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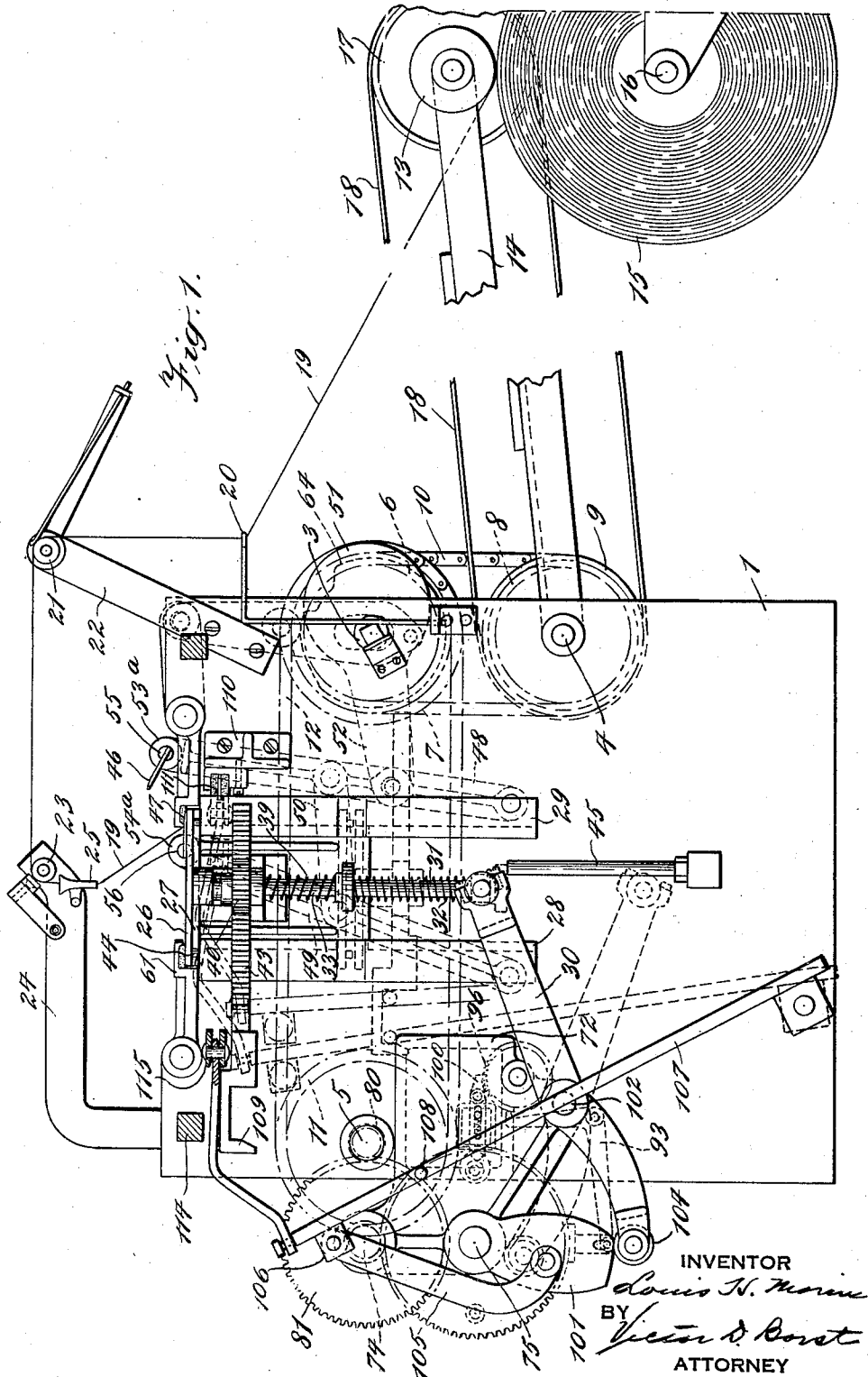
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PAPER FOLDING MACHINE

Filed Dec. 12, 1929

5 Sheets-Sheet 1



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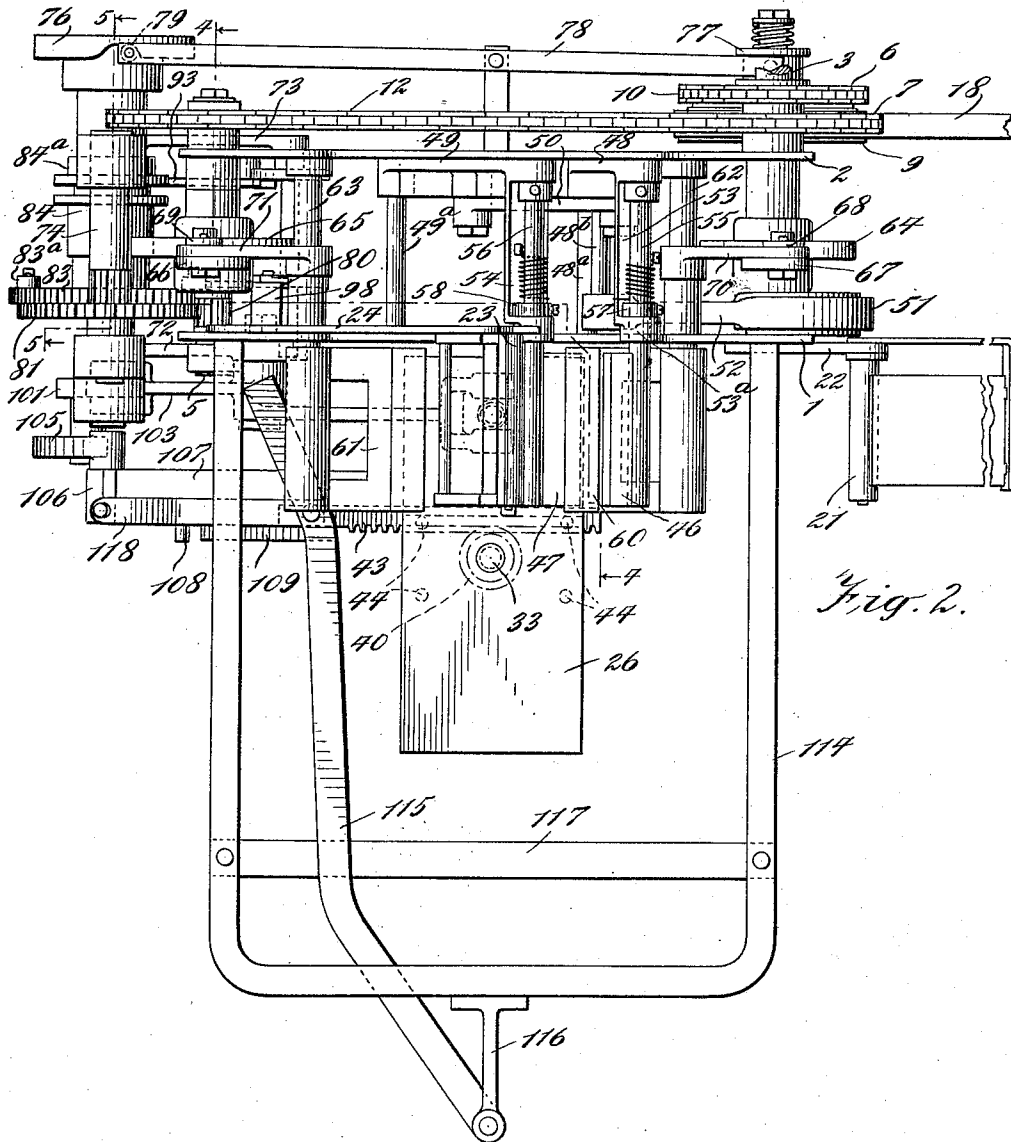
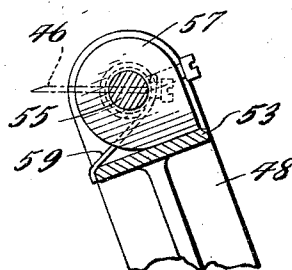


Fig. 2.

