

June 24, 1930.

W. F. MAYER

1,766,792

FOLDING MACHINE

Filed Jan. 22, 1929

8 Sheets-Sheet 1

Fig. 1.

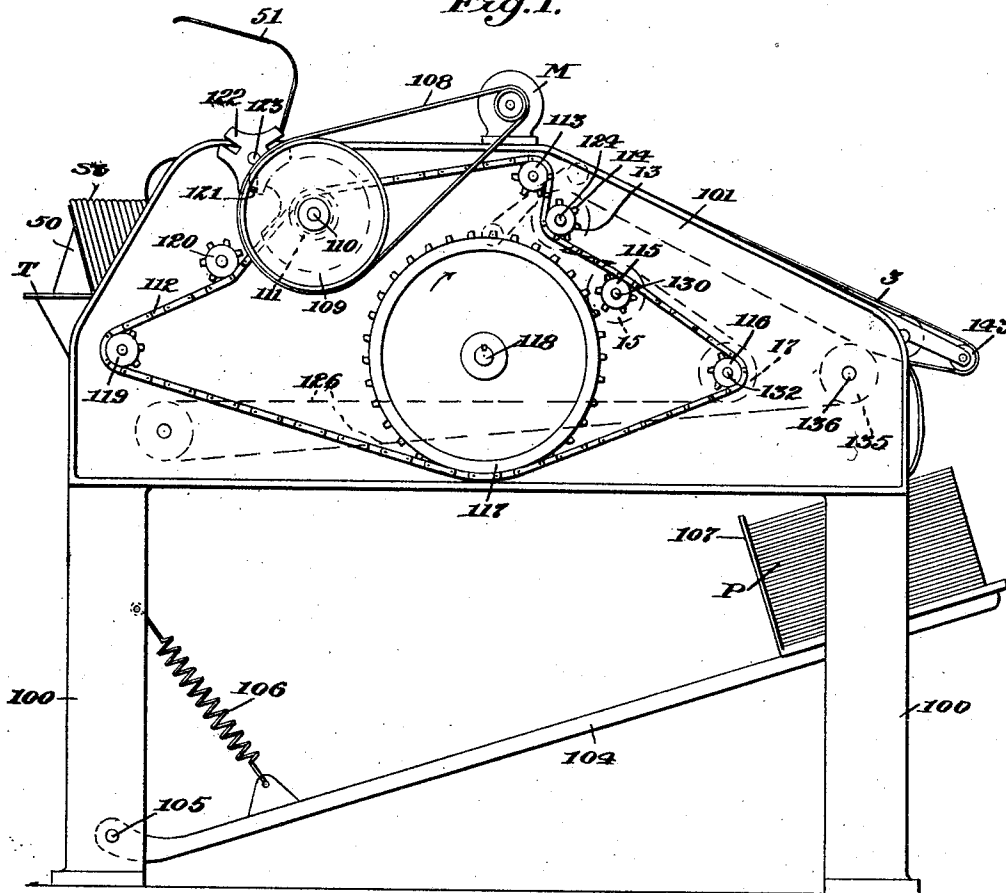


Fig. 13.

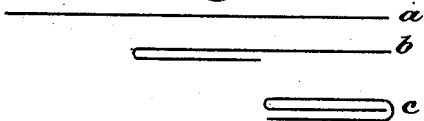


Fig. 14.

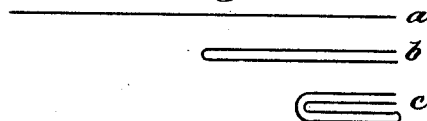
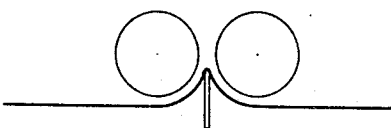


Fig. 15.



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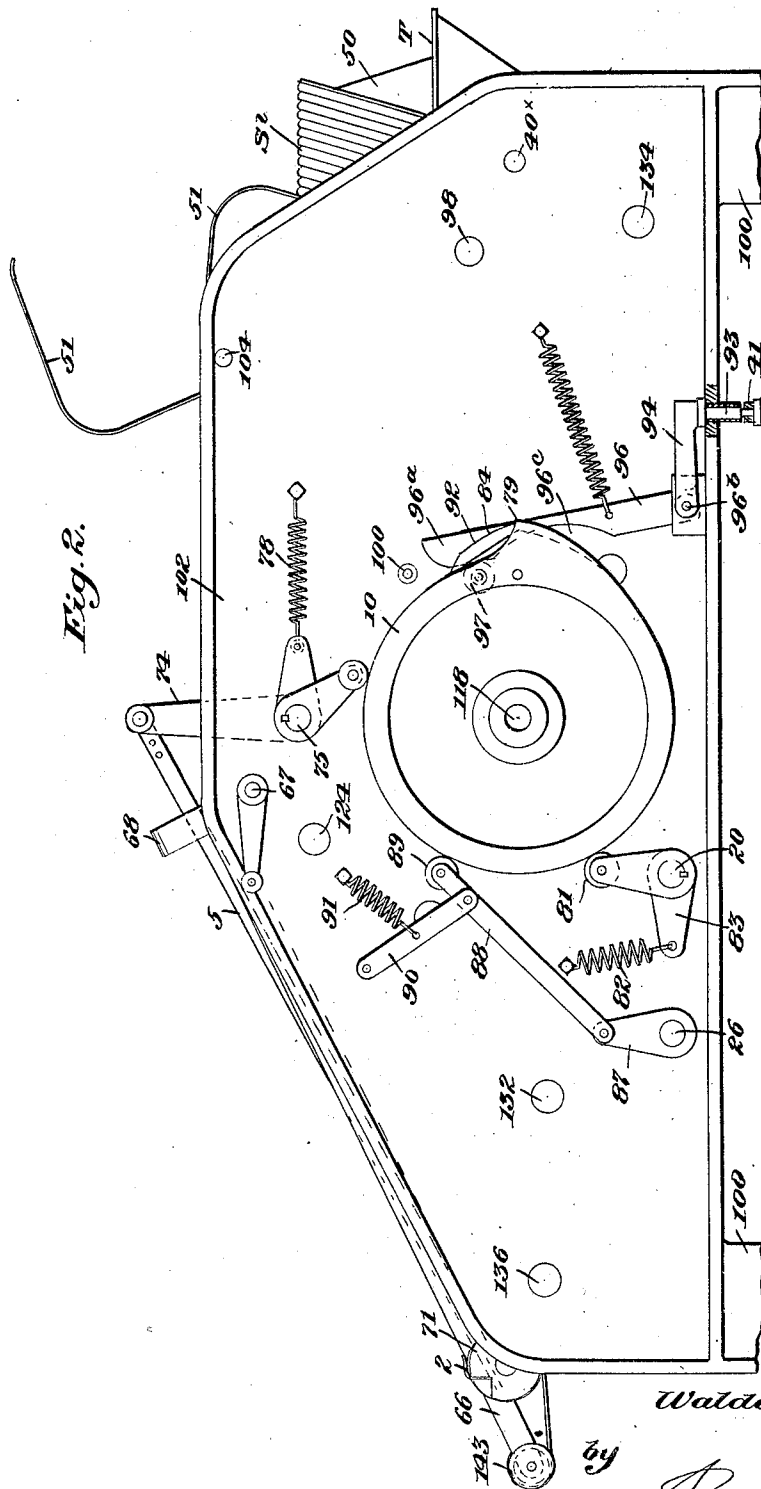
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FOLDING MACHINE

