

July 31, 1934.

C. W. BRENN

1,968,122

FOLDING MACHINE

Filed Sept. 14, 1929

7 Sheets-Sheet 1

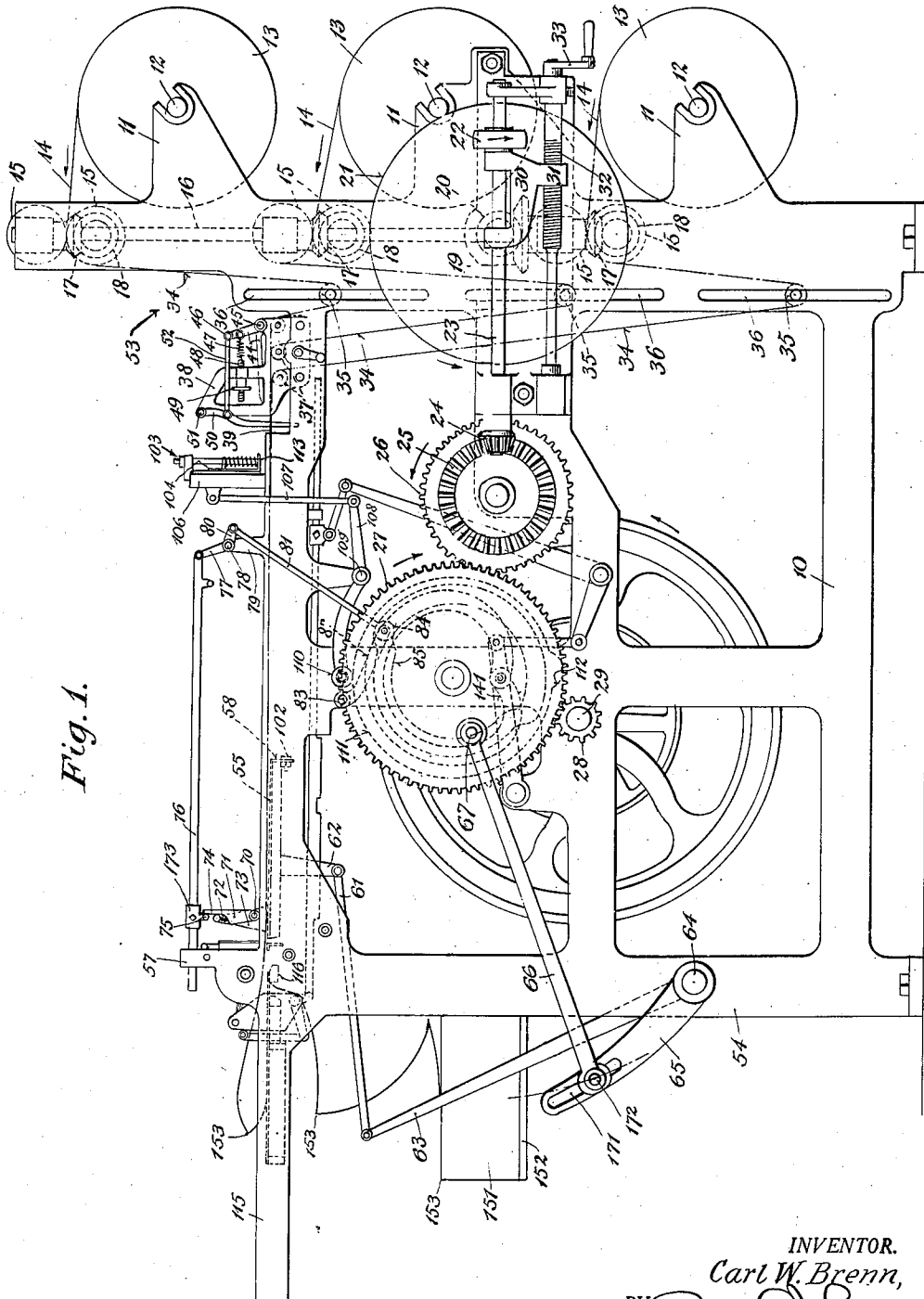


Fig. 1.

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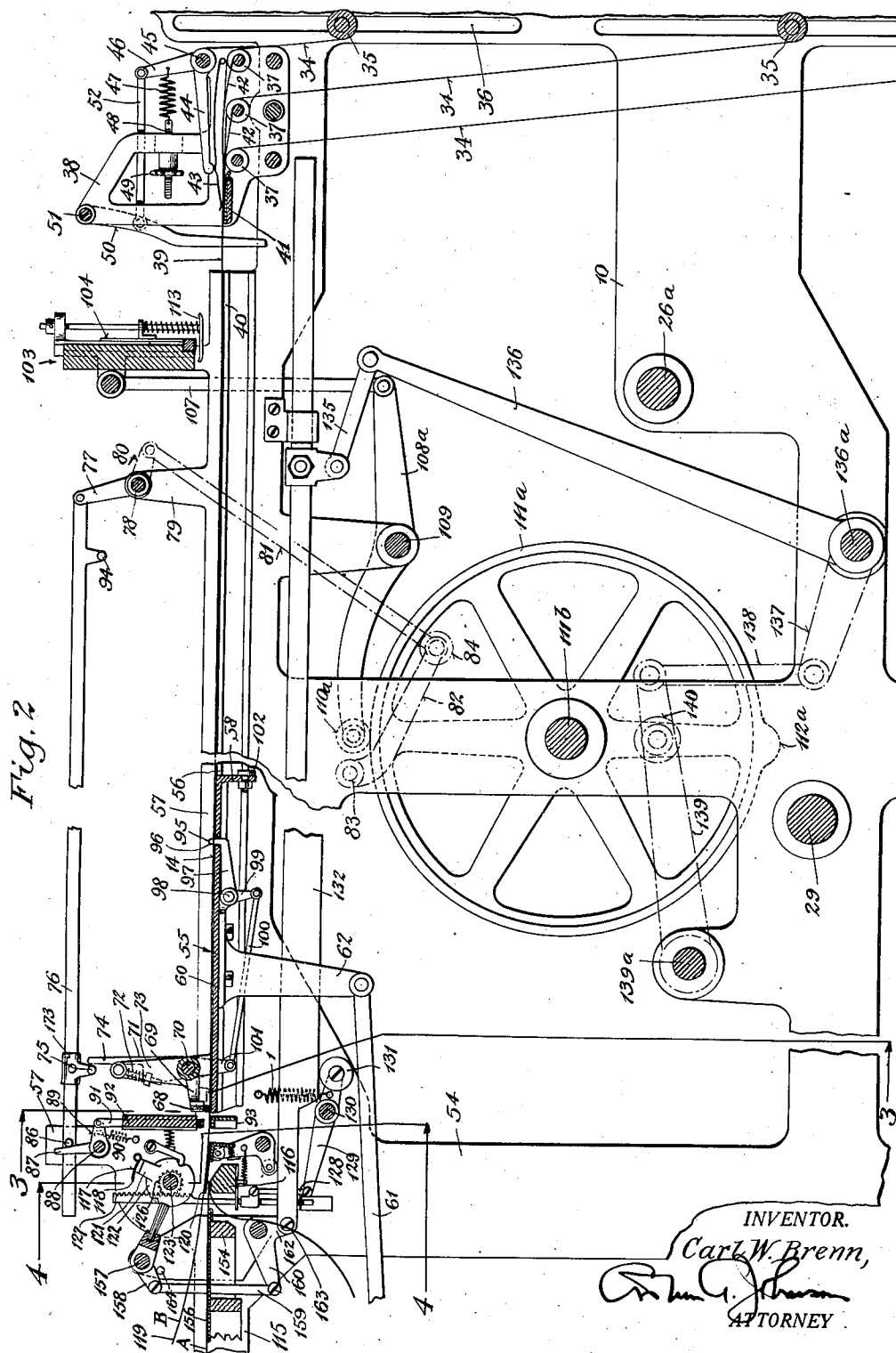
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1,968,122

FOLDING MACHINE

Filed Sept. 14, 1929

7 Sheets-Sheet 2



July 31, 1934.

