a plunger portion such as is well known in the art and hence need not be described in detail except to state that the stapler includes a reservoir for staples and means for advancing one staple at a time from the reservoir and to clinch the staple about the work and against the anvil. As shown in Figs. 22, 23 and 25, the stapler terminates in an inclined cam surface 454, which is engaged by the similarly inclined cam end 455 of the staple operating cam 456. Said cam is engaged by the rod 457 which is mounted in the bearing 458 of the bracket 459. The rod 457 is provided with an arm 460 engaging the cam 461 on the upper cross shaft 333.

It will be seen, therefore, that on the operation of the cam 461, the stapler 452 is moved inwardly to the stapling position shown in Fig. 29 at the proper time to staple the second turn on the bundle, the stapler being carried by the bearing 462 on the bracket 459 so that when the stapler is moved the proper distance in said bearing, the plunger thereof is operated to perform the stapling operation.

It will be understood that the stapler carries a suitable severing device for severing the ends of the loop parts 401 and 438 between the needle 376 and the stapler 452. After the twine has been thus stapled and cut, the stapler 452 is moved back under the influence of a suitable spring, against the cam 461 to its initial position, and the twine gripper 402 is also moved back by the operation of its cam 442 out of the way of the stack and away from the needle 376.

The upper clamping plate 320 is now moved down on the stack by the operation of the cam 328 and the upper posts 351 and 352 are rotated, through the gearing hereinbefore described for that purpose, to lock said posts to the upper post portions 262 and 263, respectively, by the entrance of the locking pins 354 in the grooves 356 on the rotation of the posts. The entire stack or bundle together with the upper clamping plate 320 and the lower hinge plates 314 and 316 are now raised in the same manner as hereinbefore described through the operation of the cam 328 until the upper portions of the posts 262 and 263 are removed from the lower portions of said posts by the removal of the studs 428 from the openings 429. The thus raised parts are now rotated back through an angle of 90° to their initial positions by the shorter segment 433 and the gears 434 and 435, after which the cam 328 operates to lower

the upper clamping plate, the stack, and all the parts previously raised, back to their initial positions wherein the studs 428 re-enter the openings 429. The posts 351 and 352 are now again rotated about their own axes to unlock them from the upper parts of the posts 262 and 263 and said clamping plate is again raised to release the bundle. The bundle is thus freed for ejection from the machine.

Ejecting mechanism

Means are provided for ejecting the tied bundle transversely of the machine on to the endless belt or conveyor 344 (Figs. 1 and 20) from which the bundle may be conveyed to a suitable conveyor 463 which carries the bundle to a central point. Said means comprises the swing ejector arm 464 which at its lower end is provided with the spaced U-shaped members 465 for engaging the bundle. The arm 464 is pivoted at its upper end 466 to the frame 325 for swinging movement laterally of the machine. A pin 467 near the upper end of the arm enters a suitable groove 468 in the cam 469 on the shaft 425. The cam groove 468 is so shaped as to give the ejector arm 464 a sudden movement at the proper time to thrust the bundle off the tying platform and on to the conveyor belt 344.

It will be understood that the mechanism hereinbefore described in connection with one of the tying platforms is duplicated in the machine for both grade A and grade B towels so that the above description of the tying, ejecting and stapling mechanism will suffice for both.

It will further be seen that we have provided a machine designed not only to sort laundered articles, and to discard articles damaged to an unuseable extent, but also efficient to fold the articles, arrange them in stacks of a predetermined number, to tie the stacks into bundles, and to convey the thus tied and folded bundles away from the machine.

While we have shown and described certain specific embodiments of our invention, we do not desire to be understood as limiting ourselves thereto, but intend to claim our invention as broadly as may be permitted by the state of the prior art and the terms of the appended claims.

We claim:

1. In a laundry finishing machine, for selecting, folding and tying similar laundered articles in bundles, means for successively advancing the laundered articles, means for folding the articles, means for stacking folded articles in a stack of a predetermined grade and for discarding the articles damaged beyond a predetermined limit, light-sensitive means for controlling the stacking means, means for tying the stack into a bundle, and means for discharging the tied bundle from the machine.

2. In a laundry finishing machine, light-sensitive means, means for feeding laundered articles in succession past said light-sensitive means, article-folding means, means controlled by the light-sensitive means for sorting and stacking the folded articles into stacks of a predetermined number and grade, and means for bundling the graded stacks.

