

Feb. 10, 1925.

1,525,969

R. J. WATERWORTH

FOLDER

Filed April 19, 1924

4 Sheets-Sheet 1

FIG. 1

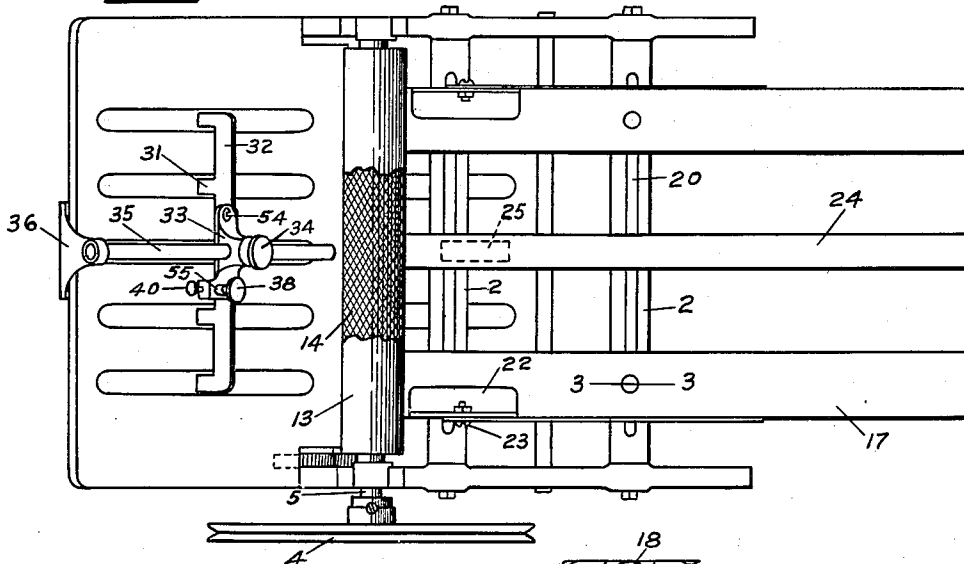
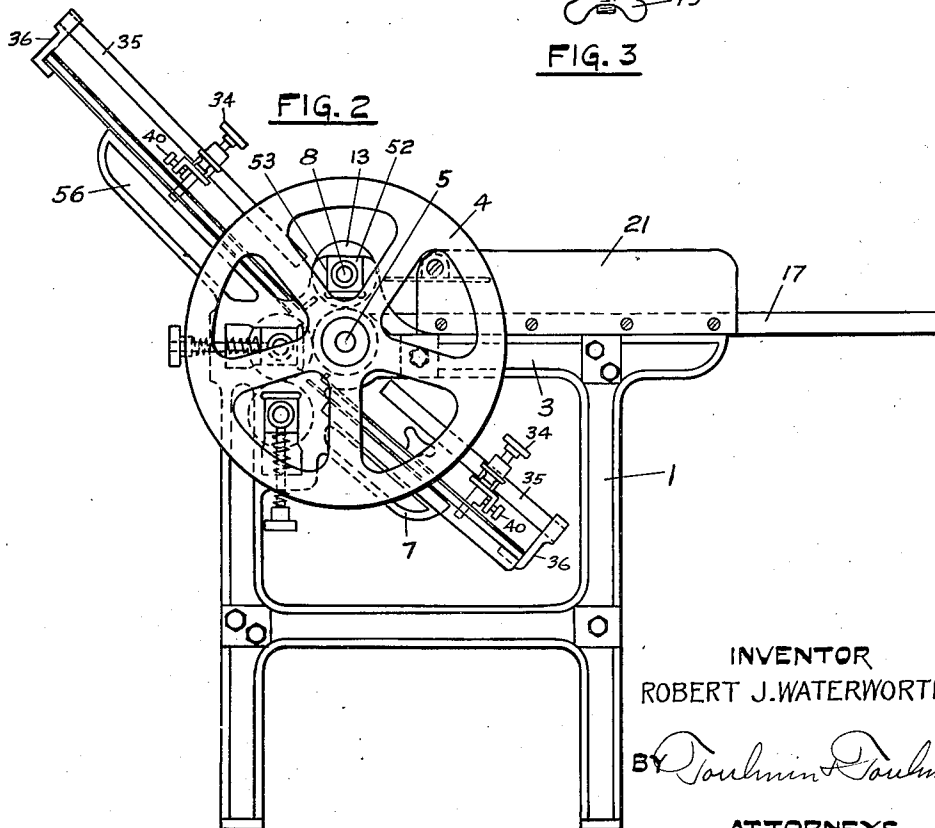


FIG. 3



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ATTORNEYS

Feb. 10, 1925.