Fig. 2-A



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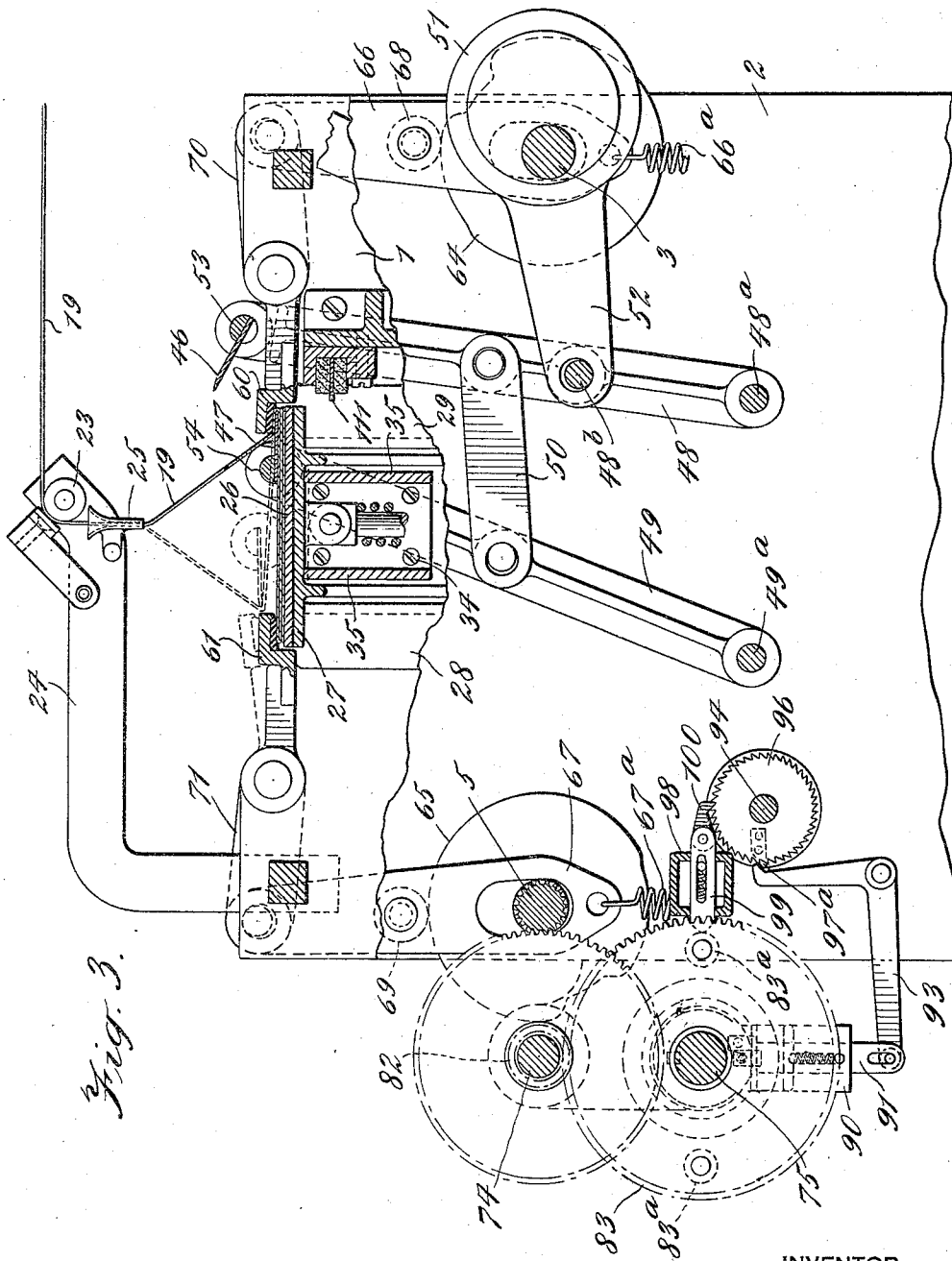


Fig. 3.