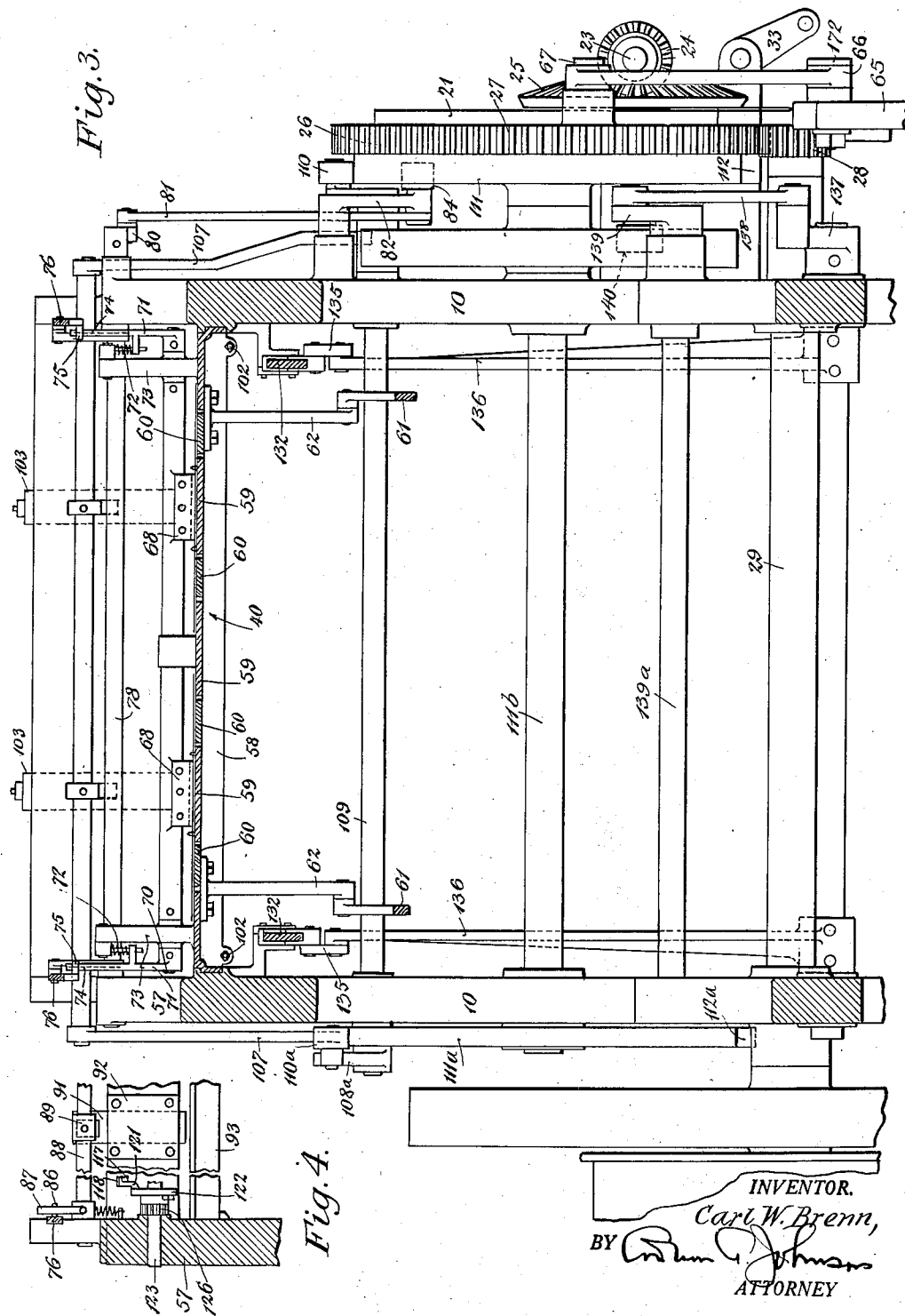
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7 Sheets-Sheet 3



July 31, 1934.

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7 Sheets-Sheet 4

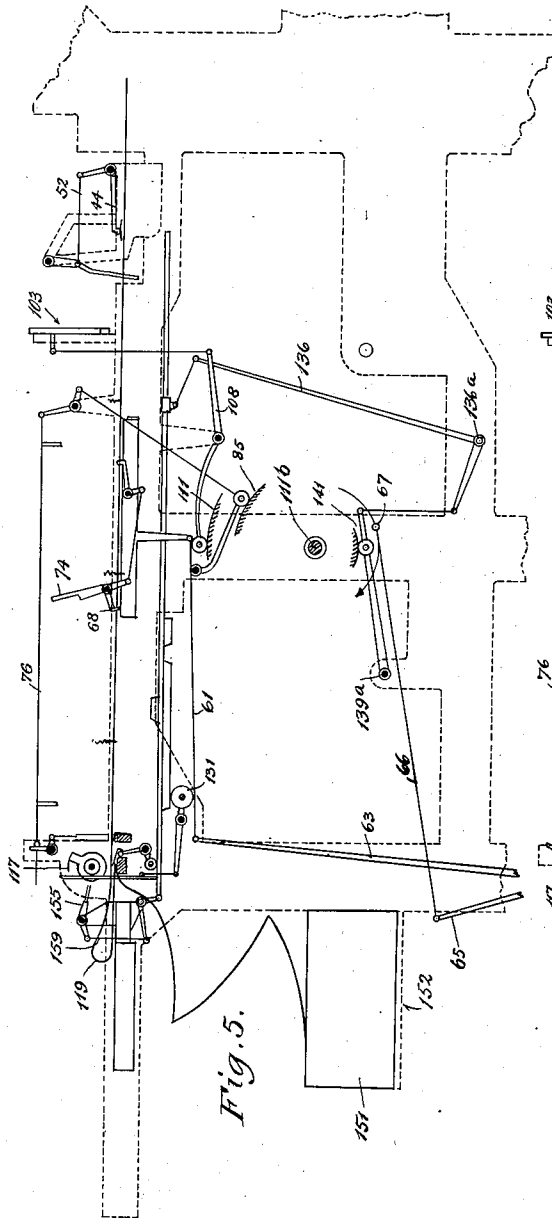


Fig. 5.

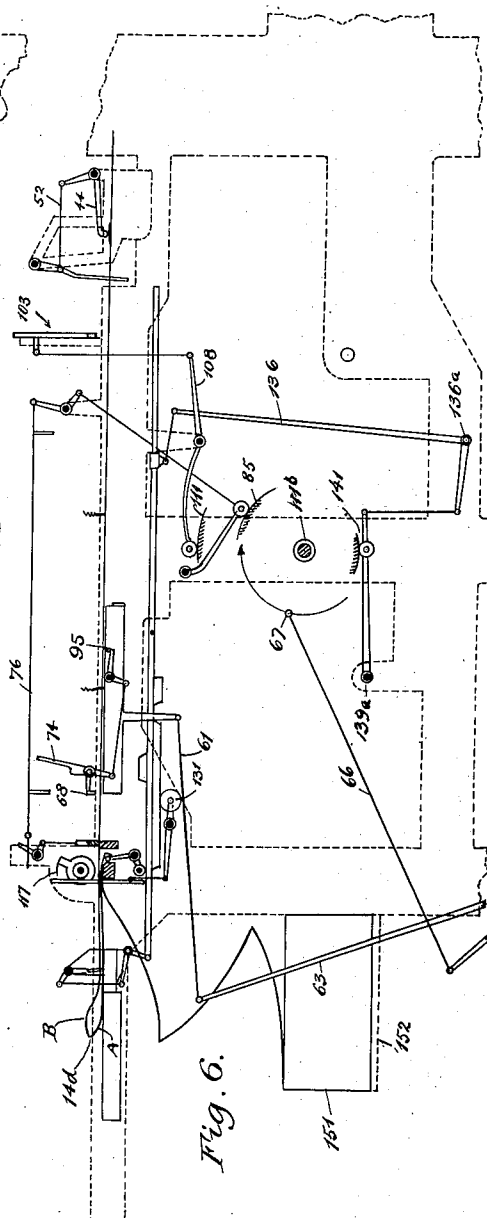


Fig. 6.