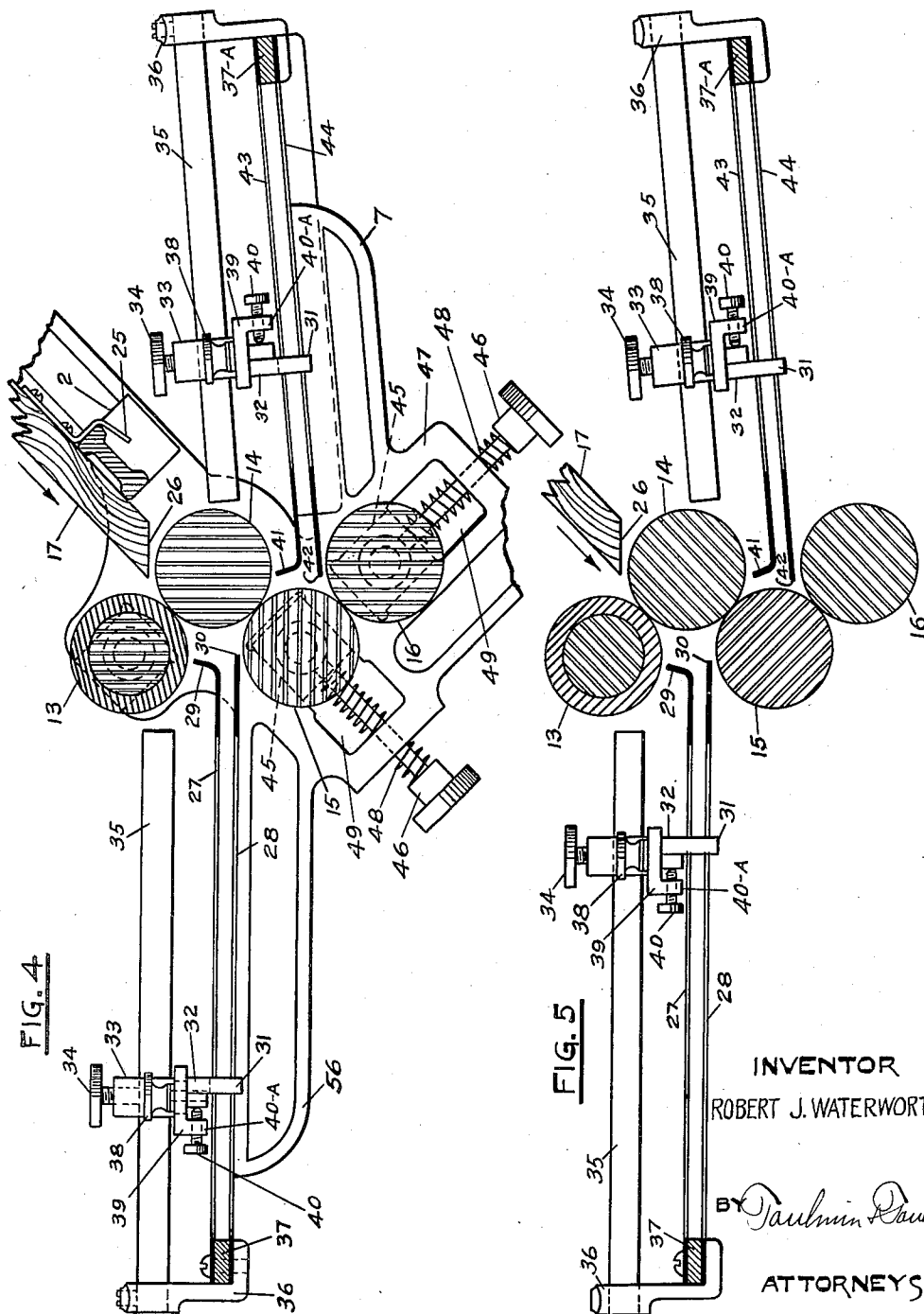
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4 Sheets-Sheet 2



Feb. 10, 1925.