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8 Sheets-Sheet 2



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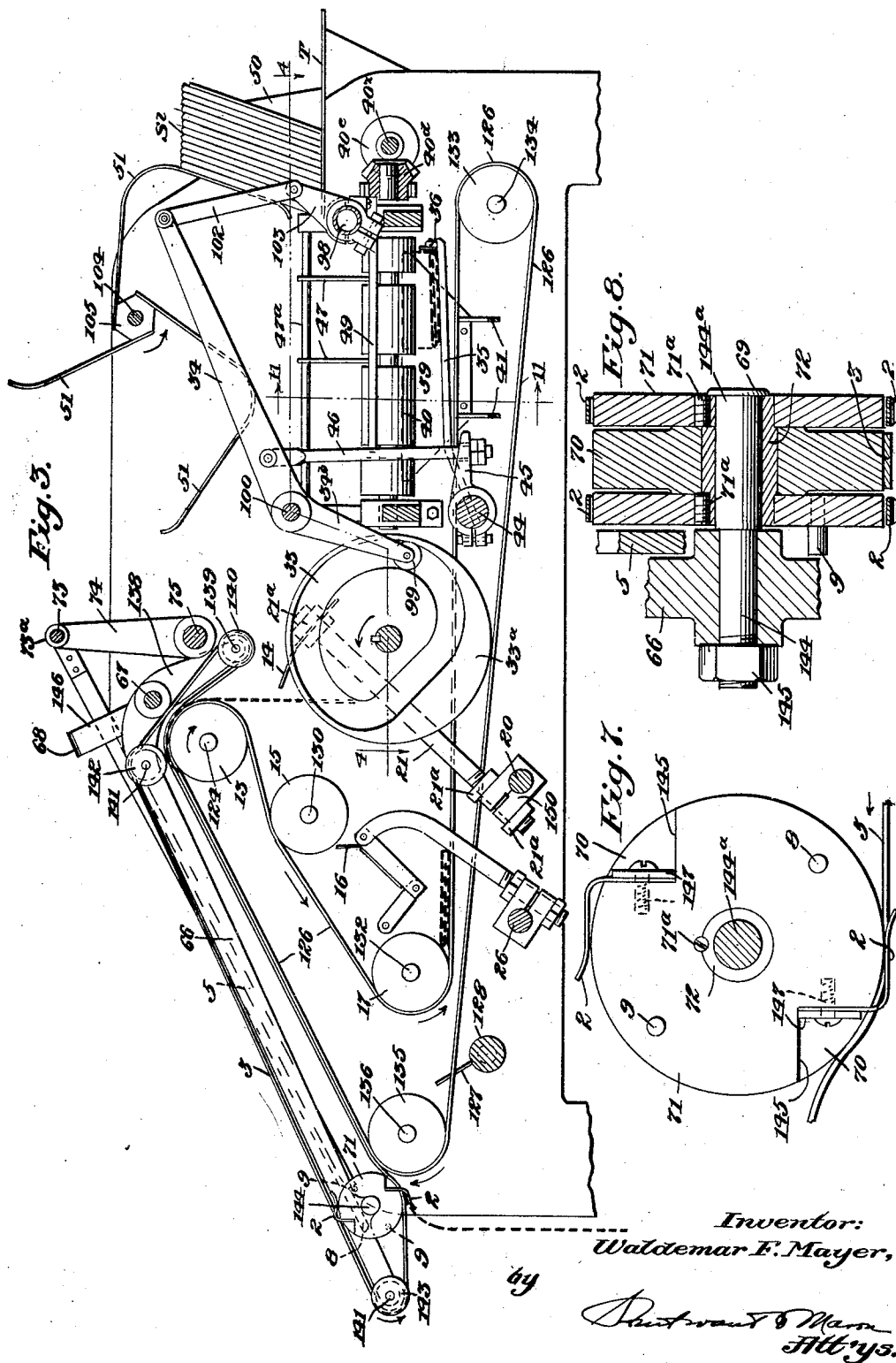
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FOLDING MACHINE

Filed Jan. 22, 1929

8 Sheets-Sheet 3



June 24, 1930.

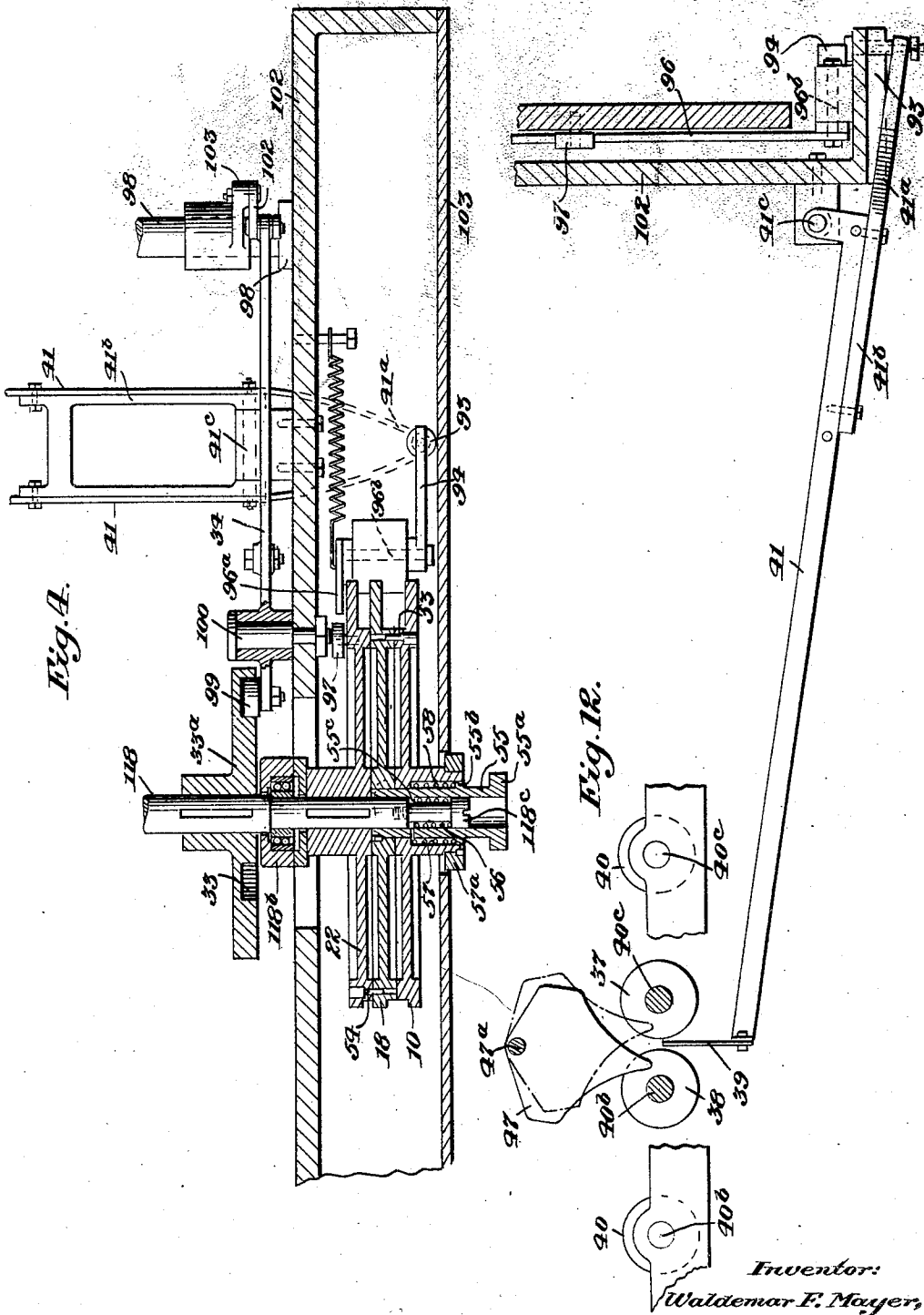
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FOLDING MACHINE

Filed Jan. 22, 1929

8 Sheets-Sheet 4



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June 24, 1930.