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1,968,122

FOLDING MACHINE

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7 Sheets-Sheet 5

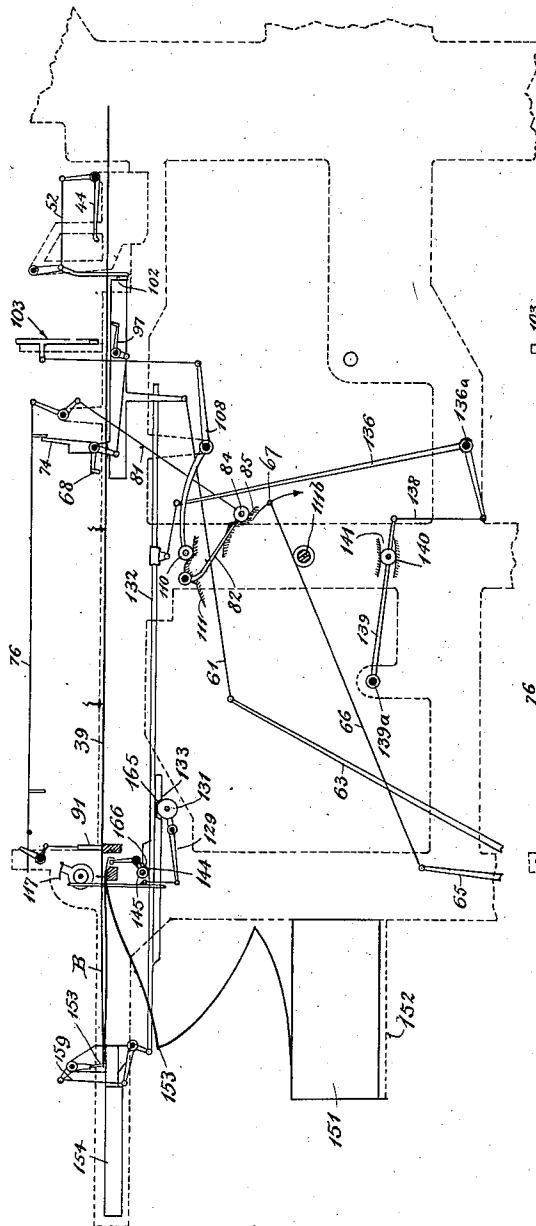


Fig. 7.

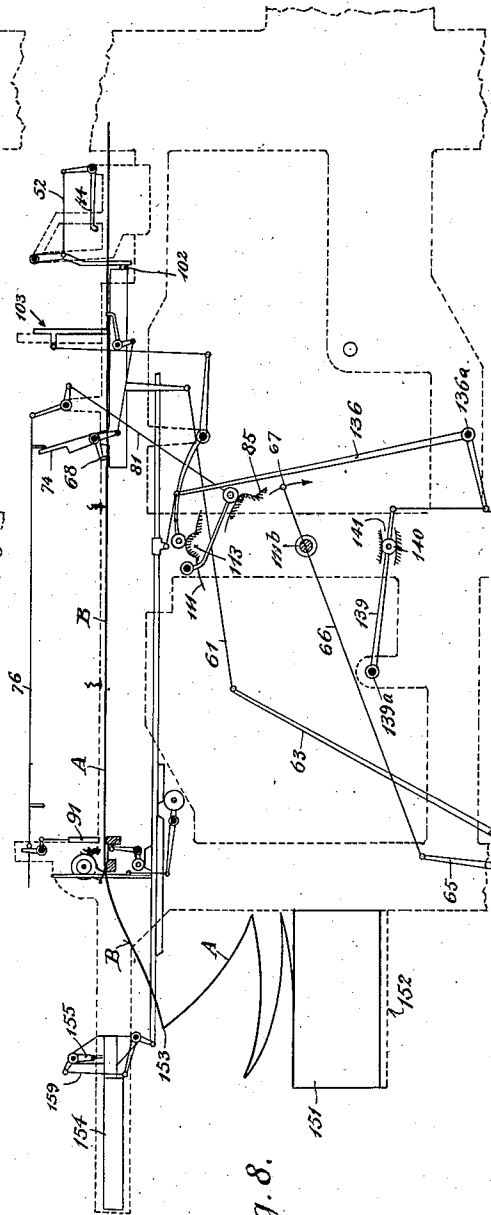


Fig. 8.

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FOLDING MACHINE

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7 Sheets-Sheet 6

Fig. 10.

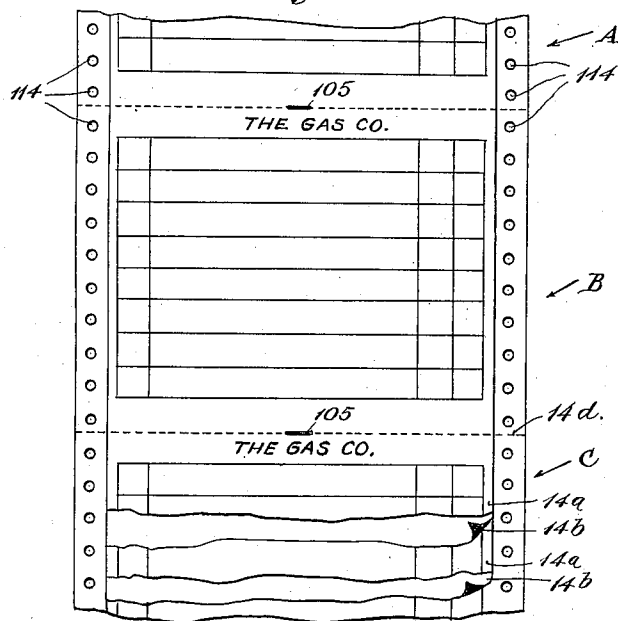
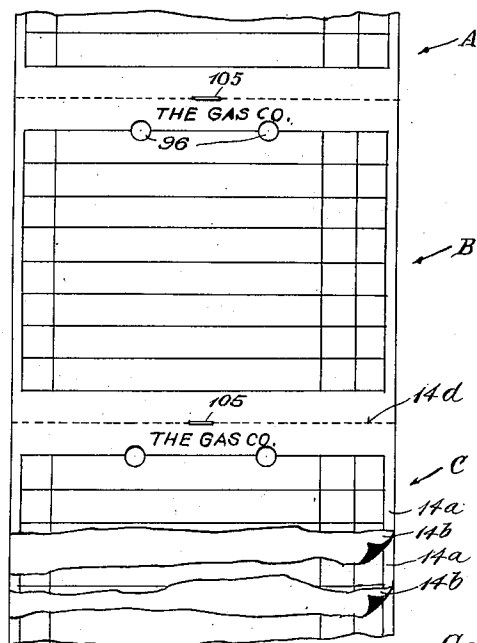


Fig. 9.



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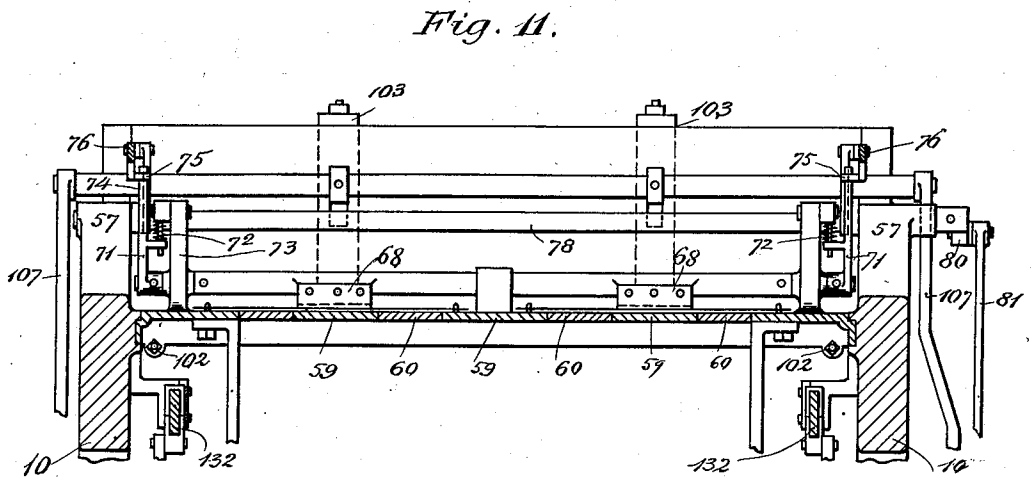
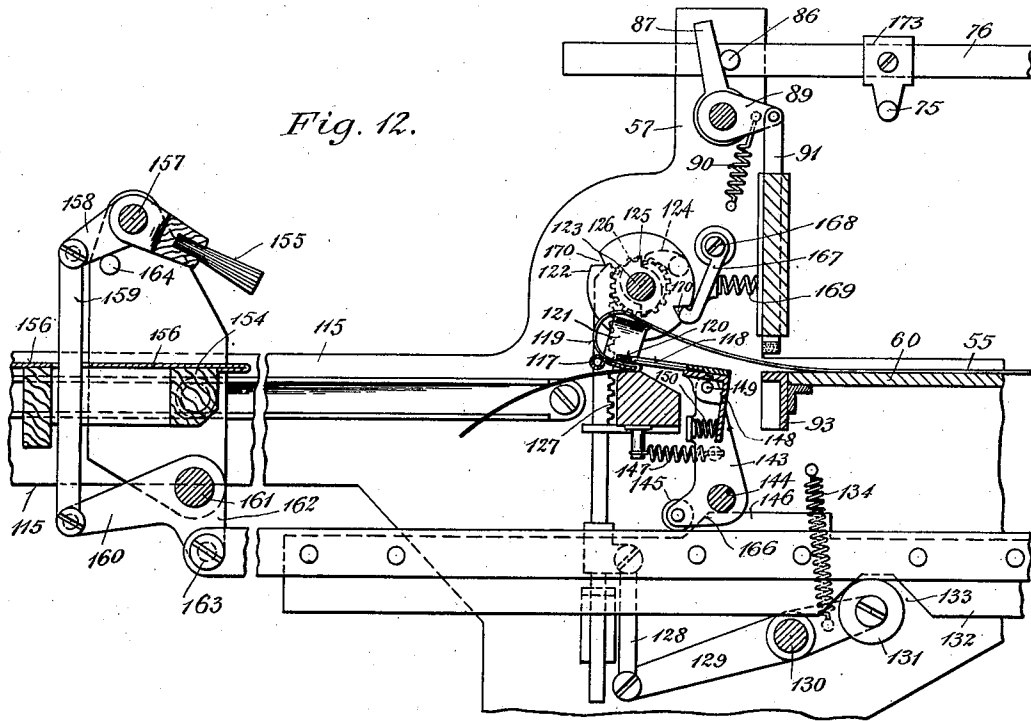
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FOLDING MACHINE