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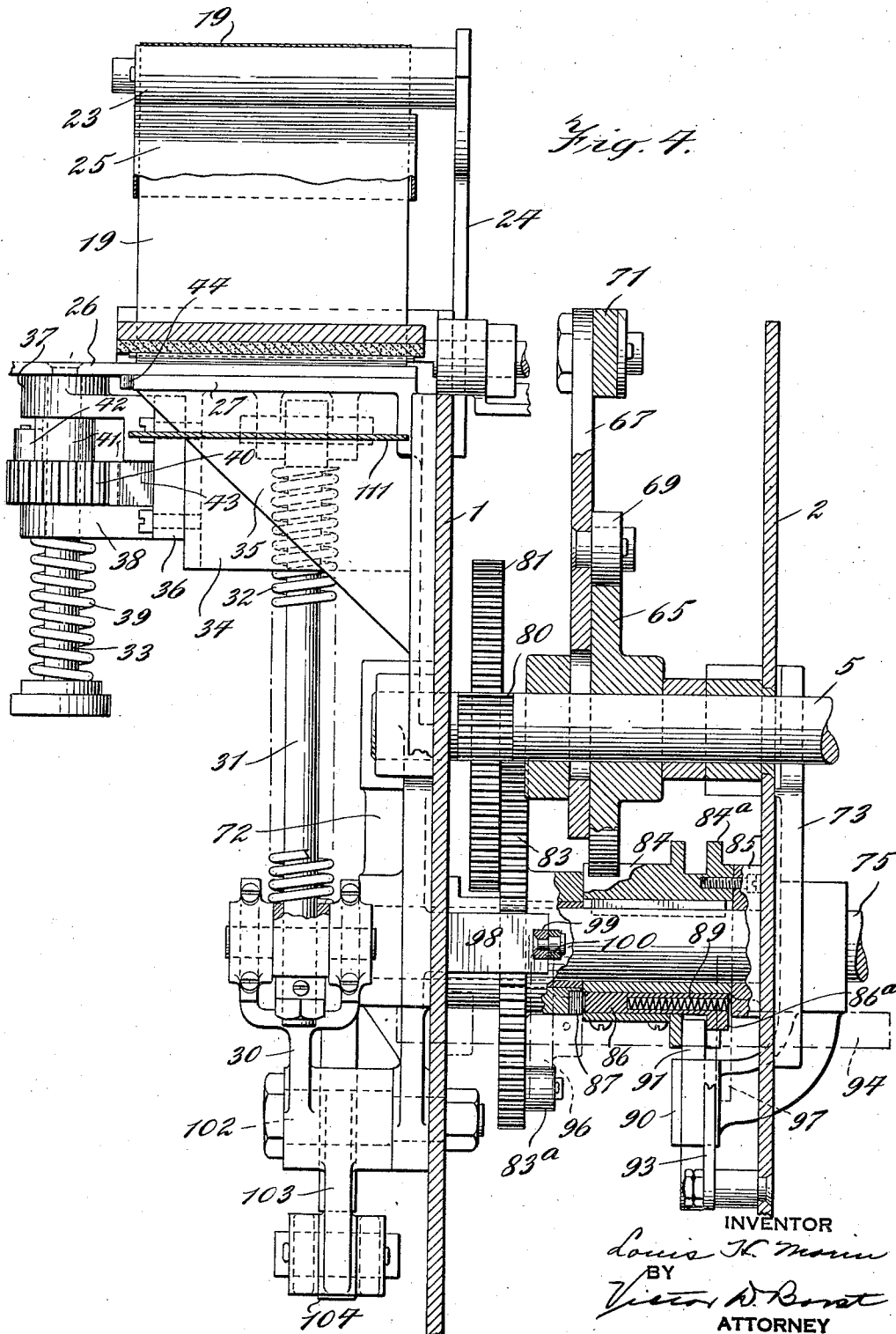
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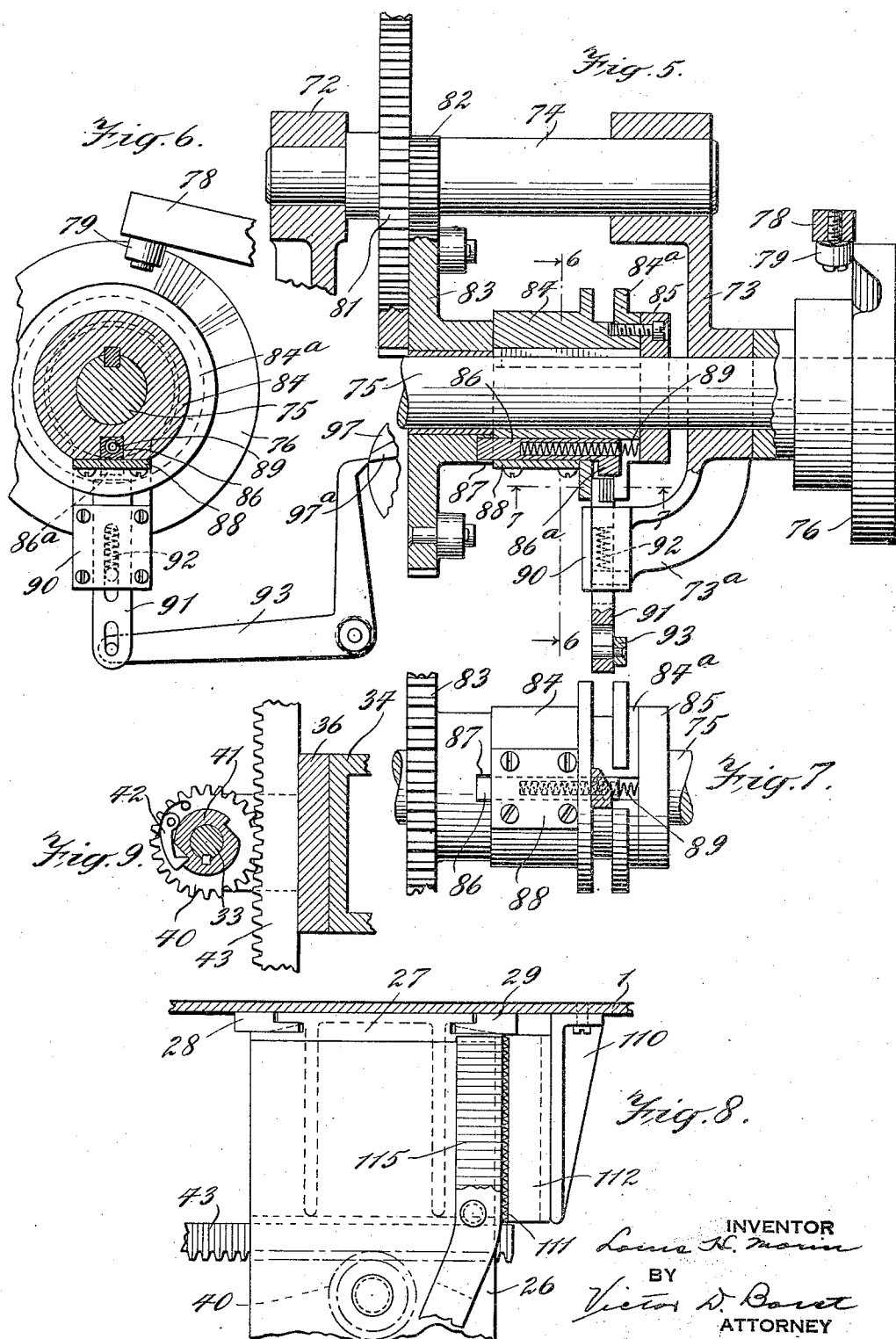
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5 Sheets-Sheet 5



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PAPER FOLDING MACHINE

Application filed December 12, 1929. Serial No. 413,461.

This invention is applicable to the folding of continuous web materials, including webs of delicate tissue, such as toilet paper. The processes and mechanisms heretofore employed in the folding of web materials into piles or bundles in which the material runs back and forth in superimposed folds, have been serviceable only with materials having considerable inherent strength. Paper toweling, for example, has been folded and dispensed in this fashion but so far as I am aware, it has not been possible heretofore to subject toilet paper to automatic folding operations.

By my machine, it is possible continuously to fold such a flimsy and fragile tissue as toilet paper back and forth into layers as it is fed off from a roll or other source. The apparatus of my invention also serves automatically to sever the web after a predetermined number of folds and to remove the folded pile or bundle from the apparatus from which it may be taken and packaged. There is thus afforded a bundle comprising a continuous length of paper web folded into layers of uniform length, the leading end of which may be withdrawn from the package and torn off into sheets of any desired lengths. Because of the previous inability to fold and package a continuous web of toilet paper in this form, it has been dispensed in roll form, but when rolled it occupies considerably more space than it does as a flat, folded bundle.

In the application of my invention to toilet paper, I feed a web continuously toward a folding surface and at regular intervals so selected as to take up the paper just as fast as it is fed, I engage the paper alternately on opposite sides of the web above the folding surface and bring the paper along the line of engagement down upon the surface. Simultaneously, the folded edge is gripped and compressed. The folds are thereby made of even lengths and the paper is subjected to no material strain in the folding operation.

As a machine or apparatus, my invention is susceptible of the folding of stronger web materials, and for some materials it is not essential that the material be positively fed,

but it may be drawn from the source of supply by the force employed in the folding operation. In any event, however, my invention contemplates that a continuous web of material to be folded be directed toward a table or platen, and two folding blades on opposite sides of the web reciprocate together in the same direction back and forth across the plane of the web. Each blade at one limit of movement comes to rest upon the platen and as it retreats it rises from the platen surface. Presser members, which I term grippers, overhang the opposite edges of the platen which are engaged by the respective folder blades, and these grippers open and close, i. e., rise and descend with respect to the surface of the platen, in timed relation to the movement of the blades so that they are open to receive their respective blades with the web material folded thereover and close after the entrance of the blades and remain closed after the blades are withdrawn, following which they are caused to close still further to compensate for the thickness of the blades and to compress the edge of the folded pile until the next approach of the respective blade.