3. In a laundry finishing machine, means for advancing laundered articles, means for grading and stacking the articles advanced by said advancing means including light-sensitive means and a circuit-making and breaking device con-

trolled by the light-sensitive means and controlling said grading and stacking means.

4. In a laundry finishing machine, means for receiving laundered articles from a mangle and for advancing said articles, a scanning plate, means for successively advancing the articles along the scanning plate, light-sensitive means adjacent the scanning plate for scanning the articles during the advance thereof, and stacking and grading means controlled by the light-sensitive means.

5. In a laundry finishing machine, means for folding laundered articles, grading and stacking means, and means responsive to defects in the articles for controlling the operation of said grading and stacking means.

6. In a laundry finishing machine, means for folding laundered articles, grading and stacking means, and means responsive to defects in the articles for controlling the operation of said grading and stacking means including a pair of photoelectric cells, one of said cells requiring a greater amount of light for operation than the other.

7. In a laundry finishing machine, folding means, grading and stacking means, means responsive to defects in the articles finished by the machine for controlling the operation of said grading and stacking means, and means for bundling the stacks sorted by said grading and stacking means.

8. In a laundry finishing machine, folding means including a reciprocating blade adapted to engage and to initiate the folding of a laundered article, a pair of cooperating rollers adjacent the blade to complete the folding and to advance the folded article, a chute adjacent the rollers to receive the folded article, said chute having a closed bottom and having a slot at substantially right angles to the axes of said rollers, means for swinging the chute with the folded article therein to a position at substantially right angles to the position assumed by the chute when the folded article is advanced thereinto, a second blade, and means for reciprocating said second blade through the slot to again fold the folded article along a line at substantially right angles to the line of fold made by said folding means.

9. In a laundry finishing machine, article-folding means including a reciprocating blade and a pair of cooperating rollers adjacent the blade, grading and stacking means for the articles, and means arranged in advance of the folding means and responsive to defects in the articles for controlling the operation of the stacking means.

10. In a laundry finishing machine, stacking means, and means for controlling the operation of said stacking means including a pair of photoelectric cells, a solenoid controlled by each of said cells, a rotatable and axially shiftable member, a movable contact member carried by the rotatable member, a pair of fixed spaced contact members and means controlled by the solenoids for axially shifting the rotatable member into a position to engage a selected one of the fixed contact members and thereby to close a circuit to the stacking means.

11. In a laundry finishing machine, a pair of similar stacking mechanisms, and means for controlling the operation of each of said mechanisms, comprising a pair of solenoids, light-sensitive means responsive to defects in the work finished by the machine for energizing the solenoids, a rotatable and shiftable contact member, a pair of fixed contact members spaced apart in the

direction in which the rotatable contact member is shiftable, and means controlled by the solenoids for shifting the rotatable contact member into position to close a circuit with a selected one of the fixed contact members and thereby to set a selected one of the stacking mechanisms into operation.

12. In a laundry finishing machine for folding, sorting and bundling articles of flat work, means responsive to defects in the articles for sorting and stacking the articles into grades and for discarding articles damaged beyond a predetermined limit, means for folding the articles, and means for tying the articles undiscarded into bundles each containing a predetermined number of folded articles.

13. In a laundry finishing machine for articles of flat work, means for advancing the articles in succession and out of contact with each other, means for folding the articles, and electrically operated means responsive to defects in the articles for stacking the folded articles into stacks of a predetermined number and grade.

14. In a laundry finishing and bundling machine for articles of flat work, electrically operated means responsive to defects in the articles for stacking the articles into stacks of a predetermined number and grade, and means for tying the stacks into bundles.

15. In a laundry finishing and bundling machine for articles of flat work, means responsive to defects in the articles for stacking the articles into stacks of a predetermined number and grade, means for tying the stacks into bundles including means for passing twine about the stack to form a pair of loops thereabout, means for turning the stack into position for the formation of said loops, means for carrying the ends of the loops into contact, means for stapling the ends together, and means for severing the twine beyond the stapled ends thereof.

16. In a laundry finishing machine for articles of flat work, means for receiving articles from a mangle and for advancing the articles, a reciprocating conveyor, suction means for transferring the articles from the receiving and advancing means to the conveyor, a darkened scanning plate, adapted to absorb light, for supporting the articles during the advance thereof by the conveyor, a pair of photo-electric cells each responsive to a different amount of light from the articles for scanning the articles during the advance thereof by the conveyor, a circuit-making and breaking device controlled by the photo-electric cells for making and breaking a pair of circuits, a pair of stacking mechanisms, means arranged in said circuits for selectively operating said mechanisms, to cause said respective mechanisms to receive and to stack articles of the same grade and to render said mechanisms inoperative and thereby to discard articles damaged beyond a predetermined limit, and means for tying the stacks graded by said mechanisms into bundles, each of a predetermined number.