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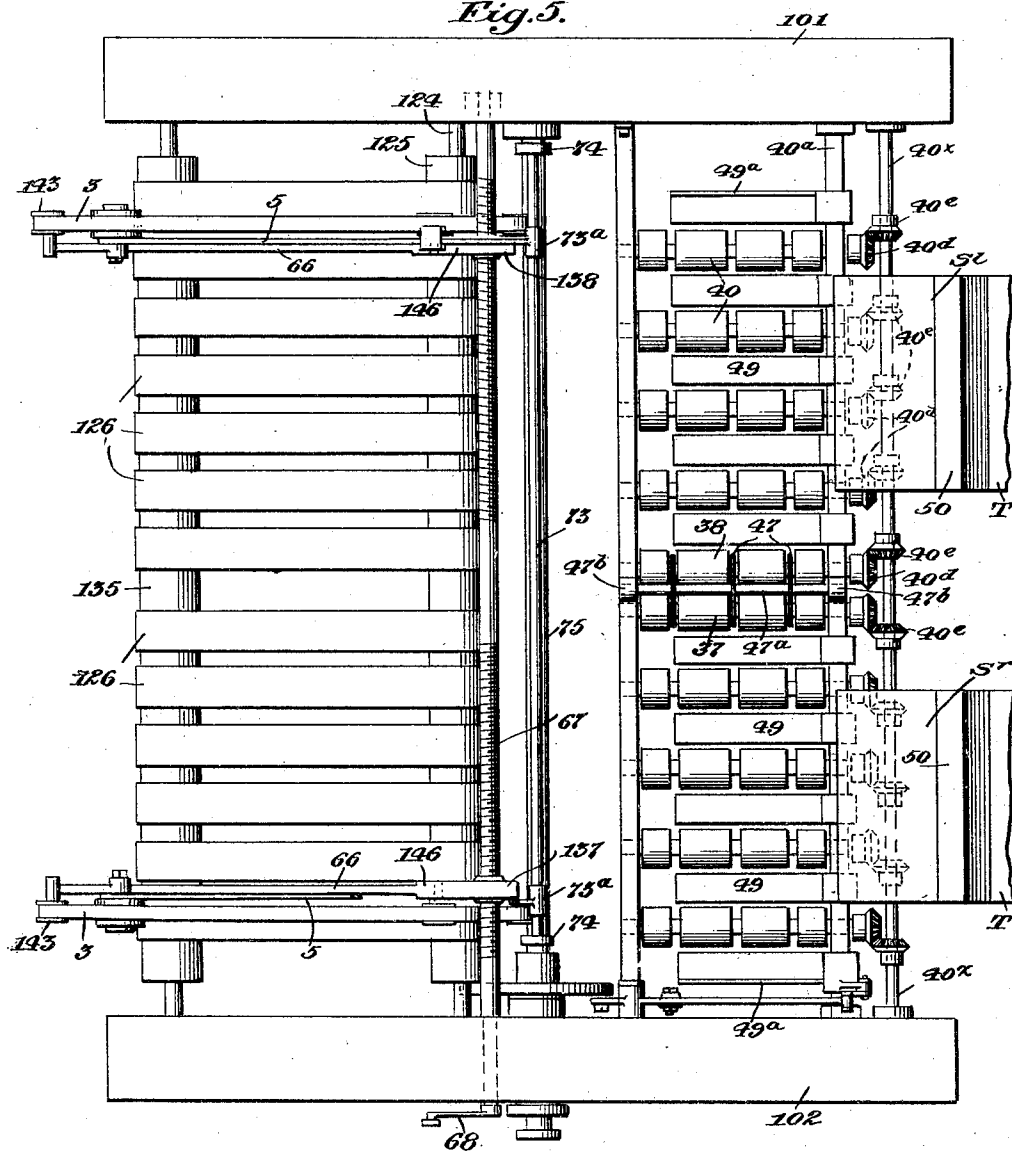
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FOLDING MACHINE

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8 Sheets-Sheet 5

Fig. 5.



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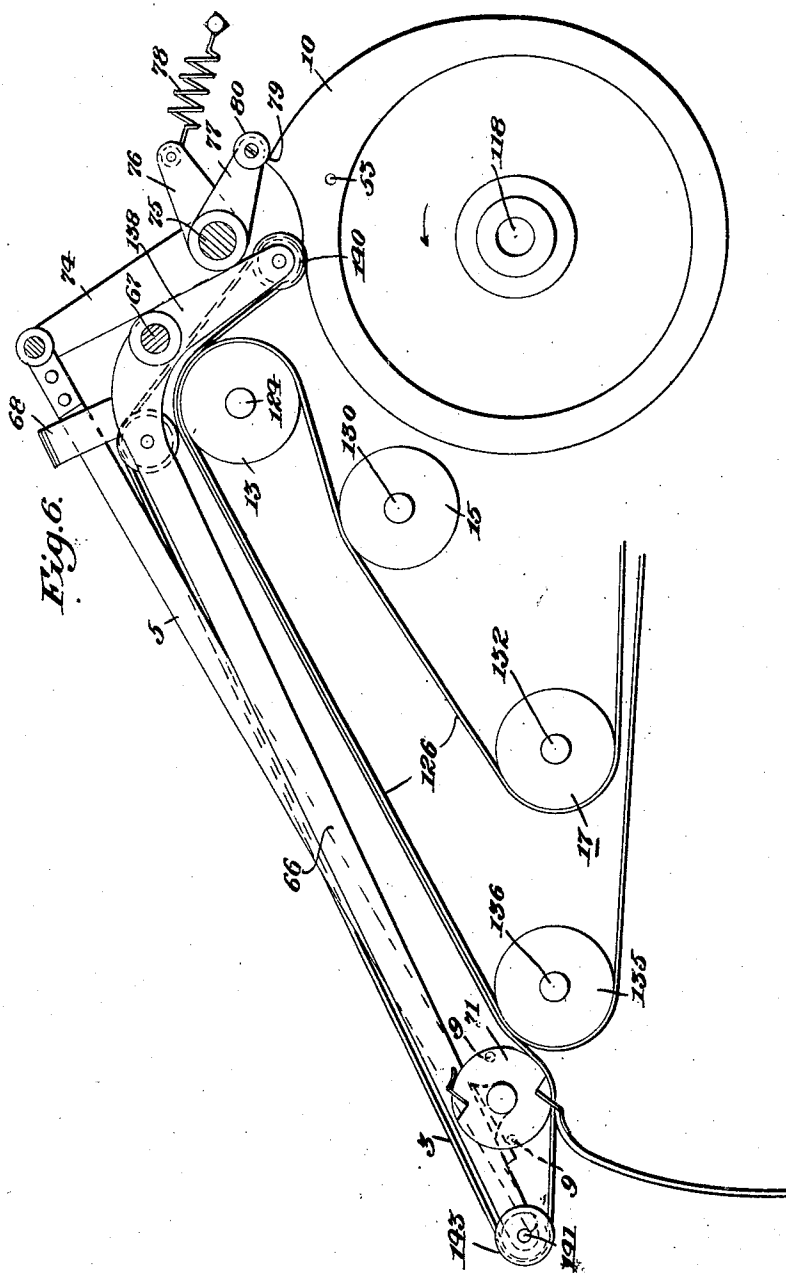
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FOLDING MACHINE.

Filed Jan. 22, 1929

8 Sheets-Sheet 6



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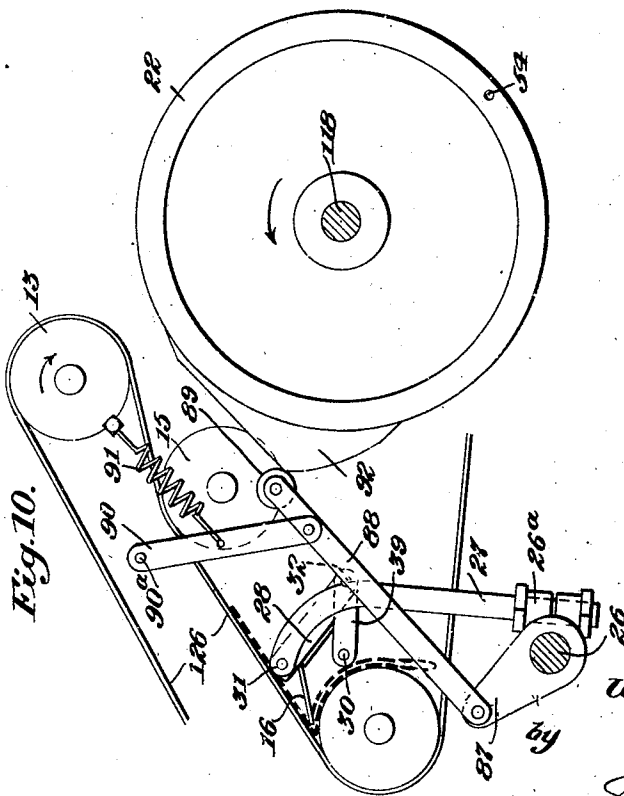
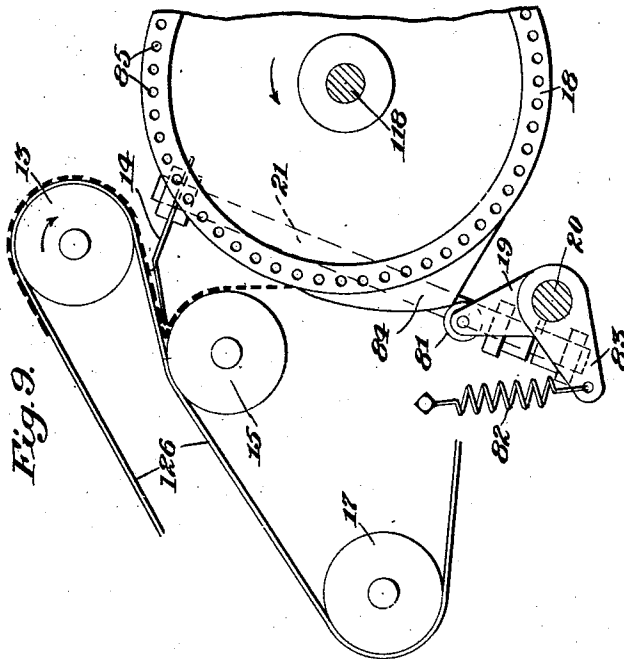
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FOLDING MACHINE