In order to accommodate itself to the thickness of the pile as it builds up, the platen has a spring mounting so that it can yield away from the grippers as fast as is necessary, there being, however, a continuous spring pressure against the grippers maintained at all times when the grippers are closed. The folding blades preferably have arcuate movement, and in order that they may be withdrawn from under the grippers without a loosening of the grippers, the blades are preferably yieldable, being mounted to rotate upon a longitudinal axis and being resiliently urged against a stop in the direction away from the platen while they may yield toward the platen.

In order to provide a minimum of interruption in the continuous operation of the machine for the removal of the finished bundles, I provide a double platen which may be reversed at the end of a folding operation so as to bring the folded package to an accessible position for removal, while the empty

platen is presented for the next folding operation. The platen, for example, may be a double length platen rotatable upon a central vertical axis. Just prior to the reversal of the platen, the web is severed. It is desirable that the folding operation be discontinued during the change just described and for this purpose my invention contemplates the interruption of the feeding operation. This may be done by temporarily unclutching the feeding mechanism from the power shaft of the machine, the connection being again automatically restored as soon as the reversal is effected.

In the form of apparatus which I employ at present, the reversible platen is mounted on a support which is slidable in vertical guides in the machine, being lowered and raised at the proper times by means of a lever connected for the purpose. Suitable positioning means on the platen and its support inter-engage to assure the proper work position of the platen, and as the support is lowered, the platen travels down with it until near the end of the movement when the platen is stopped and the support travels just enough further to disengage the positioning means and permit the platen to be reversed. As the support is raised, the positioning means again engage in the new position and the platen moves up with the support to the working level. Springs are provided to urge the support upward to a definite distance from the lever connection and to hold the platen down resiliently against its support when the two are in the working position.

The web severing means and the platen lowering and reversing means come into operation only at the end of each predetermined folding operation, and as soon as they have performed their function they again remain inactive until the next pile is folded. For this purpose I employ an impulse device which is actuated periodically and after a predetermined number of actuations serves to operate a trip device which is in control of the enabling mechanism for the severing and the platen lowering and reversing means. Suitable automatic means, such as a single rotation throw-out, disables the said means after their operation.

The apparatus also includes many other features of construction which will hereinafter appear in connection with the description of the illustrated embodiment of the invention. The apparatus which is shown in the drawings constitutes one physical embodiment of the invention. I shall now describe my invention in connection with these drawings, it being understood that the illustrated apparatus is presented merely as an example of one embodiment of the invention and that the invention as an apparatus may be variously otherwise embodied.

Fig. 1 is a side elevation of the apparatus;

Fig. 2 is a plan of the same;

Fig. 2-A is an enlarged sectional detail of the upper end of one of the link bars carrying one of the folding blades;

Fig. 3 is a broken longitudinal sectional elevation of the apparatus;

Fig. 4 is a transverse sectional elevation taken generally on the irregular line 4-4 of Fig. 2, but with portions broken away;

Fig. 5 is an enlarged sectional detail on line 5-5 of Fig. 2;

Fig. 6 is a section on line 6-6 of Figs. 4 and 5;

Fig. 7 is a fragmentary section on line 7-7 of Fig. 5;

Fig. 8 is a fragmentary horizontal sectional detail showing in plan the platen and immediately associated parts;

Fig. 9 is a horizontal fragmentary sectional detail of the rack and pinion construction for reversing the platen, with their immediately associated parts.

The machine has two side frame members 1 and 2. Journaled in these are three shafts, two in the front of the machine, one above the other, and one at the rear of the machine. The upper front shaft 3 is the power shaft and is continuously driven from any suitable source of power (not indicated). The other front shaft 4 is immediately below the shaft 3 and parallel therewith. The rear shaft 5 is in the horizontal plane of the shaft 3 and parallel therewith. On the power shaft 3 are two sprocket wheels 6 and 7. On the lower front shaft 4 is a sprocket wheel 8 immediately beneath the sprocket wheel 6, and a pulley 9 below the sprocket wheel 7. A sprocket chain 10 connects the sprockets 6 and 8. On the rear shaft 5 is a sprocket wheel 11 which is connected to the sprocket wheel 7 by sprocket chain 12. The rotation of the shaft 3 thus serves to drive both shafts 4 and 5.

A rubber feed roll 13 for paper is pivoted on the outer end of a swinging frame 14 which is pivoted at its rear end on the shaft 4. A roll of paper 15 is mounted on a holder 16 below and parallel with the feed roll 13 and the feed roll rests by gravity upon the roll of paper. A pulley 17 on the axis of the feed roll 13 is connected to the pulley 9 by a belt 18 and the feed roll is thereby positively driven as the shaft 4 is rotated by the shaft 3.

The web of paper 19 is led through a guide 20 over a roll 21 which is supported by a bracket 22 from the frame member 1, and thence over a roll 23 which is disposed directly over the platen and is mounted on a bracket 24 which is supported from the frame member 1. From thence the paper is directed downwardly toward the platen through a guide 25 also supported on the bracket 24 and disposed directly over the center line of the platen. The paper is subjected to light friction as it passes over the rolls 21 and 23 by

suitable members resting against the rolls, as indicated.

The platen 26 is a flat, double length table rotatably mounted on a central vertical axis.

5 The platen rests upon a vertically slidable support 27. The guides 28 and 29 on the frame member 1 serve to guide the platen support in its vertical movement. The platen support is raised and lowered by a lever 30, as will hereinafter be described, and this lever is connected to the bottom of the platen support by a connecting rod 31 which is pivoted at its upper end to the support and at its lower end to the lever 30. A coil spring 15 32 surrounds the connecting rod 31 and bears at its lower end against the pivot block which connects the rod to the lever 30 and at its upper end against the bosses on the under side of the support to which the rod is pivoted. 20 The lower end of the rod 31 is free to slide through the pivot block on the end of the lever 30, and the support is thus free to descend with respect to the operating end of the lever against the tension of the spring 32, while the spring tends to hold the support a definite distance above the end of the lever to which the rod is pivoted. 25

The platen 26 has a central stud or shaft 33 depending from its under side. This shaft 30 bears in brackets on the platen support. In the construction shown, the platen support has on its under side a rectangular housing 34 which encloses the upper end of the connecting rod and its pivotal connection with the support. This housing 34 is disposed between two integral brackets 35 and has a block 36 secured to its front face (see Figs. 4 and 9). Extending out from this block 36 are the two bearings 37 and 38 for the platen shaft 33. The shaft 33 terminates in a head at its lower end and a coil spring 39 surrounds the lower end of the shaft between this head and the lower bracket 38. This spring, therefore, tends to hold the platen down upon the support while at the same time permitting it to separate from the support for a reason which will hereinafter appear. 45

A pinion 40 loosely surrounds the shaft 33 between the two bearings 37 and 38 and rests 50 upon the top of the lower bearing 38. This pinion has a one-way connection with the shaft. A ratchet collar 41 immediately above the pinion is keyed to the shaft 33 and is of a length to occupy the space between the bottom of the bearing 37 and the top of the pinion 40. This ratchet 41 has two ratchet teeth 180° apart, as is shown in Fig. 9. A pawl 42 is pivoted to the top face of the pinion 40 in position to engage in the ratchet teeth, and a suitable spring (as indicated), urges the pawl resiliently toward the ratchet teeth. A rack 43 slides against the block 36 between the bearings 37 and 38 in engagement with the pinion 40. This rack is caused to slide 65 by means which will hereinafter be described

and its movement in one direction will rotate the pinion 40 idly by reason of the ratchet and pawl connection, while its movement in the opposite direction will serve to impart a rotation of 180° to the shaft 33 and hence to the platen. 70