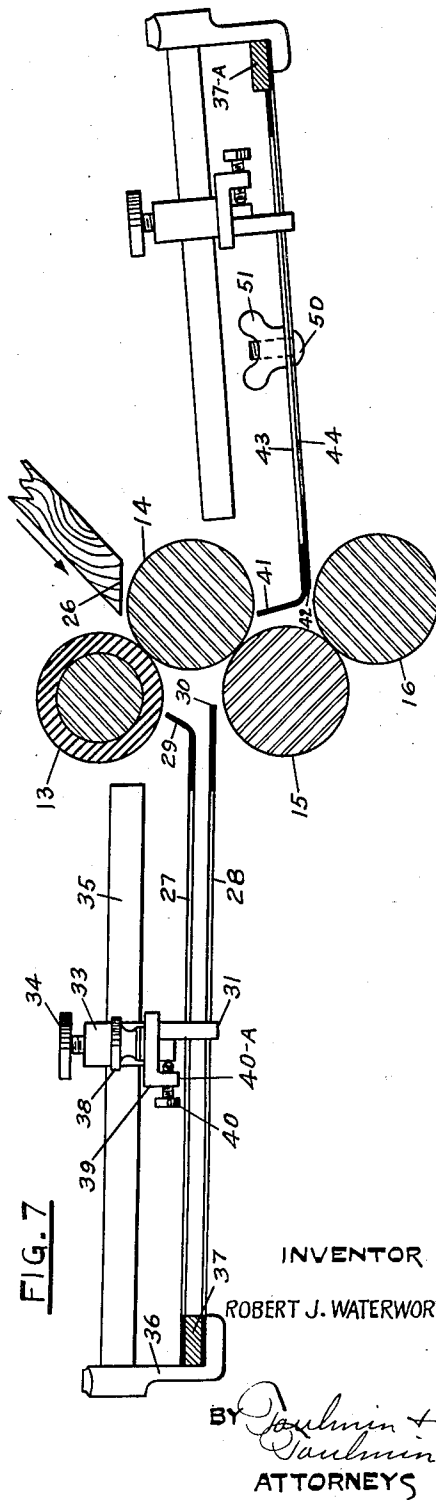
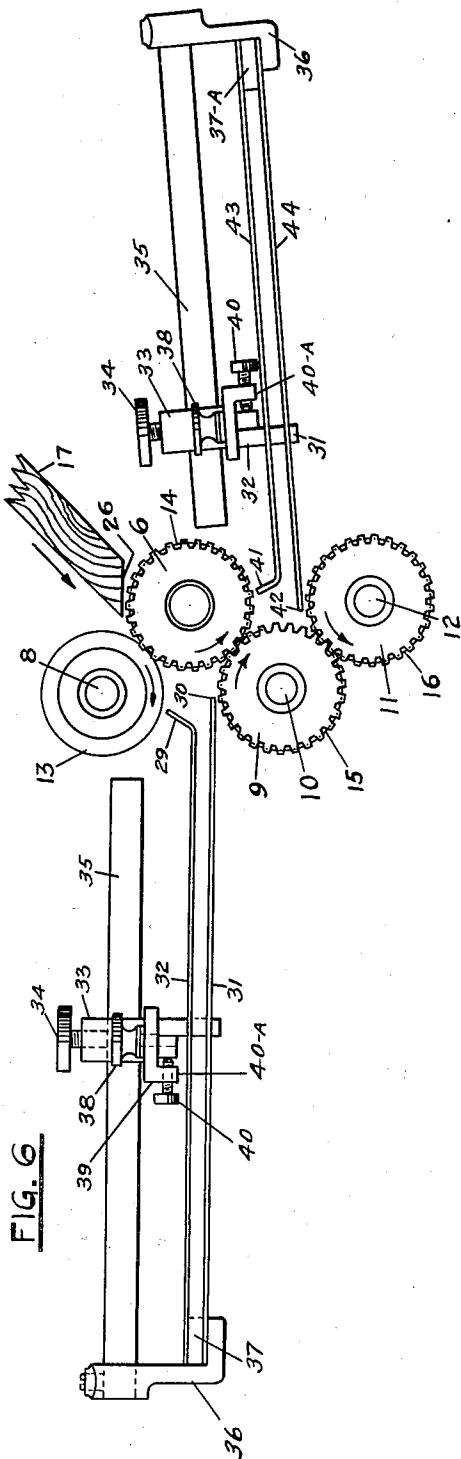
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4 Sheets-Sheet 3



Feb. 10, 1925.