Filed Sept. 14, 1929

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

1,968,122

FOLDING MACHINE

Carl W. Brenn, Montclair, N. J.

Application September 14, 1929, Serial No. 392,540

25 Claims. (Cl. 270—37)

This invention relates to folding fabric strips, and more particularly, to means for folding in zig-zag fashion paper strips for use in manifold-

5 Such paper strips usually consist of a succession of printed forms or tickets between each two of which is provided a line of perforations. The strips are folded in zig-zag fashion for use in manifold-
10 ing machines and it is imperative that the folds occur directly on the lines of perforations, for, should the folds be located either ahead or behind the lines of perforations, difficulty is frequently encountered in the manifold-
15 ing machine incidental to the operation of severing one form or ticket from the next. Moreover, when the folds do not lie directly on the lines of perforations, the pile of zig-zag forms is liable to "pitch", that is, it may lean in one direction or the other, and hence assume
20 over-all dimensions too great to properly fit in the machine.

In my copending application Serial No. 319,315, filed November 14, 1928, and now matured into Patent No. 1,805,161, I have disclosed means associated with a printing press for folding the
25 strips in zig-zag fashion as they are delivered from the press. This means has been found practicable and extremely advantageous, but since the operating parts reciprocate instead of moving continuously as in a gripper and tucker folder, the speed of operation is not such as to permit it to be used with high speed rotary presses.

An object of the present invention is to provide a folding machine like that disclosed in
35 my said copending application, but, which instead of working in conjunction with a press, has means for supporting and feeding the large or jumbo rolls which are rewound after being
40 printed upon in the press, so that the output of one press might be folded by two or more folding machines.

The folding machine disclosed in my said copending application operates directly in conjunction with the press and folds only one thickness of paper and the strips from these folded
45 packs were later collated to provide a pack comprising a plurality of zig-zag folded strips nested with each other.

To obviate the necessity of collating the strips after being folded, it is another object of the present invention to superpose, register, and feed a plurality of strips and then to fold the
55 superposed strips in zig-zag fashion so that the

output of the folding machine of the present invention is a finished pack of worksheets.

In my copending application, Serial No. 221,912, filed September 26, 1927, I have disclosed a pack of manifold-
60 ing strips comprising a plurality of continuous worksheets superposed upon each other and interleaved with continuous carbon strips and this pile of strips is held together by wire staples placed at intervals along the pile of strips, preferably on the lines of
65 perforations dividing the strips into form-lengths.

To make the pack described in my copending application last-named, more economically than was heretofore possible, the folding machine of
70 the present invention is provided with stapling means so coordinately operated with the feeding and folding means as to staple a pile of strips together at one point while the strips are being folded at another point.

Summarized briefly, according to the present
75 invention, a plurality of strips, some of which may be carbon strips, are collated into superposed condition aligned and registered, fed, stapled and folded in zig-zag fashion automatically
80 and as a continuous process, the product of which is a zig-zag folded pile of stapled strips which may be typed upon to make original and duplicate copies without further processing.

Other ancillary and equally important features
85 will hereinafter appear.

In the accompanying drawings—

Figure 1 is a side elevation of the machine of the present invention in the form at present
90 preferred.

Fig. 2 is a side view of part of the operating mechanism shown on a larger scale than was possible in Fig. 1, parts of the mechanism being shown
95 in section to illustrate their construction and operation.

Fig. 3 is a transverse section taken on the line 3—3 of Fig. 2.

Fig. 4 is a sectional detail view of part of the paper clamping means taken substantially on
100 the line 4—4 of Fig. 2.

Fig. 5 is a schematic view of the mechanism of my improved machine showing the positions of the parts while the pile of collated strips, which is shown as a single line, is being fed and
105 just prior and preparatory to the formation of the far fold.

Fig. 6 is a similar view and showing the far fold in the process of being formed, the feeding operation having been completed, the pile
110

clamped, and the feeding carriage returning to starting position.

Fig. 7 is a similar view and shows the far fold as having been formed, the feeding carriage returned to its starting position while the folding carriage still supports the far fold of the pile of strips.

Fig. 8 is like Fig. 7, but shows the far fold of the pile released by the feeding carriage and the near fold released by the gripper while the folding plate for the next near fold is in operative position gripping the pile of strips, the paper clamp being released, the paper clamp on the feeding carriage in operative position, the aligning pins in operative position and having aligned the strips, and the stapling mechanism having operated to insert a staple on the lines of perforations just in advance of the point where the strips are engaged by the aligning pins.

Fig. 9 is a plan view of a pile of manifolding strips made in accordance with my invention disclosed in my copending application, Serial No. 221,912, filed September 26, 1927.

Fig. 10 is a plan view of a pile of manifolding strips made in accordance with my invention disclosed in my copending application, Serial No. 352,934, filed April 6, 1929.

Fig. 11 is a view similar to Fig. 3, but showing a construction which may be used to fold the pile of manifolding strips shown in Fig. 10.

Fig. 12 is an enlarged side view of the folding machine.

As stated above, the machine of the present invention is designed to operate upon strips which have been printed and perforated in a printing press which strips are rewound in the press, and if several strips are printed from a single web, the latter is slit longitudinally in the press so that at the delivery end of the press a plurality of jumbo rolls of perfected strips are provided. Accordingly, the frame 10 of the machine of the present invention is provided with a plurality of brackets 11 for supporting on spindles 12 a plurality of jumbo rolls 13. The strips 14 coming from the rolls 13 each pass between cooperating rollers 15 placed in advance of the rolls 13 and constituting pay-off mechanism to relieve the feed mechanism of the machine described below of the work, and the strips of the strain of rotating the rolls 13. The pay-off mechanism further comprises a vertical shaft 16 having beveled gears 17 for engaging beveled gears 18 on one of the rollers 15 and having another beveled gear 19 meshing with a small beveled gear 20 connected to a friction plate 21, see Fig. 1. This friction plate 21 is driven by a friction wheel 22 slidably mounted on a shaft 23 and splined thereto.

The forward end of the shaft 23 is provided with a beveled gear 24 meshing with a beveled gear 25 on a gear 26 which in turn meshes with a main gear 27 driven by a pinion 28 on a power shaft 29. Thus, continuous rotation of the power shaft 29 causes the friction wheel 22 to rotate the friction disc 21 at a speed which depends upon the position of the friction wheel radially of the friction disc and the position of the friction wheel 22 is controlled by a carriage 30 carrying it which has a nut 31 engaging a screw 32 which may be rotated by a handle 33.

The strips 14, after they leave the pay-off rolls 15, have a hanging loop 34 in which rests a dancing roller 35, which are guided for vertical movement in slots 36 in the main frame 10 and main-

tain the hanging loop 34 and the forwardly extending free stretch of the strips fairly taut.

The forward stretch of each of the hanging loops 34 terminates at a guide roller 37 mounted in a guide roller frame 38. The guide rollers 37 each carry but one strip 14 and are preferably placed in a substantially horizontal plane so that the strips extending over the rollers may be led forwardly in a horizontal plane and superposed one above the other to form a pile 39 adapted to be led forwardly over a table 40.