On the under side of the platen 26 are four positioning pins 44, the disposition of which appears in Figs. 2 and 4. Two of these pins are on one side of the axis of the platen and two are on the other side. These pins are so disposed that they will bear against the edge of the support 27 and hold the platen properly aligned with the support, no matter which platen element is in service. 75

In order to allow of the rotation of the platen for the purpose of reversing it, it is necessary that the platen and its support be separated sufficiently to permit the positioning pins to clear the support. This is effected by means of a stop member 45 in the path of the head at the bottom end of the shaft 33 (see Fig. 1). When the lever 30 is operated at the end of a predetermined folding operation, and lowers the connecting rod 31 and the support to which it is connected, the platen moves downwardly with the support until the head strikes the stop 45, which is just before the downward limit of movement of the support. The support is moved just enough farther by the lever 30 to clear the pins 44, the spring 39 being compressed to that extent. While the parts are in this position, the rack 43 is operated to reverse the platen after which the lever 30 operates in the reverse direction to raise the support and with it the platen to the working level, the support and platen being again brought together at the initial part of this movement. The platen is of a length which will just clear the frame member 1 as it turns on its axis, and the guides 28 and 29 are cut away in the horizontal plane in which the platen is reversed so as to provide a clearance for the platen. 80

With the platen in its elevated position, the leading end of the web material is folded back and forth in layers upon it by means of two reciprocating folding blades 46 and 47 on opposite sides of the web. To reciprocate these blades, a four-bar link construction is provided which is oscillated by an eccentric on the power shaft. The two bars 48 and 49 are pivoted at their lower ends on pins 48a and 49a, respectively, which extend between the frame members 1 and 2, the bars being disposed adjacent the inner face of the frame member 2. Intermediate of their ends they are connected by a link 50, and they extend at their upper ends above the plane of the platen. An eccentric 51 on the shaft 3 adjacent the inner face of the frame member 1 is connected by a crank 52 to a lateral pin 48b on the bar 48 between the pivot pin 48a and the link 50. The rotation of 130

the eccentric 51 thus serves to oscillate the bars 48 and 49 and thereby reciprocate their upper ends which carry the folding blades 46 and 47. The link 50 is somewhat shorter than the distance between the stationary axes 48a and 49a whereby the arcs of travel of the upper ends of the bars and hence of the folding blades and their relative synchronous speeds will vary somewhat.

On the upper ends of the bars 48 and 49 are laterally extending arms or cross heads 53 and 54, respectively, the outer ends of which terminate in bearings 53a and 54a, respectively. Through these bearings 53a and 54a extend blade supporting bars or rods 55 and 56 which bear at their inner ends in the upper ends of the link bars 48 and 49, respectively, and extend out beyond the bearings 53a and 54a so as to overhang the platen with their outer ends. The folding blades 46 and 47 are radially secured in these extensions of the rods 55 and 56, respectively, and extend toward each other. The blade supporting rods are free to turn on their axes in their bearings, but they are resiliently held in their proper radial positions while being free to yield toward the platen. For this purpose the rods have eccentrics 57 and 58 secured to them just inside of the bearings 53a and 54a, which eccentrics engage the top faces of the cross heads 53 and 54, respectively, and are so shaped as to permit the blades to turn down while limiting their upward movement away from the plane of the platen to the radial positions indicated in the drawings (see Fig. 2-A). A coil spring 59 surrounds each rod and is connected at one end to the rod and at its other end to the cross head and thus tends to urge the rod to the stopped position indicated in Fig. 2-A.

Overlapping the opposite edges of the platen are two pivoted presser members or grippers 60 and 61, the under faces of which are cushioned with rubber, as shown in Figs. 1 and 3. The rear ends of these grippers are secured on rock shafts 62 and 63, respectively, which bear in the frame members 1 and 2 and are rocked by cams 64 and 65 on the shafts 3 and 5, respectively. Lever arms 66 and 67, respectively, carry cam rollers 68 and 69, respectively, which engage the faces of the respective cams. These lever arms are provided with vertical slots through which the shafts 3 and 5, respectively, are received, and are pivotally connected at their upper ends to operating arms 70 and 71 for the rock shafts 62 and 63, respectively. Springs 66a and 67a, respectively, are attached to the lower ends of the arms 66 and 67 and urge these arms downwardly and hence bias the grippers to open position.

The cams 64 and 65 are set to open and close their grippers in succession. The high part of the cams, which serves to hold the

grippers closed, occupies at least two-thirds of the cam face. The low part of the cams, which serves to open the grippers, is relatively short, and there is a short cam face of intermediate height which serves to close the grippers to an extent which will allow for the presence of the folding blades.

The operating of the folding blades and of the grippers will appear clearly from Fig. 3. The eccentric 51 has moved the bars 48 and 49 to the extreme right position in which position the blade 47 is in contact with the platen 26 except for the interposed folds of web material. The platen has receded against the tension of the spring 32 sufficiently far to allow for the thickness of the folds already on the platen. The blade 46 is out of contact with the web in this condition of the parts. The cam roller 69 is on the high part of the cam 65 and hence is pressing the gripper 61 to its fullest extent against the folded edge of the pile. The cam roller 68 is on the intermediate part of its cam 64 due to the presence of the blade 47 under the gripper 60. Continued movement of the parts will serve to throw the bars 48 and 49 to the left. This will withdraw the blade 47 from underneath the gripper 60, whereupon the cam roller 68 will engage the high part of the cam 64 and the gripper 60 will be further closed upon the folded edge of the pile. Meanwhile, the blade 46 will move toward the position indicated in dotted lines. This movement will bring the low part of the cam 65 underneath the cam roller 69 and the gripper jaw 61 will open to the position indicated in dotted lines. The blade 46 will thus be received underneath the gripper and will come to a position flat upon the pile, the blade 47 meanwhile rising to a position above the platen. The cam 65 will then close the gripper 61 to the intermediate position until the blade 46 is withdrawn from underneath it, whereupon the cam will close the gripper to the position now shown. In this manner the blades move back and forth and lay the web in folds upon the platen and the grippers open and close in properly timed relation to admit the blades and yet hold the edges of the pile. As the blades are withdrawn from underneath the grippers, their supporting rods are rotated slightly on their axes to allow the blades to remain horizontal until they are withdrawn from underneath the grippers. The springs 59 then immediately return the blades to their normal positions.

The means for disabling the feeding mechanism, severing the web and lowering and reversing the platen will now be described. Secured to the outer faces of the frame members 1 and 2 are auxiliary frame members or hangers 72 and 73 which extend to the rear of the frame members 1 and 2 and support two transverse shafts 74 and 75. On the outer end of the shaft 75 is a clutch

throw-out cam 76. The sprocket wheel 8 is clutched to the shaft 4 by means of a clutch 77 (Fig. 2) and a clutch operating lever 78 is pivoted intermediate its ends to the frame member 2 and is operatively connected to the clutch 77 at its front end, while its rear end is provided with a cam roller 79 which rides on the face of the cam 76 by virtue of the tension of the spring which tends to hold the clutch 77 in engagement. The cam face of the cam 76 is annular and has one short low place. When the cam roller is in the low place of the cam, the clutch is engaged, but when the cam is rotated, the roller rides up on the high part of the cam and the lever 78 throws out the clutch against the tension of the spring. In this way the connection of the feed roll 13 with the power shaft is interrupted, and, as will be seen, this operation occurs at the end of each folding operation prior to the reversing of the platen.