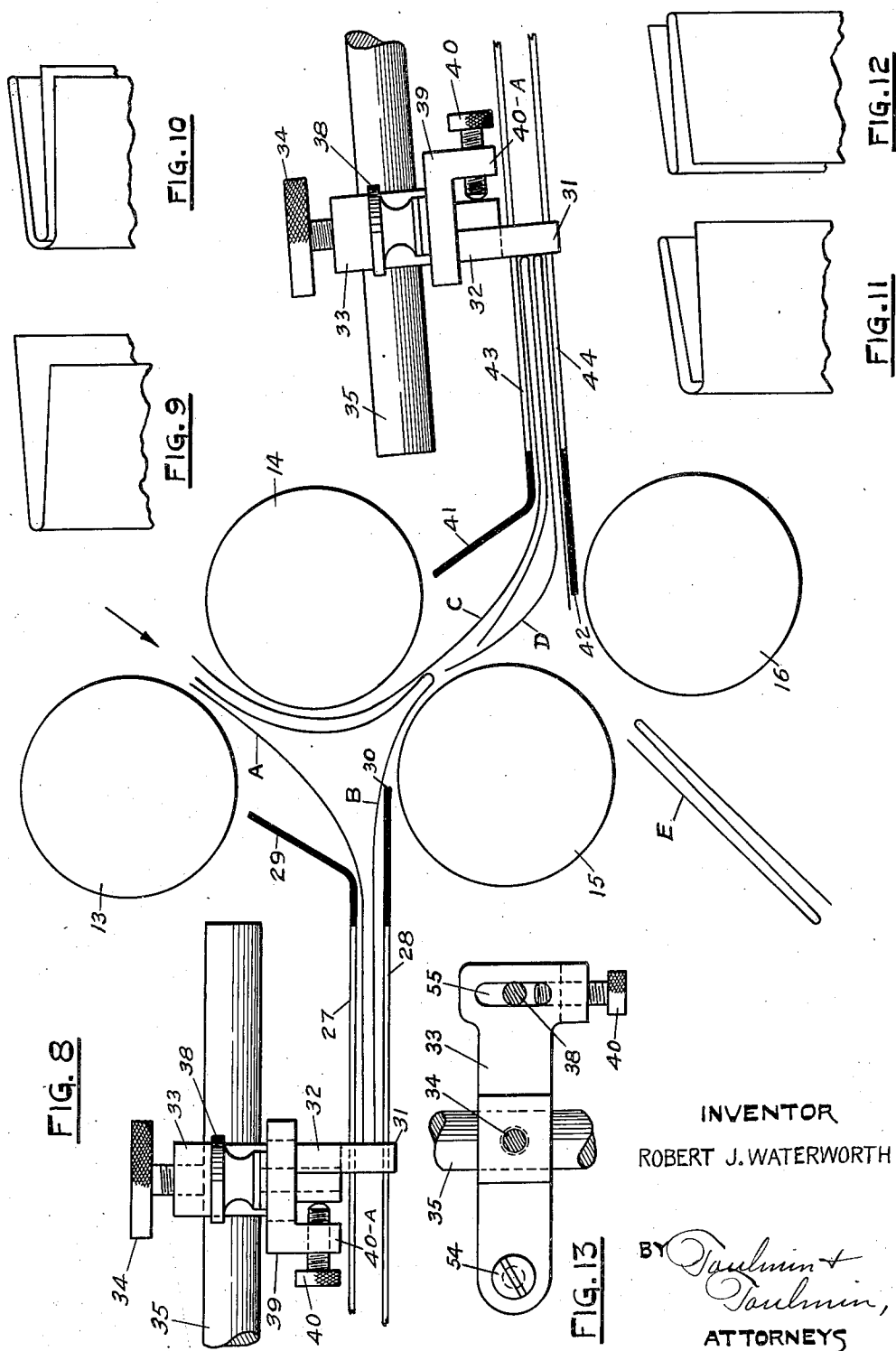
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R. J. WATERWORTH

FOLDER

Filed April 19, 1924

4 Sheets-Sheet 4



Patented Feb. 10, 1925.