In order that one strip 14 will not drag with it any of the other strips and will each be led to the table 40 with an equal and proper amount of tension or drag, the guide roller frame 38 is provided with a ledger bar 41 and separator and tensioning fingers 42 carried by all of the rollers except the one furthest in advance, are located between the strips at a point above the ledger bar and the topmost strip is engaged by a plate 43 which is urged downwardly by arm 44 pivoted at 45 and having secured to it another arm 46.

A spring 47 connected to the arm 46 and anchored at its other end in a screw 48, the position of which may be adjusted by a nut 49, urges the arm 46 forwardly and the arm 44 downwardly so as to cause the plate 43 to engage the superposed strips 14 and separator fingers 42, causing the strips 14 to be individually tensioned by the mutual cooperation of the ledger bar 41, the plate 43 and the separators 42, the amount of tension depending upon the position of the nut 49 on the screw 48.

So that its presence in the mechanism may be understood at this point, it should be noted that the arm 44 may be raised against the tension of the spring 47 to relieve the pressure on the strips 14 at certain times or when desired by an arm 50 pivoted at 51 to the guide roller frame and having a link connection 52 to the arm 46. When the arm 50 is pushed to the right as viewed in Fig. 2, the arm 46 will move likewise and the arm 44 will be raised against the tension of the spring 47 to relieve the tension between the strips.

The reason for providing such mechanism and its connection with the other parts of the machine will be described at the appropriate place in the following description.

As stated above, the pile 39 of worksheet strips 14 extends forwardly in a horizontal plane from a table 40 located across the top of the frame between the introductory side 53 of the frame and the delivery side 54. It is on this table 40 and a continuation thereof, that the feeding, aligning, stapling, and folding of the pile is accomplished, and these functions will now be described in the order named.

To feed the pile 39 of strips, so far as some aspects of the present invention are concerned, the feeding means may be of any suitable type. However, in order to maintain the strips of the pile perfectly flat during the various operations and thus avoid longitudinal off-setting of one form relative to the other which results from the strips following a curved or irregular path, a reciprocating feeding device is preferable.

Accordingly, the present invention provides a reciprocating carriage 55 mounted to slide in guides 56 in the side plate 57 of the machine, see Fig. 2. The carriage 55 has cross-pieces 58 and spaced horizontal top strips 59 located between strips 60 constituting the table 40, the top surfaces of the strips 59 and 60 being located in the same horizontal plane so as to provide a smooth plane surface,

The table 55 is reciprocated at the proper time and with the proper movement by a link 61 connected at one end to an arm 62 secured to the table 55, see Figs. 2 and 3, and at the other end to an arm 63 secured to a shaft 64 pivoted in the end 54 of the main frame and having secured to it another arm 65 connected by a pitman 66 to a crank pin 67 secured to the main gear 27. Thus, for each revolution of the main gear 27, the carriage is moved both in advancing and returning directions, the end of the movement of the carriage in advancing direction being shown in Fig. 2, and in returning direction schematically in Figs. 7 and 8.

The pile 39 of strips 14 is actually advanced by being clamped to the carriage to move with it in advancing direction. This clamp, see Fig. 2, comprises a friction contact member or bar 68 carried by an arm 69 secured to a shaft 70 having an arm or arms 71, see Fig. 3, provided with a toggle detent 72 connection with upstanding brackets 73 mounted on the carriage and in which the shaft 70 is mounted. Movement of the shaft in clockwise direction, as viewed in Fig. 2, will raise the clamp 68 from the pile 39 and at the same time cause the detent 72 to hold the clamp elevated, away from the paper strips. The shaft is rocked for this purpose by an upward extension 74 on the arm 71 which is adapted to be engaged and rocked by lugs 75 mounted on shifter bars 76, see Fig. 2. Each shifter bar 76 at one end is slidably mounted in the side 57 of the frame, but at the other end it is pivotally connected to an arm 77 carried by a shaft 78 mounted in a bracket 79 on the frame. The shaft 78 has an arm 80 connected by a link 81 to an arm 82 pivoted at 83 on one of the webs of the main frame and carries at its end, to which the link 81 is connected, a roller 84 which rides in a cam groove 85 provided in a disc 111 secured to the driving gear 27.

The timing of the movements of the carriage and of the shifter bar 76 is such that when the carriage reaches the end of its advancing movement, the roller 84 rides down in its cam groove 85 and causes the shifter bar 76 to move to the right, as viewed in Fig. 2, that is to say, toward the introductory side of the machine. This causes the lug 75 to engage the extension 74 and raise the clamping member 76 from the table 55, thus releasing the strips.

At the same time, a pin 86 on the shifter bar 76 moves away from an arm 87 on a shaft 88 and allows another arm 89 on the shaft to descend under the influence of a spring 90. When the arm 89 of the shaft moves down, it forces a clamping member 91, slidably mounted in a plate 92 extending across the frame between the sides 57 thereof, down against a ledger bar 93, also fixed between the side plates 57 of the frame. This causes the pile of sheets 39 to be clamped in fixed position on the frame at the same time that the clamp 68 is released.

The continued rotation of the master gear 27 causes the crank pin to be advanced to the right, as viewed in Fig. 1, and thus causes the carriage 55 to be returned to starting position at the right hand side of the frame, which position is indicated schematically in Figs. 7 and 8. When the carriage 55 reaches the end of its travel, the cam 85 causes the roller 84 to rise and this causes the shifter bar to move to the left from the position shown in Fig. 7 to the position shown in Fig. 8, at which time a lug 94 on the shifter bar engages the extension 74 on the arm 71 of the

clamping mechanism and causes the clamp 68 to be thrown down onto the pile 39 of the strips, and the spring detent 72 holds the clamp 68 on the pile with predetermined pressure. Thus, it will be seen, that the carriage is again ready to advance the strips the desired distance and it does so by the continued rotation of the master gear 27. At the end of the forward or advancing stroke, the operations above described are again repeated.

It should be noted that the pile of strips 39 are always held together either by the clamp 68 on the carriage or the stationary clamp 91 on the frame.

The aligning mechanism for bringing all of the strips 14 into accurate register and alignment, both transversely and longitudinally, comprises a pair of tapered pins 95 adapted to engage apertures 96 provided in the strips 14 and of such diameter as to permit the pins to readily enter the apertures and correct any minor inaccuracies of registration which might occur.

The pins 95 are carried by arms 97 secured to a shaft 98 extending transversely across the carriage. The shaft 98 also has an arm 99 and this is connected by a link 100 to an arm 101 secured to the shaft 70 of the clamping mechanism. Thus, as indicated schematically in Fig. 6, when the clamp 68 is thrown off at the end of the feeding stroke of the carriage, the aligning pins 95 are withdrawn from the apertures and remain below the surface of the table 40 during the return stroke of the carriage, due to the detent spring 72. At the end of the returning movement, which is, of course, the same as the beginning of the feeding movement, the clamp-operating arm 74 is engaged by the lug 94 on the shifter bar 76 and this causes the clamp to be thrown on. However, the timing of the operation of the clamp and pin-carrying arms is such that the pins 95 engage in the apertures slightly before the clamp 68 takes effect, and thus, when the pins 95 engage the pile, the strips 14 of the pile 39 are free, so far as the clamp 68 is concerned, to be adjusted by the pins.

During the forward stroke or advancing stroke of the carriage, the pins remain in the apertures and, therefore, to some extent assist the clamp 68 in feeding the pile 39 of strips. In some aspects of the present invention, the pins 95 may alone constitute the means for connecting the pile 39 to the carriage 55 for the advancing movements of the pile, but it is preferable where feasible to employ the clamp 68, since it relieves pressure of the pins 95 against the walls of the apertures 96 in the strips.

It will be recalled that it was stated above that the tension on the strips provided by the separator fingers 42, plate 43 and spring 47 may be relieved by operating an arm 50. This arm is in the path of an abutment 102 secured to the rear cross member 58 of the carriage so that when the carriage reaches the limit of its return movement, the abutment 102 strikes the arm 50 and relieves the pressure of the spring 47 so as to remove the tensioning and gripping action of the separator mechanism on the strips 14. This is done so that at the time the pins 95 enter the apertures, the strips 14 will be free of the separator mechanism for correction of their registration relative to each other and to the carriage 55.

So that the pack of worksheets produced by the machine will have all the strips 14 of the pile securely fastened together and in registra-

tion with each other and to facilitate the feeding and folding operations, the present invention provides the machine with a stapling device adapted to place wire staples through the pile 39 of the strips at intervals along the length of the pile.