1,766,792

Filed Jan. 22, 1929

8 Sheets-Sheet 7



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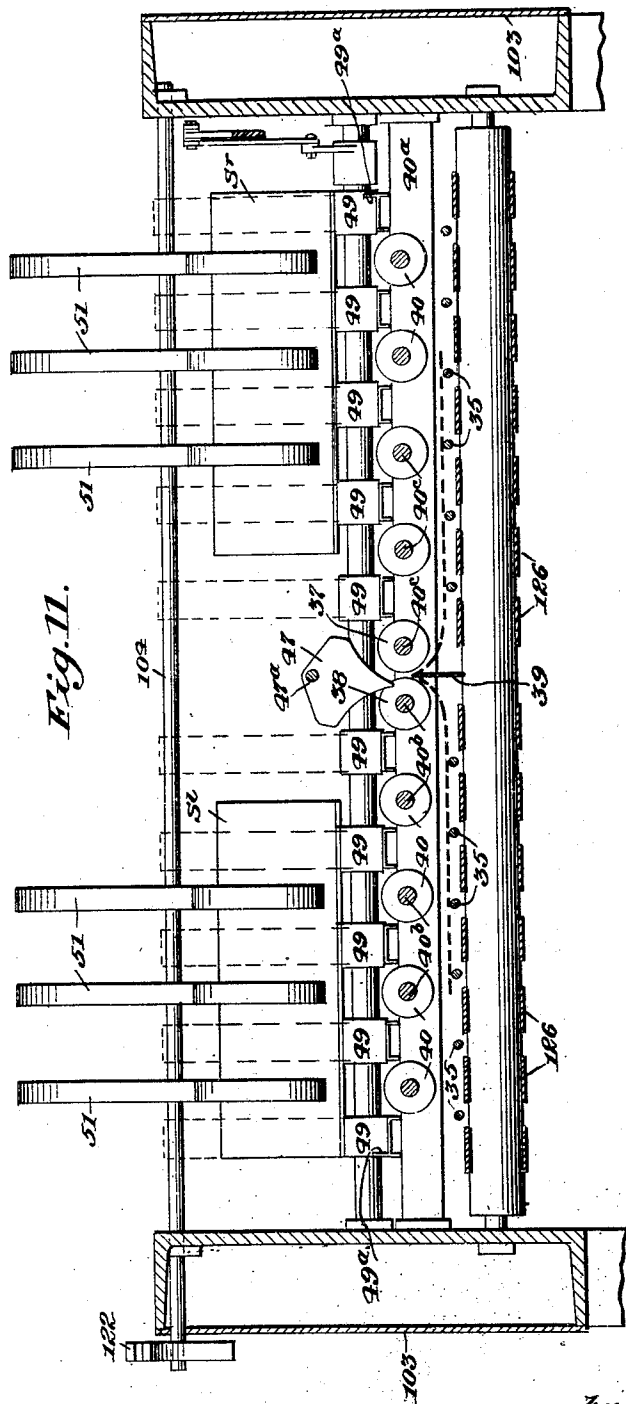
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FOLDING MACHINE

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8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE

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FOLDING MACHINE

Application filed January 22, 1929. Serial No. 334,322.

This invention relates to improvements in folding machines, and more particularly concerns a machine for accomplishing folds along lines which extend in different directions.

One of the objects of the present invention is a machine for folding a sheet on a line transverse to the line of its advancement and then folding the sheet along a line at a substantially right angle to the first line of fold.

Another object of the present invention is to provide correlated folding and cross-folding and stacking mechanisms which operate in synchronism and correlation with one another and in conjunction with a presenting mechanism, so that a sheet is folded and cross-folded in a predetermined manner and then placed in a stack.

A further object of this invention is the provision of certain folding and cross-folding mechanisms which operate upon the sheet to produce the folding thereof in a selected predetermined manner.

Still another object of this invention is the provision of a folding machine having a driving means to move parts at a uniform rate, these parts including presenting, folding and cross-folding devices and intermittently actuating parts to operate the presenting mechanism, folding devices and stacking devices at synchronized and correlated timed intervals.

A still further object of the invention is to provide means whereby parallel folds may be produced upon the sheet along lines at predetermined distances from one another and from parallel edges of the sheet.

With these objects in view, an illustrative form of the invention has been shown on the accompanying drawing to assist in the explanation of the principles of the present invention.

In these drawings:

Figure 1 is a left side elevational view of a machine according to the present invention, mounted on a stand, and with the gear-guarding face plate removed.

Fig. 2 is a right side elevation, on a larger scale than that of Fig. 1, likewise with a guard plate removed.

Fig. 3 is a view corresponding to Fig. 2, but with the frame plate removed to show the working parts of the machine.

Fig. 4 is a horizontal sectional view of a portion of the structure, substantially on line 4—4 of Fig. 3, on an enlarged scale.

Fig. 5 is a top plan view of the machine.

Fig. 6 is a detail view, on a somewhat larger scale than Fig. 3, but corresponding thereto in showing details of the feeding mechanism.

Figs. 7 and 8 are respectively an end view and a diametrical section of the aligning and engaging pulley system for the feeding mechanism of Figs. 3 and 6.

Fig. 9 is a view corresponding to a portion of the structure of Fig. 3, and showing the devices and elements for obtaining the first fold.

Fig. 10 is a similar view, showing the devices and parts for obtaining the second fold.

Fig. 11 is a transverse sectional view substantially on line 11—11 of Fig. 3, showing the cross folding, conveying and stacking elements.

Fig. 12 is a detail view substantially in transverse section, showing the cross folding blade and associated parts.

Fig. 13 shows the succession of steps in the folding of an article in a so-called "three-fold."

Fig. 14 is a similar diagram showing the folding of an article to obtain a redoubling or "four-fold."

Fig. 15 shows the article receiving a "cross-fold."

According to the present invention, a machine is provided by means of which sheets are introduced in regular order and at properly correlated intervals so that each sheet is presented to a folding mechanism by which it is folded transversely to the direction of its advancement through the machine, and then to a cross-folding mechanism by which it is folded along a line parallel to the direction of such advancement, and is finally received by a stacking mechanism which brings the folded sheet into parallelism with the other folded sheets, and in position for ready removal from the machine as a whole. The sev-

eral mechanisms are operated in proper correlation by means of cams and associated devices, the cams being located on a cam shaft which is driven at a predetermined rate of speed in respect of the conveying devices which move the sheets from one part of the machine to another.

The illustrated machine has two mechanisms for accomplishing folding along lines transverse to the direction of feed, which may be denominated the first and the second folding mechanisms, and these mechanisms may be adjusted to produce these folds at definite distances one from another, so that with the illustrated machine either simple "two-folds" (Fig. 14^b), "three-folds" (Fig. 13^c) or "four-folds" (Fig. 14^c) may be produced. Likewise, in the illustrated machine, the stacking mechanism is so arranged that the finished folded sheet may be sent to either of two stacking devices, so that the operator is enabled to continue the operation of the machine while removing a completed stack of folded sheets.