The shaft 5 has a pinion 80 on its inner ends, the teeth being cut in the shaft. This pinion 80 meshes with a gear wheel 81 on the inner end of the shaft 74. A pinion 82 on the shaft 74 meshes with a gear wheel 83 on the shaft 75. This gear wheel 83 is loose on the shaft 75 and is periodically clutched thereto and unclutched therefrom through automatic means which will now be described. It is this shaft 75 which operates the clutch throw-out cam 76 and also operates the web severing mechanism and the platen reversing mechanism. The clutching of the gear wheel 83 to the shaft 75 therefore occurs at the end of each predetermined folding operation, and the unclutching occurs as soon as the platen has been reversed and is returned to the work position. Since the shaft 5 is continuously driven from the power shaft, as above explained, the shaft 74 is also continuously driven by reason of the engagement of the pinion 80 and the gear wheel 81, and the gear wheel 83 is also continuously driven by reason of its engagement with the pinion 82 on the shaft 74. The gear wheel 83, however, turns idly on the shaft 75 except at those periodic intervals when it is temporarily clutched to the shaft.

Keyed on the shaft 75 immediately adjacent the hub of the gear wheel 83 is a two-part collar member composed of the two parts 84 and 84a. Outside of these is a collar 85 on the shaft 75 and the three members are permanently bolted together into a unitary but separable structure. The two elements 84 and 84a of the keyed two-part collar member have each a circumferential flange, the two flanges being spaced apart so as to provide a circumferential groove between them. On its under face the two-part collar member has a longitudinal slot within which is a sliding bolt 86. The hub of the gear wheel 83 has also a slot 87 in its face

adjacent the collar within which the bolt 86 is adapted to engage, as is shown in Figs. 5 and 7. A removable plate 88 on the bottom of the two-part collar member provides access to the slot within which the bolt 86 slides. A coil spring 89 is disposed in a longitudinal bore in the bolt and bears against the bottom of the bore and against the collar 85 and tends to force the bolt toward the hub of the gear wheel 83 and into the slot 87 when that slot registers with the bolt. On its bottom face the bolt has a depending wedge member 86a which extends into the circumferential groove between the flanges of the two-part collar member, the flange on the collar element 84a being slotted, as shown in Figs. 5 and 7, to allow the bolt to slide. A trip member which will now be described holds the bolt in retracted position during the normal operation of the machine so that the gear wheel 83 is unclutched from the shaft 75, but an impulse member operates the trip after a predetermined number of folding movements to release the bolt and thus lock the gear wheel 83 to the shaft and effect rotation of the shaft, and the trip is again automatically restored to position to withdraw the bolt and unclutch the shaft 75 from the power shaft after a single rotation of the shaft 75.

As shown particularly in Figs. 5 and 6, an arm 73a extends downward from the hanger 73 underneath the two-part collar member, and directly underneath the circumferential groove within which is the wedge member 86a. This arm 73a supports a vertical guide 90 within which slides a wedge member 91. A coil spring 92 is disposed within the guide in a slot in the sliding wedge member 91 and bears against a transverse pin in the guide which passes through the slot and tends to hold the wedge member 91 elevated to a position in the circumferential groove of the keyed collar where it will engage the wedge member 86a on the sliding bolt, and the wedge faces are so related that the wedge member 91 will retract the bolt when it engages the wedge member 86a as the collar and bolt rotate with the shaft 75. A bell crank lever 93 is pivotally attached to the lower end of the sliding wedge member 91 and operates under the influence of an impulse member to depress the wedge member 91. The bell crank 93 is pivoted to the frame member 2, as shown in Fig. 4.

Extending between the frame members 1 and 2 and journaled in bearings therein somewhat in front of the vertical plane of the shaft 5 and below the horizontal plane of the shaft 75, is a small shaft 94. Fixed on this shaft are two members, viz: a ratchet wheel 96 and a trip disk 97, the positions of these being indicated by dot and dash lines in Fig. 4. The ratchet wheel 96 is substantially in the plane of the inner face of the gear wheel

83 while the trip disk 97 is just at one side of the plane of the upstanding arm of the bell crank lever 93. A tripping finger 97a is fixed on the side of the trip disk 97 in the plane of the bell crank lever 93, and this lever terminates at its upper free end in an overhanging nose piece in the path of the trip finger 97a. As the shaft 94 is rotated, therefore, it gradually brings the finger 97a around to the point where it strikes the end of the bell crank lever and rocks this lever on its pivot as the finger passes and so withdraws the wedge member 91. As soon as the finger 97a passes the end of the bell crank lever, the spring 92 returns the wedge member 91 to its elevated position, if and when the wedge 86a has rotated with the shaft 75 out of the way of the inner end of the wedge member 91.

Extending inwardly from the auxiliary member 72 through the frame member 1 is an arm 98. The inner end of this arm 98 is hollow and affords a guide for an impulse member 99 which is mounted to slide therein in a direction longitudinally of the machine. A spring tends to hold the impulse member in a rearwardly retracted position while on its front end externally of the arm 98 is pivoted a pawl 100 which engages in the teeth of the ratchet wheel 96. On the inner face of the gear wheel 83 are two rollers 83a disposed 180° apart, as is indicated in Figs. 1 and 3. These rollers are in position to engage the rear end of the impulse member 97 as they rotate, the rear end of the impulse member being rounded off so that it is pushed forward each time that it is struck by a roller 83a. In other words, the impulse member gets two impulses with each rotation of the gear wheel 83 and the ratchet wheel 96 is thus advanced two teeth for every rotation of the gear wheel 83. The ratio of gearing is such that the ratchet wheel 96 will thus make a complete rotation for every predetermined number of folds laid on the platen.

Meanwhile, the bolt 86 is withdrawn by reason of the engagement of the wedge member 91 behind the wedge 86a which position is shown in Fig. 4. The gear wheel 83 is therefore turning idly while the shaft 75 is stationary. When the shaft 94 has been given a complete rotation by these impulse means, the finger 97a engages underneath the overhanging end of the bell crank lever 93 and withdraws the wedge member 91. Fig. 3 illustrates the parts when they are just ready to perform this operation. The wedge member 91 is thus withdrawn to the position shown in Figs. 5 and 6, the finger 97a being shown in Fig. 6 as just ready to release the bell crank lever and allow the wedge 91 to be retracted by the spring 92.

As soon as the wedge 91 is withdrawn from its engagement with the wedge 86a, the spring 89 urges the bolt 86 toward the hub

of the gear wheel 83 and into the socket 87 as soon as that socket comes into register with the bolt. The gear wheel 83 is thus locked to the shaft 75 through the keyed two-part collar member and rotation is therefore imparted to the shaft 75. The wedge 86a is thereby rotated out of line with the wedge member 91 with the result that the latter moves into the path of the wedge member 86a under the influence of the spring 92. When the shaft has completed one rotation, however, the wedge 86a again engages the wedge member 91 and the two inclined faces serve to retract the bolt 86 and again unclutch the shaft 75. In other words, these elements constitute what may be termed a single rotation clutch.

I have already explained that this single rotation of the shaft 75 serves at the initial part of its movement to throw out the clutch 77 and disengage the feeding mechanism by reason of the coaction of the cam 76 and the cam roller 79 on the end of the clutch operating shaft 78. I shall now describe how this single rotation of the shaft 75 also serves to sever the web, depress the platen support, reverse the platen and again elevate the platen with its support, whereupon the cam roller 79 again rides into the low part of the cam 76 and the feeding mechanism is again clutched to the power shaft.