Accordingly, as shown in the accompanying drawings, a stapling or stitching device 103 is provided between the separating and tensioning device and the folding device. The stapling device 103 may be of any suitable or conventional kind or form and, as shown, comprises a plunger 104 for setting wire staples 105, see Fig. 9, through the pile of strips 14. The plunger is mounted in a head 106 and has a link connection 107 to a lever 108 pivoted at 109 on the frame work and having at its opposite end a roller 110 riding on the periphery of the disk 111 which is provided with the cam groove 85. Located on the periphery of the disk 111 is a cam 112 which, at the proper point in the cycle of operations, engages the roller 110, rocks the lever 108, pulling down on the link 107 to operate the plunger 104 to set the staples 105 in the pile 39. The stapling device may comprise a presser-foot 113 for holding the strips tightly together during the stapling operation.

The location of the cam 112 with relation to the crank pin 67 and cam groove 85 is such that when the carriage is at the end of its movement in returning direction and just after the pins 95 have entered the apertures 96 to align the strips, the cam 112 causes the stapler to operate and apply the staple to the pile of strips. Immediately thereafter, the roller 110 leaves the cam 112 and allows the plunger 104 of the stapling machine to return to its normal position shown in Fig. 2.

At this point, it should be noted that, since the strips in advance of the stapling device 103 are held together by the staples 105, there is very little likelihood of any of the strips getting out of alignment or registration, and hence, the pins 95 will only have to correct very minor variations in the registry of the respective strips.

With the strips so stapled together, they may, of course, be advanced by pressure being applied to one or more than one of the strips—that is to say, by any number of strips. This is particularly important and advantageous when it is desired to fold and staple the pile of strips, such as shown in my copending application, Serial No. 352,934, filed April 6, 1929, and illustrated in Fig. 10. In this case, all of the strips, except the lowermost one, have plain edges, and the lower strip is made wider than the others and is provided with a longitudinally extending row of apertures 114 at each side edge. This pile of strips contains work-sheet strips 14a and carbon strips 14b, and hence it is preferable, when making this kind of pack, that the pins 95 be located in position to engage the apertures 114. It is also preferable that the clamps 68 and 91 be arranged to only engage the side margins of the strips. All of this is possible because of the stapling of the strips to make them one unitary pile.

Regarding the folding mechanism, attention is called to my Patent No. 1,805,161, granted May 12, 1931, which discloses the specific mechanism illustrated herein and describes in greater detail than below the mechanism of the folding machine.

The folder disclosed in my said copending application is distinguished from the ordinary or conventional folder in that separate means are

provided for producing the right-hand and left-hand folds in the pile, and the points of folds are in both cases positively controlled by the feeding means.

The folding device illustrated herein comprises an extension 115 of the frame 10 onto which the pile 39 of strips is fed intermittently or step-by-step by the feeding carriage 55 from the table 40 after first passing over a stationary ledger bar 116 fixed to the frame 10. This ledger bar serves to back-up and support the pile 39 of strips at the point where the righthand fold is formed.

To hold the web securely during the folding operation and to provide a straight edge against which the web is folded, there is provided a gage plate 117 adapted to be brought down upon the pile 39 and clamp it against the ledger bar 116 at a predetermined stage in the cycle of operations. The edge 118 of the plate 117 is so arranged as to be directly above lines of perforations 14d, see Figs. 9 and 10, when in operative position. This situation is shown in Fig. 8, and exists at a point in the operation of the machine while the feeding carriage 55 is returning to starting position, at which time, of course, the paper does not travel.

As soon as the feed mechanism begins again to operate, the web starts to form a loop 119, see Fig. 12, lying over the surface of the plate 117. At this time, a creasing bar 120 is caused to move in the direction of the web travel from a position shown in Fig. 8, where it is located beneath the plane of the table 40, ledger bar 116 and the pile 39 upwardly and to the left as viewed and over the top of the plate 117 to the position shown in Fig. 12, with the result that the web at the line of perforations, that is, at the point where the edge 118 of the plate 117 is located, is folded over and creased.

This creasing action is very easily accomplished and does not require a great deal of pressure because of the weakened condition of the strips by the lines of perforations, and a slight urge in the folding direction will cause the strips to be easily folded.

So far as some of the aspects of the invention are concerned, this creasing bar is all that is needed to engage the web at the fold. However, since the operations of the machine are expedited by the withdrawal of the plate 117 as soon as possible to an out-of-the-way position, the creasing bar 120 is provided with clamping fingers which in operative position engage the folded strip directly above notches not shown in the gage plate 117 to hold the strips rigidly against the ledger bar 116, as shown in Fig. 2, independently of the folding plate 117. Immediately upon the conclusion of this operation, the plate 117 is withdrawn from between the fold and moved to the position shown in Fig. 5.

In order to obtain this movement above referred to, the plate 117 is mounted on arms 121 secured to discs 122, which, in turn, are fastened to a shaft 123 having bearings in the vertical extensions of the side plates 57 of the frame. One of these discs 122 is provided with a pawl 124 adapted to engage a ratchet tooth 125 carried by a gear 126 rotatably mounted on the shaft 123 and confined between the disc 122 and the frame 57. The gear 126 meshes with a rack 127 mounted on guides in the frame and having at its lower end a link 128 connected on a lever 129 secured on a shaft 130 pivoted in the frame 54. The other end of the lever 129 is provided with a roller 131 for engaging a cam bar 132 adapted to reciprocate

in the direction of the travel of the web, that is, longitudinally of the machine.

When the parts are in the position shown in Fig. 12, with the loop 119 partly formed and the gage plate 117 in operative position holding the web against the ledger bar 116, the roller 131 lies in a dwell 133 in the cam bar 132. The cam bar 132 is connected to the power shaft of the press in the manner hereinafter described, so that, immediately after this condition exists, the cam bar moves to the right as viewed in Fig. 12, and causes the roller to be depressed and the rack 127 to be raised. The ratio between the movements of the rack 127 and gear 126 is such that the plate 117 is moved 180 degrees, that is to say, to the position shown in Fig. 2. The rack is caused to descend and the roller rises when the latter is located under the dwell 133 in the cam bar 132 by means of a spring 134 connected to the lever 129 and anchored on the frame of the machine. The cam bar 132 is connected to the power shaft of the press by a link 135 connecting it with an arm 136 of a bell crank, the other arm 137 of which is connected by a link 138 to a pivoted arm 139 having a roller 140 riding in a groove 141 in a cam disc 142 secured to the master gear 27. Thus, when the master gear rotates, the cam bar 132 will be reciprocated in the frame 10.

The movement of the creasing bar 120 to and from operative position is also controlled by the cam bar 132. For this purpose, the creasing bar 120 is carried by a pair of arms 143 secured to a shaft 144 and having a roller 145 located in the path of a cam 146 carried by the cam bar 132. When the cam 146 engages the roller 145, it rocks the arm 143 clockwise so as to withdraw the creasing bar 120 from its operative position shown in Fig. 12 to its inoperative position where it is located below the plane of the path of the web as shown in Fig. 8.

The creasing bar remains in this position until the roller 145 rides down the incline on the cam 146, at which time springs 147 connected to the arms 143 and anchored on the ledger bar cause the arms 143 to move counter-clockwise. The creasing bar 120 is secured to an angle bar 148 pivotally mounted at 149 on the arms 143 and is urged to move downwardly by reason of the provision of springs 150 between the angle bar 148 and the arms 143. When the arms 143 are rocked clockwise, the creasing bar 120, after it leaves the fold in the pile, rides down an incline on the ledger bar and remains in a substantially horizontal position below the path of the pile. Thus, the creasing bar with its spring fingers forms a continuation of the table 40 so as to prevent any draping of the pile from the clamp 68 to the ledger bar. When the arms 143 are permitted so to do by the cam 146 at the proper time, the spring 147 pulls the creasing bar 120 in the direction of web travel with the result that it rides up the incline pushing the pile of strips upwardly and then creasing it over the gage plate 117 to form the fold, yielding upwardly as permitted by the springs 150 in this operation.

After the parts described above assume the positions shown in Fig. 2, which is accomplished at the very beginning of the feeding operation of the carriage 55, they remain in these positions during the feeding of the form A which has been provided with the fold, and also, during the feeding of the next adjacent form B, the stroke of the feeding carriage being such as to feed two forms for each complete movement in advancing direction.

After the feeding of the form B is concluded and while the feeding carriage 55 is returning, the aligning pins are engaging the apertures and the stapler is operating to staple the strips together, the creasing bar 120 is withdrawn to the position shown in Fig. 8 to permit the web to be released, so that the fold produced by the creaser bar may drop off the ledger bar and allow the end of the overlying form B to rest directly upon the ledger bar.