Referring particularly to Figs. 1 and 2 of the drawings, the legs 100 of the stand support a housing comprising the side plates 101, 102, which may be provided with the guard plates 103 shown in Figs. 4 and 11. A rocking pile support 104 is pivoted by the bolts 105 on the legs 100, and is provided with a spring 106 serving to lift the support 104 together with the pile P of sheets to be folded into easy reach of the operator who places the individual sheets in the feeding system, as will be described more fully hereinafter. An alining plate 107 is provided to guide the sheets and cause them to be presented in proper position for easy grasp by the feeding operator.

Drive system

The moving parts of the folding machine receive their energy from a driving motor represented at M in Fig. 1, which by a belt 108 drives a pulley 109 on a shaft 110 having a sprocket 111 engaging the main drive chain 112 which passes over the idler sprocket 113, the belt driving sprocket 114, the sprocket 115 for the first folding roll, the sprocket 116 for the second folding roll, the large sprocket 117 of the cam shaft 118, the sprocket 119 for the stacking conveyor, and the idler sprocket 120. The pulley 109 likewise has a pin 121 thereon engaging with the Geneva plate 112 on the stack retaining shaft 123, as will be more fully described hereinafter. When the motor is set in operation, the chain 112 is driven, and therewith the conveyors and other parts are driven at speed ratios one to another which are determined by the relative diameters and numbers of teeth of their several sprockets and rollers.

Feeding mechanism

As shown in Figs. 1, 3 and 5, the conveyor

shaft 124, driven by the sprocket 114, carries a roll 13 over which pass the folding conveyor tapes 126, which are held at proper spaced intervals by the guide fingers 127 (Fig. 3) of a cross rod 128. The tapes 126 pass over the roll 13, the first folding roll 15 mounted on the shaft 130 driven by the sprocket 115, the second folding roll 17 mounted on the shaft 132 driven by the sprocket 116, over the returning roll 133 mounted on the shaft 134, back to the guide roll 135 mounted on the shaft 136, and then upward and to the right in Fig. 3 to its driving roll 13; this latter portion of the length of the tapes 126 constituting a part of the feeding mechanism.

Journalled in the frames 101, 102 for easy rotation is the spindle 67 having right and left hand threads thereon to engage the threaded portions of the supporting arms 137, 138 whereby to move the latter to and from the longitudinal vertical sectional plane of the machine; the spindle 67 being provided for this purpose with a crank handle 68. The supporting arms 137 and 138 have short downwardly extending arms terminating in pivots 139 for the flanged guide rollers 140, and the long relatively forwardly and downwardly extending arms 66 which likewise have pivots 141 for the flanged guide rollers 142 and 143, as well as the pivot pins 144. As shown in Figs. 7 and 8, the pivot pins 144 have an enlarged journal portion 144^a terminating each in a head 69. When the nut 145 is drawn tight, the shoulder between the stem 144 and the enlarged portion 144^a is drawn down upon the respective arm 66. A sleeve 72 turns freely about the pivot 144^a, between the boss shown on the arm 66 (Fig. 8) and the head 69. Two substantially circular disks 71 are rigidly connected by pins 71^a with the sleeve 72, so that they turn together. Between the cheeks of the rollers 71 is mounted a central roller 70 which is free to rotate with respect to the sleeve 72 and its disks 71. These timing plates or disks 71 (Fig. 7) have kerfs 145 cut therefrom, which in the illustration are located 180° apart. Spring fingers 2 are clamped into these kerfs by the plate and screw assemblies 147, so that only the ends of the fingers project beyond the peripheries of the respective disks 71.

Over each set of guide rollers 140, 142, 143, and the corresponding loose rollers 70 is passed a feeding tape 3, and by reason of the loose positioning of these rollers upon their pivots, these tapes are permitted at all times to move freely and in contact with and driven by the feeding portion of the corresponding tapes 126 (Fig. 3).

The face of one of the feeding plates 71 carries two pins 9 located 180° apart. A transverse rock shaft 75 has rock arms 74 carrying at their upper ends a rocker bar 73

which is fitted with two sliding collars 73^a each carrying a feeding thrust rod or link 5 which is formed with a notch or cut away portion at its lower end leaving a shoulder to engage the respective pin 9, and a projecting finger 8 extending therebeyond and adapted to rest upon the boss of the arm 66, whereby to form a detent to prevent the rotation of the feeding plates 71 when not desired. At its lower or free end, the link 5 is guided between the arm 66 and the adjacent plate 71, while near its upper end, the link 5 is held to move transversely of the machine with the arm 66 by a yoke 146. It will be understood that as the crank 68 is turned, and the spindle 67 revolves, the arms 66 are drawn near toward the center or moved away from the center, and that therewith the links 5 and their collars 73^a make a similar movement. The arms 66 are pivoted to the frame at 67, to that the feeding system carried by these arms may be rocked relatively clockwise about the spindle 67 as a pivot to gain access to the space between the tapes 3 and 126 if so desired.

The cam shaft 118 is provided with a cam plate 10, coupled to rotate with the shaft 118 in the manner to be described hereinafter, and having a rise 79 thereon to engage the roller 80 on a rock arm 77 fixed to the rock shaft 75 (Figs. 2 and 6), while a further rock arm 76 is connected to a return spring 78 to return the roller and rock shaft after the rise 79 of the cam 10 has operated.

First folding mechanism

The cam shaft 118 also carries a cam disk 18 having a rise 84 thereon to engage a roller 81 on a rock arm 19 of the rock shaft 20 which has a further rock arm 83 connected to the return spring 82. The rock shaft 20 likewise carries the clamping head 150 supporting the threaded rods 21 carrying at their free ends the first folder plate 14. The adjustment of the nuts 21^a permits the regulation of the spacing of the edge of the folder plate 14, with respect to the axis of the rock shaft 20 so that this edge is neatly and closely inserted between the first folding roller 15 and the tapes 126 when the rise 84 causes the plate 14 to rock counterclockwise in Figs. 3 and 9.

Second folding mechanism

The cam shaft 118 likewise has a third cam disk 22 having the rise 92 thereon to engage the roller 89 carried by the swinging link 88 which is pivoted at its lower end to the rock arm 87 of a rock shaft 26. The swinging link 88 is connected by a guide link 90 with a pivot 90^a on the frame 102, and having a return spring 91 likewise connected thereto which tends to return the rock shaft 26 in a clockwise direction after it has been actuated by the rise 92. The rock shaft 26 likewise carries a clamp 26^a having the extension arms 27 with

the pivots 31 at the free ends thereof to connect with the swinging links 28 and at their opposite ends have a pivot 32 connecting them to guide links 39 which are pivoted at 30 on the frames 101, 102. The swinging links 28 carry the second folding plate 16, which is held in the position of Fig. 3, so that it will receive a once-folded sheet from the folding roll 15, and then deliver it when the arms 27 are actuated as shown in Fig. 10 into the angle between the traveling tapes 126 and the second folding roll 17. It will be understood that the arms 27, links 28 and 39 are located adjacent the sides of the frame, and that the second folding plate 16 extends across the width of the machine.

Cross folding mechanism

As described above, the tapes 126 after leaving the guide and second folding roll 17 pass rearward in a substantially horizontal upper flight, and return after passing the guide roll 133 to the feeding guide roll 135 (Fig. 3). The sheet after folding by the tapes 126 in their passage around the second folding roll 17, continues with the tapes 126 until it comes over the lifting fingers 35 which are secured on a rock shaft 44 having an operating finger 45 with an aperture therethrough to receive the connecting rod 46 pivoted to the long arm 34 of the stacking lever which rocks about a shaft 100 accordingly as the short arm 34^b of this lever has its roller 99 moved by the eccentric cam track 33 of the cam disk 33^a fixed on the cam shaft 118.