On the end of the shaft 75 opposite to the cam 76 and secured to the shaft to rotate therewith, is a radially extending cam 101 which has two curved sides constituting the cam faces, terminating in a circular hub portion, and having an outer end face that is concentric with its axis and connects the two curved side faces. The platen operating lever 30, which serves to raise and lower the platen support, is connected on a rock shaft 102 which bears in the side frame member 1. Extending rearwardly from the rock shaft 102 is an arm 103 on the rear end of which is a cam roller 104 which bears against the face of the cam 101, being urged thereagainst by the weight of the platen and platen support.

Also pivoted to the face of the cam 101 is a crank arm 105 which is pivotally connected at its upper end to a block 106 on the rear face of an arm 107, which arm is pivoted at its lower end to the outer face of the frame member 1 so as to swing in a vertical plane. The arm 107 has on its outer side, somewhat below its upper end, an outstanding pin 108. The rack 43 has on its rear end a downwardly open hook shape member 109 which is disposed in the vertical plane of the pin 108, the parts being so related that the pin 108 will just escape the outer end of the hook as the hook descends and the arm 107 is rocked to the right, as shown in Fig. 1, but will strike against the inner upright

face of the hook. The operation will, therefore, be as follows:

When the shaft 75 becomes clutched to the gear wheel 83, its rotation will be in a clockwise direction, as seen in Fig. 1. The end of the cam 101 will, therefore, immediately ride out from under the cam roller 104 and the cam roller will ride abruptly up the right face of the cam as the cam rotates out from under it until the cam roller comes upon the hub portion of the cam, as is indicated in the dotted position of the cam roller in Fig. 1. This elevation of the cam roller permits the shaft 102 to rock and allows the lever 30 to fall to the position shown in dotted lines. In this position of the lever the platen support has moved down the guides to its lowermost position and the end of the platen stud or shaft has struck the stop member 45 and the platen has thereby been elevated from the support for a sufficient distance to allow the positioning pins to clear the support. Meanwhile, the movement of the crank 105 has moved the arm 107 to the right and the pin 108 is engaged in the hook 109 and has moved the rack to its furthestmost position to the right, as viewed in Fig. 1. This position of the arm 107 is indicated in dotted lines in this figure. This movement of the rack, however, has been ineffective to rotate the platen by reason of the ratchet and pawl connection between the pinion 40 and the shaft 33. The cam roller 104 rides on the hub portion of the cam 101 during the further rotation of the cam which serves to swing the arm 107 to the left through the agency of the crank 105 and thereby slide the rack to the left by reason of the engagement of the pin 108 against the left end of the hook 109. This retracting of the rack imparts a rotation of 180° to the pinion 40 and this rotation is imparted to the shaft 33 and hence to the platen by reason of the pawl and ratchet connection. The platen is thereby reversed and its opposite or empty end is brought into the work position while the end which contains the folded pile is brought outside the machine where it is accessible. The cam roller 104 completes its travel on the hub portion of the cam 101 during this reciprocation of the rack and consequently the platen remains in its lowermost position during its reversal. When that is completed the cam roller rides up the opposite face of the cam and operates the lever 30 to elevate the platen to the work level the pin 108 meanwhile escaping from the hook 109 by reason of the upward movement of the hook.

The movement of the arm 107 to the right by the operation of the crank 105 serves not only to slide the rack idly to the right but also to sever the web. Extending outwardly from the outer face of the frame member 1 immediately in front of the platen support is a knife-supporting bracket arm 110 (Figs.

1 and 8), on which is secured a knife 111 having a serrated edge. This knife is shown in section in Fig. 4. The knife is contained between two rubber strips or press blocks 112, the edge of the knife extending slightly beyond the rubber strips.

Extending outwardly from the top of the frame member 1 is a horizontal U-shape frame member 114 and a web-severing arm 115 is pivoted on a bracket 116 on the outer end of this frame member so as to swing in a horizontal plane, being guided between the bottom of the end piece of the frame member 114 and an intermediate cross strip 117. The arm 115 is of such length that it engages sideways near its inner end with the rubber strips 112, and the arm is a double member with the two component arm members disposed one above the other and spaced apart substantially the same distance as are the rubber strips 112. As the inner end of the arm 115 is swung around to the right, as shown in Figs. 1 and 2, it strikes the web and presses it against the knife with a yielding force by reason of the fact that the two members of the arm 115 straddle the knife and press against the rubber strips. The severing of the web is thereby done without tearing.

The arm 115 is reciprocated by the arm 107. For this purpose it is connected to the top of the arm by a connecting bar 118. As the cam 101 rotates, therefore, the crank 105 moves the arm 107 to the right, as above explained, and brings the arm 115 against the rubber strips 112, which position is indicated by dotted lines in Fig. 1. The web is thereby severed near the work level of the platen. At this time the platen and its support are in their lowermost position and the return movement of the arm 107 effects first a reversal of the platen and then an elevation of the platen and its support.

It will thus be seen that while the power shaft 3 is continuously driven, the machine functions automatically to fold the web into individual piles, the quantity of which is determined by the number of teeth on the ratchet 96, and to sever the web at the end of the formation of each pile and reverse the platen to bring the folded pile out where it will be accessible and interpose an empty platen for the next folding operation, the feeding of the web being interrupted during each period of reversal and until the machine is ready to resume operation to form the next pile. The invention is in no wise limited to the particular mechanism illustrated for the purpose of performing these several functions but it is obvious that one skilled in the art may readily devise other means for accomplishing the same results without departing from the scope of the invention as pointed out in the appended claims.

I claim:

1. A web folding machine comprising a

yieldably mounted platen, gripper jaws pivoted on fixed pivots and overhanging opposite edges of the platen, means for directing web material toward the platen between the jaws, two folder blades on opposite sides of the web connected to reciprocate together each to and from a position underneath the jaw on the side of the web opposite to it, and means for raising and lowering the jaws in timed relation to the entrance and withdrawal of the blade coacting therewith.

2. A web folding machine comprising a platen, feeding means for continuously feeding web material toward the platen, reciprocative folding means operative to fold the web upon the platen as it is fed, means to withdraw the platen and sever the web at the end of a predetermined folding operation, and means for simultaneously disabling the feeding means and enabling the withdrawing and severing means.

3. A web folding machine comprising a double platen reversible in relative position to bring the two platen elements alternately into working relation to the web, means for continuously feeding web material toward the platen element in working relation thereto, reciprocative folding means operative to fold the web upon said platen element, means for successively severing the web and reversing the platen at the end of each predetermined folding operation, and means for simultaneously disabling the feeding means and enabling the severing and reversing means.

4. A web folding machine comprising a double platen reversible in relative position to bring the two platen elements alternately into working relation to the web, means for directing web material toward the platen, two folder blades on opposite sides of the web reciprocative so as to fold the web alternately in opposite directions upon the platen, and means for successively severing the web and reversing the platen at the end of each predetermined folding operation.

5. A web folding machine comprising a double length platen constituting two platen elements and mounted to rotate upon a central vertical axis, means for directing web material toward the platen on one side of the axis, two folder blades on opposite sides of the web reciprocative so as to fold the web alternately in opposite directions upon the platen, and means for successively severing the web and rotating the platen 180° at the end of each predetermined folding operation.