17. In a laundry finishing machine for articles of flat work, means for receiving articles from a mangle and for advancing the articles, a circuit-making and breaking device for selectively opening and closing a pair of circuits, light-sensitive means responsive to defects in the articles for controlling the operation of said device, a pair of stacking mechanisms, and means arranged in said circuits for selectively operating said mechanisms to cause said respective mechanisms to receive and to stack articles of

the same grade, and to render said mechanisms inoperative and thereby to discard articles damaged beyond a predetermined limit.

18. In a laundry finishing machine for articles of flat work, means for advancing the articles successively with a gap therebetween, a circuit-making and breaking device for selectively opening and closing a pair of circuits, light-sensitive means responsive to defects in the articles for controlling the operation of said device, means for folding the articles into a predetermined number of folds, a pair of similar stacking mechanisms, and means arranged in said circuits for selectively operating said mechanisms to cause said respective mechanisms to receive and to stack articles of the same grade, and to render said mechanisms inoperative and thereby to discard articles damaged beyond a predetermined limit.

19. In a laundry finishing machine for articles of flat work, means for advancing the articles successively with a gap therebetween, a circuit-making and breaking device for selectively opening and closing a pair of circuits, light-sensitive means responsive to defects in the articles for controlling the operation of said device, means for folding the articles into a predetermined number of folds including a reciprocatory blade, a pair of similar stacking mechanisms each including a plate hinged about a horizontal axis and a vertically reciprocating plate arranged to swing the hinged plate on its upward movement and to deposit the article on said hinged plate on its downward movement, and means arranged in said circuits for selectively operating said mechanisms.

20. In a laundry finishing machine for articles of flat work, means for folding the articles, and electrically-controlled means for stacking the articles into stacks of a predetermined grade and number.

21. In a laundry finishing machine, folding means including a reciprocatory blade and a pair of cooperating rollers cooperating with the blade, a single, rigid chute in the path of an article folded by said folding means and adapted to receive the folded article, said chute having a slot therethrough arranged at substantially right angle to the axes of said rollers and a second reciprocatory blade carried by the chute and adapted to pass through the slot thereof to again fold the folded article at substantially right angles to the fold made by said folding means.

22. In a laundry finishing machine, a single chute having a middle slot therein, means for advancing a folded article into said chute in a direction parallel to said slot, a blade carried by the chute and entering the slot to again fold the folded article along a line at substantially right angles to the direction of the advance of said article into the chute, and a pair of cooperating rollers in the path of the blade for receiving therebetween the article folded by the blade and to again advance the article.

23. In a laundry finishing machine, means for advancing laundered articles, means arranged in the path of the articles for stacking the articles into stacks of a predetermined grade and number, and means for rendering the stacking means inoperative to stack an article damaged beyond a predetermined limit.

24. In a laundry finishing machine, stacking means, and means for controlling the operation of said stacking means including a rotatable and shiftable contact member, a pair of fixed spaced

contact members, and means for shifting the rotatable member into position to engage a selected one of the fixed contact members and thereby to close a circuit to the stacking means.

5 25. In a laundry finishing machine for articles of flat work, means for advancing the articles in succession and out of contact with each other, means for folding the articles, and means responsive to defects in the articles for stacking the
10 folded articles into stacks of a predetermined number and grade.

15 26. In a laundry finishing machine for articles of flat work, means for advancing the articles, a pair of stacking mechanisms arranged in the path of the articles, and means responsive to defects in the articles for selectively operating said mechanisms, to cause said respective mechanisms to receive and to stack articles of the same grade

and to render said mechanisms inoperative and thereby to discard articles damaged beyond a predetermined limit.

27. In a laundry finishing machine for articles of flat work, a circuit-making and breaking device for selectively opening and closing a pair of
5 circuits, means responsive to defects in the articles for controlling the operation of said device, a pair of stacking mechanisms, and means arranged in said circuits for selectively operating
10 said mechanisms to cause said respective mechanisms to stack articles of the same grade in bundles of a predetermined number and to render said mechanisms inoperative and thereby
15 to discard articles damaged beyond a predetermined limit.

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