The extreme ends of the lifting fingers 35 are provided with the stop devices 36 which normally extend about the upper surfaces of the several tapes 126. It will be understood that a plurality of fingers 35 are provided, located each between the tapes 126, as shown in Fig. 11, and all being rocked at the same time from a position in which the respective fingers 35 are below the upper surface of the tapes 126 and thus afford no obstacle to the movement of the folded sheet with the tapes 126, and a position above the same (Fig. 3) in which the folded sheet is held above the tapes and is no longer dragged along by the latter.

The cam disk 22 (Fig. 4) carries a roller 97 pivoted at its periphery on an axis parallel to the cam shaft 118. During each revolution of the cam shaft 118, the roller is presented against the nose 96^a of a rock lever 96 which has a pivot 96^b on the frame (Fig. 2) and is rigidly connected with a lever arm 94. The lever arm 96 is cut away at 96^c to permit the free movement of the roller 97 except at the time it is to encounter and move the nose 96^a. A vertical movable plunger 93 has a reduced lower end passing through an aperture in the lifting extension 41^a of the lifting lever frame 41^b which carries the lever arms 41 proper (Fig. 4); the whole assembly being carried by a pivot 41^c on the side frame 102.

The outer or left hand ends of the levers 41 in Fig. 12, carry the cross folding plate 39 which is presented between the cross folding rolls 37 and 38.

Manually operated switch members 47 are fixed on a shaft 47^a carried by brackets 47^b of the cross frame members 40^a.

The cross frame members 40^a carry a plurality of shafts 40^b, 40^c for the rolls 37, 38 and 40 (Fig. 11). Each of the shafts 40^b, 40^c has a bevel gear 40^d, in mesh with respective bevel gears 40^e carried by the transverse shaft 40^x journaled in the side frames 101, 102. It will be noted that the bevel gear drives are so arranged that the shafts 40^b turn in a counter-clockwise direction in Fig. 12, while the shafts 40^c turn in a clockwise direction in this figure. The two rolls 37, 38 are therefore driven in opposite directions, and a sheet issuing from between these rolls is diverted by the switch members 47 which operate in the spaces between the segments of the respective rolls (Fig. 5) to cause the folded sheet to travel to the right (full line position, Fig. 12) or to the left (dotted line position, Fig. 12), being conveyed by the positively driven rollers 40 in each instance.

Stacking mechanism

The cam track 33 causes a rocking of the lever 34, and thus a downward movement of the link 102 connected at respective ends to the lever 34 and to the cam arm 103 of the stacking rock shaft 98 which has fixed thereto a plurality of stacking fingers 49 which normally rest slightly below an upper tangent plane to the rollers 37, 38, 40 (Figs. 3 and 11), and cooperate therewith to form paths along which the folded sheet may move toward the right or the left until its encounters a stop edging 49^a. The stacking fingers 49 are thereupon actuated to deliver the folded sheet against the last sheet of the respective stack S^r or S^l (Fig. 5) located on the tables T and supported against the triangular base blocks 50.

The Geneva plate 122 (Fig. 1) is connected to the shaft 104 having the blocks 105 at intervals thereon to receive the rebent flexible stack maintaining blades 51 which in turn are brought against the last folded sheet placed in the respective stack (Fig. 3) to retain this folded sheet in position while the next sheet is being placed against it and against the retaining fingers 51.

Adjustment for widths of folds

As described above, the cam shaft 118 has in succession the cam disk 33^a (inside the frame 102), a ball bearing 118^b, the second folding cam disk 22, the first folding cam disk 18, and the feeding cam disk 10. As shown in Fig. 4, the hubs of the cam disks 33^a and 22 are keyed to the shaft 118. The periphery of the central cam disk 18 is

formed with a plurality of apertures 85 having any spacing found desirable for the purpose now to be described. The peripheries of the outer cam disks 10 and 22 are each provided with the locating pins 53; and similarly the cam disk 22 has a guide pin 54. The cam disk 18 (Fig. 4) is fixed to a sleeve 55 having an enlarged head 55^a and a collar 55^b along its length: it is guided at the inner end by embracing the end of the cam shaft 118, and is provided with an internal flange or collar 55^c which may rest against the end of the cam shaft 118 in spring pressed position. The cam disk 10 is formed with a sleeve 57 having an enlarged head 57^a secured thereto: this sleeve 57 in part rests for sliding movement on the external surface of the sleeve 55, and in part forms an angular cavity around said sleeve to receive the coil spring 58 which presses at its ends against the collar 55^b and against a shoulder of the sleeve 57. A similar coil spring 56 bears against the collar 55^c and against the head 118^c of a screw fitting the passage in the sleeve 55 and threaded into the end of the cam shaft 118.

It will be understood that by seizing the head 55^a, the cam disk 18 and therewith the cam disk 10 and associated parts may be pulled away from the cam disk 22, and thereafter be rotated as desired: after the desired angular displacement has been obtained between the nose 92 of cam 22 and the nose 84 of cam 18, the gradual release of the head 55^a will permit the pin 54 to engage in the corresponding aperture 85 under the pressure of the return spring 56. Similarly, by pulling outward on the head 57^a, the cam disk 10 may be caused to disengage its pin 53 from an aperture 85 and then the disk 10 may be rotated as desired until the rise 79 of cam 10 is given a desired angular displacement with respect to the rise 84 of cam 18, and then by gradually releasing the cam 57^a the spring 58 will turn the pin 53 into the selected aperture 85. It will be noted that the pins 53, 54 each extends not greater than one-half the length of the apertures 85, so that the two pins may be located in the same aperture if so desired.

Method of operation

The operation of the machine will be described in conjunction with the folding of towels. The towels to be folded are arranged in a pile P crosswise of the machine, i. e., the direction of length of the towel is transverse of the machine. The machine is now adjusted by turning crank 68 (Fig. 5) whereby the right-and-left threaded spindle 67 is rotated so that the feeding tapes 3 are brought closer together or farther apart until they rest adjacent the ends of the pile of towels.

The type of fold to be given the towel may

now require an adjustment of the relative angular positions of the cam disks 10, 18, 22. The determination of this is based on the following considerations: if it is desired to form a three-fold as in Fig. 12, the width of the towel is divided into three substantially equal parts, and the relative angular positions of the feeding cam disk 10 and of the first cross folding cam disk 18 are so regulated with respect to one another that the folding blade 14 engages the towel and presents it between the tapes 126 and the first folding roll 15, at such an instant and position that one-third of the towel is beneath the blade and two-thirds above the same (Fig. 9). Similarly, the cam disk 22 for the second fold is so adjusted with respect to the cam disk 18 for the first fold that the folding blade 16 receives and tucks the once-folded towel between the tapes 126 and the second folding roll 17 at such a time and position that two-thirds of the towel is beneath the blade (this two-thirds being doubled on itself), and one-third of the towel is above it (see Fig. 10). It will be noted that the two-thirds of the towel as delivered from between the tapes 126 and the first folding roll 15 has been sliding down on the leftward face of the folding plate 16 (Fig. 3), and that the second folding occurs so that the tucking is accomplished without dropping of the towel from the plate 16 until the tucking is occurring (Fig. 10).

It will be noted that the feeding tapes are driven at a definite speed relationship to the cam shaft 118, so that this first and second folding of the towel is accomplished in definite widths of fold, regardless of the exact width of the towel presented. As a result, if a towel 18 inches wide is fed through the machine with the adjustment as set forth above at a six inch width of fold, the fold according to Fig. 13 will be produced. On the contrary, if with the same cam settings, a towel 24 inches in width is presented, a redouble or four-fold according to Fig. 14 will be produced. Further, it is obvious that by suitable change of the camming system with due respect to the width of the towel or other article, practically any desired fold may be produced by the regular employment of a plurality of folding devices.