6. A web folding machine comprising an axial support for a roll of the web material, a driven friction feed roll engageable with the periphery of the roll of web material to rotate the same and positively feed off the web material therefrom, a platen and means to direct the leading end of said web mate-

rial toward the platen, gripper jaws overhanging opposed edges of the platen, and reciprocating folding means over the platen properly related in its operation to the rate of feed to fold the web material back and forth upon the platen underneath the gripper jaws as fast as it is fed off the roll.

7. A web folding machine comprising a platen, means for directing web material toward the platen, gripper jaws overhanging opposed edges of the platen, two reciprocative bars connected together and pivoted with their free ends above the platen on opposite sides of the plane of the web, a folding blade extending laterally from the free end of each bar over the platen toward the web and adapted upon reciprocation to move to and from a position underneath the gripper jaws on the side of the web opposite to it, means to reciprocate the bars, and means to open the jaws to receive the blades and to close the jaws upon the blades and interposed web material and to hold the jaws closed until after the blades are withdrawn, the blades being resiliently angularly yieldable on a longitudinal axis to allow of their withdrawal from underneath the closed gripper jaws.

8. A web folding machine comprising a platen, means for directing web material toward the platen, gripper jaws overhanging opposed edges of the platen, two reciprocative bars connected together and pivoted with their free ends above the platen on opposite sides of the plane of the web, a folding blade extending laterally from the free end of each bar over the platen toward the web and adapted upon reciprocation to move to and from a position underneath the gripper jaws on the side of the web opposite to it, means to reciprocate the bars, and a cam device operative in timed relation to the reciprocation of the blades to open the jaws to receive the blades and to close the jaws to one position upon the blades and interposed web material and to close the jaws further after the withdrawal of the blades.

9. A web folding machine comprising vertical guides, a platen support slidable thereon, a lever for raising and lowering the support, a double platen mounted on the support and reversible relative to the support to bring the two platen elements alternately into working position on the platen, means for directing web material toward the platen element on the support, reciprocative folding means operative to fold the web material on the said platen element, means operative at the conclusion of a predetermined folding operation to actuate the lever successively to lower and raise the platen support, and means operative during the lowered position of the support to reverse the platen.

10. A web folding machine comprising vertical guides, a platen support slidable thereon, a lever for raising and lowering the sup-

port, a double length platen on the support constituting two platen elements mounted to rotate upon a central vertical axis to bring the platen elements alternately into working position upon the support, means for directing web material toward the platen element in working position, reciprocative folding means operative to fold the web material on the said platen element, interengaging positioning means on the platen and support, means operative at the conclusion of a predetermined folding operation to actuate the lever successively to lower and raise the platen support, a stop disposed to halt the downward movement of the platen prior to that of the support and thus separate the two and disengage the positioning means, and means operative during the lowered position of the support to rotate the platen 180° on its axis.

11. A web folding machine comprising vertical guides, a platen support slidable thereon, a lever for raising and lowering the support, a double length platen on the support constituting two platen elements mounted to rotate upon a central vertical axis to bring the platen elements alternately into working position upon the support, means for directing web material toward the platen element in working position, reciprocative folding means operative to fold the web material on the said platen element, interengaging positioning means on the platen and support, means operative at the conclusion of a predetermined folding operation to actuate the lever successively to lower and raise the platen support, a stop disposed to halt the downward movement of the platen prior to that of the support and thus separate the two and disengage the positioning means, a reciprocative member operative to sever the web and rotate the platen 180° on its axis, and means to actuate the reciprocative member during the lowered position of the support.

12. A web folding machine comprising vertical guides, a platen support slidable thereon, a lever for raising and lowering the support, a double length platen on the support constituting two platen elements mounted to rotate upon a central vertical axis to bring the platen elements alternately into working position upon the support, means for directing web material toward the platen element in working position, reciprocative folding means operative to fold the web material on the said platen element, interengaging positioning means on the platen and support, means operative at the conclusion of a predetermined folding operation to actuate the lever successively to lower and raise the platen support, a stop disposed to halt the downward movement of the platen prior to that of the support and thus separate the two and disengage the positioning means, an axial depending shaft on the platen, a pinion

on the shaft having a one-way rotative connection therewith, a longitudinally slidable rack meshing with the pinion, a reciprocative member operative in one direction of movement to sever the web and slide the rack to rotate the pinion idly and in the opposite direction of movement to slide the rack to its original position and thereby rotate the platen 180°, and means to actuate the reciprocative member during the lowered position of the support.

13. A web folding machine comprising a reversible platen, feeding mechanism to feed web material toward the platen, folding mechanism for folding the web material upon the platen, a power shaft, a drive connection between the feeding mechanism and the power shaft, means for reversing the platen, means for severing the web material, a second shaft having operative connection with the reversing and severing means, a coupling member adapted to couple the power shaft to the second shaft, an impulse device operated by the power shaft for effectuating the coupling member at predetermined intervals, and means operated by the second shaft for disabling the coupling member.

14. A web folding machine comprising a reversible platen, feeding mechanism to feed web material toward the platen, folding mechanism for folding the web material upon the platen, a power shaft, a drive connection between the feeding mechanism and the power shaft, means for reversing the platen, means for severing the web material, a second shaft having operative connection with the reversing and severing means, a coupling member adapted to couple the power shaft to the second shaft, an impulse device operated by the power shaft for effectuating the coupling member at predetermined intervals, means operated by the second shaft for interrupting the drive connection between the power shaft and feeding mechanism when the coupling member is effectuated and again restoring the connection when the coupling member is disabled.

15. A web folding machine comprising a reversible platen, feeding mechanism to feed web material toward the platen, folding mechanism for folding the web material upon the platen, a power shaft, a drive connection between the feeding mechanism and the power shaft, means for reversing the platen, means for severing the web material, a second shaft having operative connection with the reversing and severing means, a gear wheel on the second shaft having operative connection with the drive shaft, a clutch member for clutching the gear wheel and second shaft, an impulse device operated by the gear wheel, means actuated by the impulse device after a predetermined number of impulses to engage the clutch, and a single

revolution throw-out device operated by the second shaft for disengaging the clutch.

16. A web folding machine comprising a platen, means for directing web material towards the platen, gripper jaws overhanging opposite edges of the platen, folding blades extending over the platen on opposite sides of the plane of the web, means for reciprocating the blades to and from a position underneath the gripper jaws on the side of the web opposite to it, and means operative in timed relation to the reciprocation of the blades to open the jaws to receive the blades and to close the jaws to one position upon the blades and interposed web material and to close the jaws further after the withdrawal of the blades.

17. A web folding machine comprising a platen, means for directing web material toward the platen, gripper jaws overhanging opposite edges of the platen, folding blades extending over the platen on opposite sides of the plane of the web, means for reciprocating the blades to and from a position underneath the gripper jaws on the side of the web opposite to it, and means to open the jaws to receive the blades and to close the jaws upon the blades and interposed web material, the blades being resiliently angularly yieldable on a longitudinal axis.

18. A web folding machine comprising a platen, means for directing web material toward the platen, gripper jaws overhanging opposite edges of the platen, folding blades extending over the platen on opposite sides of the plane of the web, means for reciprocating the blades to and from a position underneath the gripper jaws on the side of the web opposite to it, the blades being resiliently angularly yieldable on a longitudinal axis, and means operative in timed relation to open the jaws to receive the blades and to close the jaws to one position upon the blades and interposed web material, and to close the jaws further after the withdrawal of the blades.

In witness whereof, I hereunto subscribe my signature.

LOUIS H. MORIN.