Due to the accurate control of the pile 39 by the feeding carriage, the line of perforations 14d between the forms B and C is in exactly the right position on the ledger bar, so that when the folding plate 117 is again swung down which is done as soon as the creasing bar 120 and fingers have been withdrawn, the edge 118 of the gage plate 117 will lie on the line of perforations 14d. When the feeding operation is resumed, the form C starts to make a loop 119 and the creasing bar 120 again operates to make another right-hand fold in the web, whereupon the fingers hold the web in creased condition on the ledger bar.

When the right-hand fold leaves the ledger bar 116, the folded web falls in a pile on a supporting table 152 carried by the end of the frame 10.

It has been found in practice that the right-hand folds produced by the gage plate 117 and the creasing bar 120 is sufficient to produce the zig-zag folded pile 151, for the left-hand fold 153 may be produced by the weight of the other forms which follow it and finally rest upon it. Even if the weight of the forms were not sufficient to produce a sharp crease at the left-hand fold 153, this may be done from time to time by the operator pressing down the pile by hand.

However, to produce these left-hand folds 153 in the machine so that no hand-operation is needed and for other purposes, the present invention provides a carriage 154 adapted to ride in tracks in the extension 115 of the machine frame, and mounts on this carriage a pressing brush 155. At the beginning of the feeding operation, that is, when the loop 119 is being formed, the brush 155 is located in position adjacent the ledger bar, as shown in Fig. 5, and is also elevated above the plane of the loop 119, while a table 156 which is mounted on the carriage 154 has its end located adjacent the ledger bar so that the loop 119 may extend over onto the table 156, as shown in Fig. 5, during the continuation of the feeding of the web.

The brush 155 extends transversely of the pile 39 and is secured to a shaft 157 journaled in vertically extending arms on the carriage 154. The shaft 157 also has secured to it levers 158 to each of which is connected a link 159 whose lower end is connected to an arm 160. Both arms 160 are secured to a shaft 161 mounted in arms secured to the carriage 154. One of the arms 160 is in the form of a bell-crank and has another arm 162 to which the cam bar 132 is pivotally connected at 163. In the idle position of the cam bar 132, that is to say, the position shown in Fig. 5, the arms 158 of the brush structure engage stop pins 164 mounted in the arms in which position the brush 155 is elevated above the plane of the loop 119. The parts assume these positions until the loop 119 is completely formed as shown in Fig. 1, that is to say, when the feeding operation of form B has been concluded.

Then, during the return of the carriage 55, the aligning, and stapling of the pile 39, the cam bar 47 is moved to the left as viewed in Fig. 2. The

first thing that occurs is that the cam bar 132 through the bell-crank 160—162 rocks the shaft 161 and causes the links 159 to be raised. This causes the brush 155 to be rotated so as to move
 5 downwardly against the form B until movement of the brush is limited by the engagement of arms, integral with the arms 158, with the stop pins 164. Continued movement of the cam bar causes the brush and carriage to be moved toward
 10 the left to press down the form B on the form A and slide along the surface of the form B until the end of the loop is reached, during which operation the web is caused to crack along the line of perforations 14d and be sharply creased by
 15 the downward pressure of the brush thereagainst. In Fig. 6, the brush is shown in a position intermediate its limits of travel while in Fig. 7 the brush is shown as having just passed over the fold 153.

20 At this point in the cycle of operations, the folded forms A and B at their ends adjacent their folds 153 may slip off the end of the table 156 if the web is sufficiently flexible to permit this. However, whether it does so or not is immaterial, for upon further movement of the carriage the end of the table is moved beyond the fold 153 and the folded forms A and B are allowed
 25 to drop onto the pile 151 supported by the table 152. At the same time that this is being done, the fingers and the creasing bar 120 are being withdrawn to permit release of the fold at the beginning of the form A, and in Fig. 8 both these operations are assumed to have been completed and the forms A and B are shown in the act of
 30 falling onto the pile 151.

35 Before the feeding operation is again resumed, the gage-plate 117 is brought down into position on the ledger bar. This gage plate is so shaped as to have a slight wiping action on the pile 39 before it reaches its final position so as to draw the web taut between the ledger bar and the clamp 91. The weight of the pile depending from the ledger bar 116 should be sufficient to do this, but the wiping action is provided to insure this taut
 40 condition of the pile, so that the point of fold will be controlled solely by the feed mechanism assisted by the clamp 91.

45 At this point it should be noted that the cam track 141 is so arranged that the cam bar 132 is fully retracted before the loop 119 has had an opportunity to become too large. This retracted position of the cam bar is shown in Fig. 5, at which time the gage plate 117 is elevated and the creasing bar 120 and the fingers are in operative position. The cam bar remains in this position due to the fact that the roller 140 rides on a concentric portion of the cam during the remaining portion of the feeding operation of the form A after the loop 119 is started and the fold
 50 formed and until the loop 119 is about completed by the feeding of the form B. At this time, the roller 140 rides down in the cam track 141 and causes the cam bar 132 to be moved outwardly, first rocking the brush 155 to its operative position which is shown in Fig. 6. As the brush reaches the fold 153 of the pile, the roller 131 on the lever 129 controlling the rack 127 is permitted to drop into the dwell 133 in the cam bar, so that it is in position to be engaged by the
 55 incline 165 on the cam bar to again move the rack up when the brush and its carriage move from the position shown in Fig. 7 to the position shown in Fig. 8.

60 Since the folds 153 have then been formed, the fold may be released, and this is accomplished

by the incline 166 on the cam 146 engaging the roller 145 on the arm 144 which carries the gripping fingers and creaser bar 120 to withdraw the latter.

Thus it will be seen that during the movement of the cam bar 132 from the position shown in Fig. 7 to that shown in Fig. 8, the gripping fingers and creaser bar 120 are withdrawn just before the gage plate 117 is brought down upon the end of the form B. This occurs while the feeding mechanism is idle and during the operation of the aligning pins 95, stapling device 103 and gripper 68. As soon as the feeding mechanism begins again to operate, the roller 140 rides up out of the dwell in the cam track 141 and starts the retracting movement of the cam bar 132. However, before the carriage can move back with the cam bar, the brush is rocked upwardly out of the way by its link connection 159 until the arms 158 engage the pins 164, as shown in Fig. 12, because the resistance offered by the rotation of the brush is less than that offered by the carriage.

During this initial retracting movement of the cam bar, the roller 145 rides down the incline 166 on the cam 146 and permits the spring 147 to move the creaser bar 120 to the position shown in Fig. 12 to form the fold. At the same time or rather shortly before this occurs, the roller 131 moves into the dwell 133 in the cam bar so as to move the rack 127 downwardly and get it in position to operate. After the fingers have gripped the fold, the roller 131 is forced out of the dwell 133 causing the rack to move upwardly and rotate the gage plate 117 one half a revolution, that is to say, to the position shown in Fig. 5, where it too is out of the way of the advancing loop 119.

The continued movement of the cam bar 132 causes the carriage to be moved to the position shown in Fig. 5 in which it remains until the form being fed and the one following it is in position for the formation of the left-hand fold 153.

The gage plate 117 may be held in its operative and inoperative positions by any suitable means. In the accompanying drawings, this means comprises a detent pawl 167 pivoted at 168 and normally under pressure of the spring 169 which urges it into notches 170 in the disc 122 secured to the shaft 123 and carrying the folding bar 117.

The length of movement of the brush 155 and the table 156 is made sufficient to function with a form of maximum length which it is desired to fold, and since the left-hand fold 153 is formed by the wiping or sweeping action of the brush 155, no adjustment or change in the mechanism need be made when the forms are of less length, nor is it necessary to adjust the position of the ledger bar 116 and gage plate 117 when it is possible to adjust the feeding mechanism, both as to its starting position and length of throw, so that the line of perforations 14d may be made to always come to rest in the same position irrespective of the length of the forms operated upon.

The machine, according to the present invention as illustrated herein, is designed to simultaneously operate upon two piles 39 of strips placed side-by-side, in which case two sets of pins 95 are placed side-by-side on the table 40 and two stapling devices 103 are also employed. Otherwise, the mechanism for operating upon the pile 95 is merely extended to make it of suitable width so that it will operate on both piles. By having these duplex arrangements, it is possible, even with the relatively slow speed of the folder,

1. e. when compared with a gripper and tucker folder, to use but one folding machine to fold the output of the faster rotary presses.