Having adjusted the cams 10, 18, 22 with respect to one another, and started the motor M, the operator (standing at the right end of the machine in Fig. 1, corresponding to the left end in Fig. 2) seizes the top towel at its ends, and raises it and turns the edge toward the machine, as shown by the uppermost towel in Fig. 1. This edge is then thrust between the respective tape 3 and fingers 2 near each end of the towel, the continuous movement of the tapes 3 facilitating this operation. It will be noted that there is no danger in so inserting the towel, since

the feeding plates 71 are at this moment stationary. The spring fingers 2 hold the edge of the towel taut against the respective tape 3. As the cam shaft 118 continues to revolve, the rise 79 on cam disk 10 will ultimately rock the roller 80 outward, and cause a rocking of the shaft 75 and therewith a downward and leftward movement of the connecting links 5 near each of the arms 66. The thrust of the respective link 55 engages the respective pin 9 on the disk assembly 71-72-71 (Figs. 3, 7 and 8) and causes a quick counterclockwise rotation of these members in Fig. 3. The peripheral speed of this movement in part is slightly greater than the advancement of the tapes 3, so that the towel is tucked between the tapes 3 and 126, and then the fingers 2 continue in their movement and are withdrawn from the path of the towel. The speed of movement of the plates 71 will vary on the one hand with the shape of the rise 79 of cam 10, and on the other hand by reason of the changing angle of attack of the respective link 5 with respect to the direction of the radius from axis 144^a which passes through the pin 9, in well known manner.

The sheet is now held between the tapes 3 and 126, and moves continuously forward at a constant speed along these tapes until its free edge drapes over the guide roller 13 and hangs freely down within the folding machine (Fig. 3).

When the duly calculated proportion of the towel hangs down within the machine, the cam disk 18 has passed to a position (Fig. 9) in which it has rocked the roller 81 and therewith the shaft 20 until the folding plate 14 tucks the towel between the tapes 126 and the first folding roll 15, as pointed out above.

Similarly, at a predeterminable time and hence width of fold thereafter, the rise 92 of cam disk 22 rocks the corresponding roller 89 to provoke an endwise movement of the swinging link 88 and therewith a quick rocking of shaft 26 so that the folding plate 16 tucks the towel for the second fold.

The towel now continues on its way on the upper flight of tapes 126 until it encounters the projecting stops 36. A short time thereafter the cam 33^a causes a rocking of the lever 34, 34^b so that the link 46 moves the rock shaft 44 and raises the fingers 35, and the towel is now held out of engagement with the tapes 126, and hence there is no tendency of these tapes to cause a wrinkling of the towel. It is preferred to cause this movement of the fingers 35 a very short time interval after the towel normally should encounter the stops 36, in order to allow for the justifying of the towel if it has for any reason been slightly delayed or distorted during its passage.

The folded towel now lies stretched across the width of the machine upon the several fingers 35. Shortly thereafter the roller 97

provokes the movement of the lever 96^a resulting in the raising of the lever arms 41 and therewith of the folding blade 39 (Fig. 11) so that the center of the towel is forced upward between the constantly rotating rolls 37, 38 and these rolls now accomplish the cross folding, the ends of the towel dragging freely over the fingers 35. Accordingly as the switch is in the right hand or left hand position, this towel will be turned toward the left or the right as it passes from the rolls 37, 38. In Fig. 11, the switch 47 is shown in a relatively left hand position so that the towels will be delivered onto the rolls 37 at the right side of the machine, and be carried by these rolls and over the stacking levers 49 until clear of the cross folding rolls 37, 38. Shortly thereafter the folded end of the towel will encounter the stop 49^a, and by reason of the relative slight contact of the feeding rolls 40 with the towel, the latter will remain in this position.

Shortly after encountering the stop 49^a however, the cam shaft 118 will have gone so far in its movement of revolution that the lever 34, 34^b, is again rocked and therewith the link 102 will cause a clockwise rotation of the rock shaft 98 and the stacking levers or fingers 49 will be rocked from the lower position shown in full lines in Figs. 3 and 11 into the upper position shown in dotted lines in Fig. 11, carrying with them the sheet which has been resting thereon and placing it in the stack S^r at the right of the machine (Figs. 3, 5 and 11), either against the already folded sheets or against the stop block 50 on the respective table T. This same movement of the lever 34 also permits the receiving fingers 35 to drop into position ready to receive the next towel moving along the conveyor tapes 126.

While the sheet is held against its stack S^r, the movement of the drive chain 112 in operating the Geneva shaft 104 causes this shaft to move by one-third of a revolution, thus pulling the spring retaining finger 51 from between the two folded towels, and bringing the next successive finger 51 up against the towel which has just been placed on the stack S^r. Since the towels are held clamped between the stacking fingers or levers 49 of the backing block 50, the towels can not change their position during this operation, and obviously the stack is maintained in compact and regular condition at all times.

It will particularly be noted that when 10, 20 or 30 towels have been folded and placed in the stack S^r, the operator can vary the switch shaft 47^a so that further towels will be diverted toward the left side of the machine in Fig. 11, and a similar stack S^l built up at that side: the procedure and operation being the same as before. During this change, the operator can remove the stack S^r from the machine, and readjust the backing

block 50 by pushing it to the front. In this way, the folded towels may be removed from the machine quickly and easily, and without loss of folding time.

It will be understood from the description above that the several parts are timed in regular relationship one to another so that all operations occur at definite predetermined tape travels and hence relative widths, with respect to the time from the movement of the feeding disks 71 until the towel has been located in the stack S^r, and that this predetermination is accomplished by suitable variation of the several cams with respect to one another on the cam shaft 118. One or more towels may be passed through the machine at any given time, depending upon the selected relationship of the cams with respect to one another. In the particular illustration shown, solely by way of example, one towel is shown in Fig. 3 as inserted between the tapes 3 and fingers 2; a second towel is hanging draped over the guide roll 13 ready to be engaged by the first folding blade 14; a third towel has just received a second fold and emerged from beneath the second folding roll 17; while a fourth towel has just been tucked by the cross folding blade 39 into the space between the cross folding rolls 37 and 38 (see also Fig. 11).

It is obvious that the invention is not limited to the form of construction and arrangement of the parts shown, but that it may be modified in many ways within the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a folding machine, a presenting device for temporarily holding a sheet to be folded, a feeding mechanism to receive the sheet from the presenting device, said presenting mechanism including fingers for holding the sheet in contact with moving parts of the feeding mechanism and means to prevent the movement of the fingers from such position except during operation of an actuating device, a folder mechanism to receive and fold the sheet from the feeding mechanism, and a uniform speed drive for the feeding and folding mechanisms which includes said actuating device to operate the same at uniform speed for actuating said fingers to deliver the sheet to said feeding mechanism at intervals timed with respect to the folding device.

2. In a folding machine, a presenting mechanism for holding the sheet to be folded, feeding mechanism to receive the sheet from the presenting mechanism, a folding mechanism to receive and fold the sheet from the feeding mechanism, cams, a uniform speed drive for said feeding mechanism and said cams, devices connecting said cams with said presenting and folding mechanism whereby to actuate the same synchronously, and means for

adjusting and fixing the angular relationship of the cams whereby to vary the position of the line of fold on the sheet.

3. In a folding machine, a presenting mechanism to hold the sheet to be folded, a feeding mechanism to receive the sheet from the presenting mechanism and comprising tapes to engage the sheet adjacent its edges, means to support said tapes at varying distances apart whereby to accommodate the feeding mechanism to sheets of different widths, a folding mechanism to receive and fold the sheet from the feeding mechanism, a uniform speed drive for the feeding and folding mechanisms, and an actuating device intermittently operated from said uniform speed drive for actuating said presenting mechanism to cause it to deliver the sheet to said feeding mechanism.

4. In a folding machine, presenting and feeding mechanisms for the sheet to be folded, said mechanisms including a shaft, a roller rotatable about said shaft, a tape passing over said roller, means to drive said tape at a uniform speed, a presenting disk coaxial with said roller, a retaining finger on said disk to receive the sheet to be folded, a folding mechanism to receive and fold the sheet from the feeding mechanism and operatively connected to said uniform speed driving means, and means operated from said uniform speed driving means to hold said disk against rotation for a part of a cycle and then to rotate said disk whereby to cause said presenting mechanism to deliver the sheet to the feeding mechanism at a predetermined time with respect to the operation of said folding mechanism.

5. In a folding machine, presenting and feeding mechanisms, including a feed tape whereby to deliver the sheet at a predetermined time and at a predetermined rate, a forwarding tape cooperating with said feeding tape and passing over a folding roll, a cam, common means to drive said presenting and forwarding mechanisms, said forwarding tape and said cam whereby the presenting mechanism and cam operate synchronously, and devices operated by the cam to move said folding blade to tuck the sheet between the forwarding tape and said folding roll.

6. In a folding machine, a presenting mechanism, a feeding mechanism including a feeding tape, a forwarding tape cooperating in part with said feeding tape, said feeding tape passing over two folding rolls, first and second folding blades, cams, means to operate said tapes and cams at a uniform speed, devices operated by said cams to cause said presenting device to hold a sheet therein for a part of a cycle and thereupon to release the sheet and present it to the feeding and forwarding tapes so that it is carried forward in the machine at a predetermined rate and

time, devices operated by said cam to respectively move said first and second folding blades at predetermined timed intervals as the said operation of said presenting mechanism, whereby folds are produced on the sheet transverse to the direction of movement of the tapes, said blades tucking the sheet at the predetermined line of fold between said forwarding tape and a respective roll.

7. In a folding machine, a presenting mechanism, a feeding tape to receive the sheet from the presenting mechanism at a predetermined time, fingers having stops thereon to engage a sheet moving with said tape, actuating devices to move said fingers after a sheet carried by the feeding tape has encountered said stops, means to drive said feeding tape at a uniform speed, a folding mechanism to receive and fold the sheet from the feeding mechanism, and devices operated from said uniform speed driving means to operate said presenting and folding mechanisms and said actuating devices in synchronism from said uniform speed driving means whereby the sheet is raised from said feeding tape at a predetermined time after the operation of said presenting mechanism.

8. In a folding machine, a presenting mechanism, a forwarding tape, fingers having stops thereon to engage a sheet moving with said tape, actuating devices to move said fingers to remove a sheet from said tape, a first folding mechanism located between said presenting mechanism and said stops, a second folding mechanism, driving means to move said forwarding tape at a uniform speed, and means operated from said uniform speed driving means to actuate said presenting and folding mechanisms and said actuating devices in synchronism whereby a sheet is delivered from said presenting mechanism to said tape for a first folding by said first folding mechanism and later delivery to said stops and whereby said fingers remove the sheet from said tape and present it to said second folding mechanism for a second folding at predetermined times after the operation of said presenting mechanism.

9. In a folding machine, forwarding tapes, cross-folding rolls having their axes parallel to the direction of movement of said tapes, a folder blade normally located beneath the carrying flight of said forwarding tapes, a cam, means to operate said feeding tapes, said cross-folding rolls and said cam at a uniform speed, devices to present a sheet to said forwarding tapes at a predetermined instant of time, and means operated by said cam to actuate said blade at a predetermined time interval thereafter whereby to tuck the sheet between the cross-folding rolls.

10. A folding machine as in claim 9, in which fingers having stops thereon are located between the forwarding tapes, a second cam operated at uniform speed with

said first cam, and means whereby said second cam moves said fingers to raise the sheet from the forwarding tapes after it has encountered said stops.

11. A folding machine as in claim 9, in which right and left conveyors are provided to selectively receive the sheet from the cross-folding rollers, stack forming devices to remove the folded sheet from said conveyors and arrange it in a stack, and switch means whereby to divert the sheet to the right or left conveyor.

12. In a folding machine as in claim 9, a stacking device to receive the sheet as it leaves the cross-folding rolls, means to actuate said stacking device in synchronism with the movement of said folder blade, a stack holding device, and means to operate said stack holding device in synchronism with said stacking device whereby to maintain the stack of folded sheets.

13. In a folding machine as in claim 9, right and left conveyors to selectively receive the folded sheet as it leaves the cross-folding rolls, a switch to determine the movement of said sheet to the right or left conveyor, a stacking device to remove the sheet from the conveyor on which it lies, and means to operate said stacking device actuated in synchronism with said folder blade.

14. In a folding machine, forwarding tapes, fingers disposed between said tapes and normally located beneath the forwarding flight thereof, stops on said fingers projecting into the path of the sheet of the forwarding tapes, a cross-folding mechanism, a stacking device to receive the sheet from the cross-folding mechanism, and common operating means for said fingers and said stacking device, so that the fingers raise a sheet from the forwarding tapes for presentation to the cross-folding mechanism at the same time that the stacking mechanism moves the last folded sheet.

15. In a folding machine, forwarding tapes, a cross-folding mechanism including folding rolls and a folding means to raise a sheet in alined position from said forwarding tapes and deliver it between said cross-folding rolls, a stacking device to receive the sheet from the cross-folding rolls, stack holding members to support the folded sheets after they have been placed in a stack, and a driving mechanism to move said forwarding tapes and cross-folding rolls at a uniform speed and including means operated at timed intervals to actuate the said folding means and said stack holder.

16. In a folding machine, a presenting mechanism to temporarily receive and hold the sheet to be folded, a feeding mechanism to receive the sheet from the presenting means, folding and cross-folding mechanisms, a stacking device, said feeding mechanism delivering the sheet successively to said

folding and cross-folding mechanisms, said stacking device receiving the sheet from said cross-folding mechanism, and a driving means to move said feeding mechanism at a uniform speed and including devices to operate said presenting, folding, cross-folding and stacking mechanisms at predetermined time intervals with respect to one another.

17. A folding machine as in claim 16, in which fingers and stops are provided to receive and aline the sheet on its way between the folding and the cross-folding mechanisms, and devices operated in common with a stacking mechanism to move said fingers.

18. In a folding machine, a forwarding tape, a guide roll, first and second rollers located respectively between the tape so that the tape passes around said guide roll and beneath the same and over said folding rolls, a first folding blade mounted to rock to and from a position between said tape and said first roll, a second folding mechanism mounted to rock to and from a position between said tape and said second roll, a cam shaft, cams on said shaft, and devices operated by said cams to rock said folding blades so that when a predetermined length of sheet has been draped from said guide roll, it will be tucked by said first folding blade for a first folding, and so that when a predetermined length of the sheet is draped from said first folding roll it will be tucked by said second folding blade for a second fold, and means to move said cam shaft and forwarding tapes at a uniform speed.

19. In a folding machine, a forwarding tape, a folding roll over which said tape passes, a folding rock shaft having a rock arm thereon, a swinging link mounted on a fixed pivot at one end, a free link pivoted to the other end of said swinging link and to the end of said rock arm, and a folding blade mounted on said free link.

20. In a folding machine, forwarding tapes, cross-folding rolls mounted above the tapes with their axes parallel to the direction of the movement of said tapes, forwarding rolls mounted with their axes parallel to said cross-folding rolls, a cam, means to drive all of said rolls and said tapes and said cam at a uniform speed, a cross-folding blade adapted to tuck a sheet from said feeding tapes between said cross-folding rolls, and devices operated by said cam to actuate said cross-folding blade.

21. In a folding machine, forwarding tapes, cross-folding rolls mounted with their axes parallel to the direction of the movement of said tapes, a shaft, a cross-folding blade adapted to tuck a sheet from said forwarding tapes between said cross-folding rolls, supporting arms for said folder blade mounted on a pivot parallel to the axes of said rolls, means to drive said tapes, rolls and shaft at correlated speeds, an offset member carried

by said shaft, and a plunger operated by said offset member to rock said arm whereby to move the folder blade to tuck the sheet between the cross-folding rolls.

5 22. In a folding machine, a presenting mechanism to temporarily hold a sheet, a feeding mechanism, first and second folding mechanisms, a cam shaft, means to drive said feeding mechanism and said cam shaft at cor-
10 related speeds, cams on said shaft and devices operated by one of said cams to cause said presenting mechanism to deliver the sheet to said feeding mechanism, a device operated by another cam to actuate said first folding
15 mechanism, and a device operated by a third cam to operate said second folding mechanism, and means whereby said cams may be secured to said shaft at selected predetermined angular distances with respect to one
20 another whereby to determine the distances of the lines of fold of said first and second folding mechanisms one from another and from the parallel edges of the sheet.

23. A folding machine as in claim 22, in
25 which one of said cams is provided with a plurality of apertures arranged concentrically to its axis, and another of said cams is provided with a pin adapted to engage a selected one of said apertures, one of said cams being fixed to said cam shaft and the other cam
30 being loosely mounted thereon for relative axial movement, and means to hold said latter cam against such axial movement when said pin is engaged in one of said apertures.

35 In testimony whereof, I affix my signature.
WALDEMAR F. MAYER.

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