For instance, if each pile 39 contains three strips 14 and there were two piles 39, the folding device of the present invention could still handle the output of a single rotary press printing two strips side-by-side so long as the press operates not faster than three times as fast as the folder.

The end of the feeding movement of the carriage in advancing direction as well as the length of stroke thereof may be varied by adjusting the connection between the pitman link 66 and the lever 65 between the carriage and the master gear 27. Accordingly, as shown, the lever 65 is provided with a slot 171 in which the pin 172 of the pitman 66 may be adjusted to move the pin nearer to the shaft 64 on the lever 65 and at the same time move the lever 65 closer to the master gear and thus vary the stopping position of the carriage in advancing direction. For the same purpose, the lug 75 on the shifter bar 76 may, as shown in Fig. 1, be mounted on a block 173 which is adjustable on the shifter bar 76 to make the normal position of the lug 75 agree with the end of the feeding movement of the carriage.

Variations and modifications may be made within the scope of this invention and portions of the improvements may be used without others.

Having thus described the invention, what is claimed as new and for which it is desired to obtain Letters Patent, is:—

1. A folding machine comprising means for supporting a plurality of rolls of perfected strips and guiding said strips in a superposed pile; folding mechanism; means for advancing said strips to the folding mechanism to be folded zig-zag fashion to produce a pack of continuous strips; and means located in advance of said roll-supporting means for stapling the strips of the pile together.

2. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of strips; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips zig-zag fashion to form a pack of continuous strips; and reciprocatory means between the roll-supporting means and the folding means to advance the pile of strips to the folding means regular and predetermined amounts at each operation thereof.

3. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of strips divided into form-lengths by transverse lines of perforations; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for intermittently folding the pile of strips along each line of perforations and alternately in opposite directions to form a zig-zag pack of continuous strips; and means between the roll-supporting means and the folding means to advance the pile of strips to the folding means two form-lengths at each operation thereof during the intervals between operation of the folding means.

4. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of strips divided into form-lengths by transverse lines of perforations; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips along each line of perforations alternately in opposite directions to form a zig-zag pack; and reciprocating

means between the roll-supporting means and the folding means to advance the pile of strips to the folding means two form-lengths at each operation thereof.

5. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of apertured strips; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips in zig-zag fashion to form a pack; and means between the roll-supporting means and the folding means adapted to engage said apertures to hold the superposed strips in registration.

6. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of strips; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips zig-zag fashion to form a pack; means between the roll-supporting means and the folding means to advance the pile of strips to the folding means regular and predetermined amounts at each operation thereof; and means between the roll-supporting means and the folding means for applying a predetermined tension or drag to the strips as they are advanced by the strip advancing means.

7. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of strips; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips zig-zag fashion to form a pack; reciprocating means between the roll-supporting means and the folding means to advance the pile of strips to the folding means at regular and predetermined amounts at each operation thereof; means between said advancing means and said roll-supporting means for applying a predetermined tension or drag to the strips as they are advanced by the advancing means; means for bringing the strips into registration operative at one end of the movement of the reciprocating means; and means operated by the reciprocating means for rendering the tensioning means inoperative during the operation of the means for bringing the strips into registration.

8. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of strips divided into form-lengths by transverse lines of perforations; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips along each line of perforations and alternately in opposite directions to form a zig-zag pack; means between the roll-supporting means and the folding means to advance the pile of strips to the folding means two form-lengths at each operation thereof; and means for stapling the strips of the pile together before they are folded by said folding means.

9. A folding machine comprising a frame; means at the introductory side of the frame for supporting a plurality of rolls of apertured strips; means for guiding the strips into superposition to form a pile; means at the delivery side of the machine for folding the pile of strips in zig-zag fashion to form a pack; means between the roll-supporting means and the folding means adapted to engage said apertures to hold the superposed strips in registration; and means for stapling the strips of the pile together, said means being

located in position to engage the strips while supported on said reciprocating means and at one end of the travel of said reciprocating means.

10. A folding machine comprising means for collating a plurality of separate continuous paper strips to form a superposed pile; folding mechanism; means for advancing said pile of strips to the folding mechanism to be folded zig-zag fashion to produce a pack of continuous strips; and means for stapling the strips of the pile together before the pile reaches the folding mechanism.

11. A folding machine comprising a frame; means for collating a plurality of separate continuous paper strips to form a superposed pile; means at the delivery side of the machine for folding the pile of strips zig-zag fashion to form a pack of continuous strips; and reciprocatory means between the collating means and the folding means to advance the pile of strips to the folding means regular and predetermined amounts at each operation thereof.

12. In a machine of the character described, means for collating a plurality of separate continuous paper strips to form a superposed pile; means including pins engaging apertures in the strips for advancing the superposed pile of continuous strips intermittently; and means for stapling the continuous strips of the pile together and operating during intermissions between the feeding operations.

13. In a machine of the character described, means for collating a plurality of separate continuous paper strips to form a superposed pile; means including pins engaging apertures in the strips for bringing said collated continuous strips into predetermined registration; and means for stapling said collated continuous strips together to hold them in registration.

14. In a machine of the character described, means for collating a plurality of separate continuous paper strips to form a superposed pile; means including pins engaging apertures in the strips for advancing the superposed pile of continuous strips intermittently; and means for stapling the continuous strips of the pile together and acting coordinately with the feeding means.

15. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips, divided into form lengths by transverse lines of perforations, to form a superposed pile; means at the delivery side of the machine for intermittently folding the pile of strips along each line of perforations and alternately in opposite directions to form a zig-zag pack of continuous strips; and means between the collating means and the folding means to advance the pile of strips to the folding means to form lengths at each operation thereof during intervals between operations of the folding means.

16. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips, having apertures at regular predetermined distances therein, to form a superposed pile; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; and means between the collating means and the folding means adapted to engage said apertures to hold the superposed strips in registration.

17. A folding machine comprising a frame; means at the introductory side of the frame for

collating a plurality of separate continuous paper strips to form a superposed pile of continuous strips, and having apertures at regular spaced distances therein; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; reciprocating means for intermittent feeding said pile of strips from the collating to the folding means; and pins carried by the reciprocating means adapted to engage said apertures to hold the superposed strips in registration.

18. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips to form a superposed pile of continuous strips, and having apertures at regular spaced distances therein; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; reciprocatory means for intermittently feeding said pile of strips from the collating to the folding means; movable pins carried by the reciprocatory means adapted to engage said apertures to hold the superposed strips in registration; and means for moving said pins up and down in said table and into and out of registry with the apertures in said strips at predetermined stations in the travel of said reciprocating means to hold the superposed strips in registration during travel.

19. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips to form a superposed pile of continuous strips, and having apertures at regular spaced distances therein; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; and means for intermittently feeding said pile of strips from the collating means to the folding means including mechanism for aligning and for gripping said pile of strips intermittently on the feeding means.

20. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips to form a superposed pile of continuous strips; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; reciprocating means for intermittently feeding said pile of strips from the collating to the folding means; and a gripper carried by said reciprocatory feeding means adapted to clamp the pile of paper to the feeding means during its reciprocatory travel toward the folding means.

21. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips to form a superposed pile of continuous strips, and having apertures at regular spaced distances therein; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; movable paper feeding means; and a gripper carried by said feeding means and adapted to clamp thereto the pile of strips during its movement toward the folding means.

22. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips to form a superposed pile; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; means for intermittently feeding said pile of strips from the collating to the folding means; and means on the frame for holding said pile of strips during

the interval when the feeding means is not advancing the pile toward the folding means.

23. A folding machine comprising a frame; means at the introductory side of the frame for collating a plurality of separate continuous paper strips to form a superposed pile of continuous strips; means at the delivery side of the frame for folding the pile of strips in zig-zag fashion to form a pack; means for intermittently feeding said pile of strips from the collating to the folding means; a gripper carried by said feeding means adapted to clamp the pile of paper strips to the feeding means during its travel in one direction, toward the folding means; and a second gripper on the frame adapted to hold the paper pile during the time that the first named gripper is in paper-releasing position.

24. A folding machine comprising means for

collating a plurality of separate continuous paper strips to form a superposed pile; a folding mechanism; means for advancing said pile of strips to the folding mechanism; and means between the collating and folding means for applying a predetermined tension or drag to the strips as they are advanced by the strip-advancing means.

25. In the machine of the character described, a stapling device; means for advancing a pile of superposed continuous paper strips step by step at predetermined intervals relative to the stapling device said means including pins engaging apertures in the strips; and means for operating the stapling device during the periods of intermission between feeding operations.

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