1,525,969

UNITED STATES PATENT OFFICE.

ROBERT J. WATERWORTH, OF SIDNEY, OHIO, ASSIGNOR TO L. M. STUDEVANT, OF
SIDNEY, OHIO.

FOLDER.

Application filed April 19, 1924. Serial No. 707,566.

To all whom it may concern:

Be it known that I, ROBERT J. WATERWORTH, a subject of Great Britain, residing at Sidney, in the county of Shelby and State of Ohio, have invented certain new and useful Improvements in Folders, of which the following is a specification, reference being had therein to the accompanying drawing.

10 My invention relates to folders.

It is the object of my invention to provide a machine for folding paper sheets and the like which is adjustable to folding the sheets in a plurality of different folds.

15 It is a further object of my invention to provide means of folding sheets of varying thicknesses and stiffness. It is an additional object to provide a machine which is adjustable not only for the number of the folds, but for the size of the sheets.

20 It is a further object of my invention to provide a machine which because of its simplicity may not only be easily adjusted by any person, but may be also light and strong, so that it will be both cheap to manufacture and portable. It is my object to eliminate the complications of folding machines which have heretofore been found in the art, which are both expensive and 30 complicated.

It is a further object of my invention to provide a machine which will occupy the minimum of floor space.

35 It is an additional object to provide a machine in which the folding of the paper can be confined to one portion of the machine in order to secure a particular kind of fold.

Referring to the drawings:

40 Figure 1 is a plan view of the complete machine.

Figure 2 is a side elevation of the complete machine.

45 Figure 3 is a detail section of the wing nut lock of one of the feeding bars taken on the line 3—3 of Figure 1.

Figure 4 is an enlarged elevation with the rolls in section, showing the parts in position for making a six-page standard fold.

50 Figure 5 is a similar view, showing the parts in position for making a six-page accordion fold.

Figure 6 is a similar view, showing the parts in position for making an eight-page 55 fold.

Figure 7 is a similar view, showing the parts in position for making a four-page fold or merely doubling the paper.

Figure 8 is an enlarged view similar to the preceding ones, showing the strips of 60 paper in the various positions of folding to produce various folds.

Figure 9 is a perspective of the four-page fold produced by the machine when in the position shown in Figure 7. 65

Figure 10 is a perspective of one end of the paper as folded by the machine when the positions of the parts are as in Figure 6.

Figure 11 is a fold of the paper when passed through the machine when it is in 70 the position shown in Figure 5.

Figure 12 is a perspective of the paper as folded when it is passed through the machine when it is in the position shown in 75 Figure 4.

Figure 13 is a plan view of the fine adjustment of the angular position of the paper.

Referring to the drawings in detail:

1 is a side frame, of which there are a pair joined by the cross-members 2. The 80 upper end of the frame has transverse members 3. This frame has journaled therein a driving pulley 4, which is driven by a belt and electric motor not shown, but of any conventional construction. The exact 85 source of motive power is immaterial, although it is preferable to operate the machine at a fairly high rate of speed. This pulley is mounted on the shaft 5 carried by the frame member 3. On this shaft is 90 mounted a gear 6. 8 is the rubber roller. The gear 9 is carried by one of the corrugated roll shafts 10. The gear 9 meshes with a third gear 11, mounted on the lower corrugated roll shaft 12. Thus the upper 95 rubber roll 13 and the corrugated rolls 14, 15 and 16 turn in synchronism with one another as they are rotated by the pulley 4 through the above-mentioned train of gears. The paper sheets are fed along the 100 horizontal wooden supports 17, which are clamped to the cross-members 2 by the bolts 18 and wing nuts 19. These bolts project through slots 20 in the cross-members 2 so that the position of the bars 17 may be ad- 105 justed laterally. The outermost bars 17 are provided with vertical metal guide plates 21. These guide plates are also provided at their forward ends with pivoted, transversely located guide plates 22, which are pivoted as 110

at 23 so that they may be tilted to direct the paper between the rubber roll and the corrugated roll below. Supplementary guide bars 24 may be provided in any desired number, which are attached to one of the transverse members 2 by spring clips 25. The inner ends of these supports 17 and 24 are tapered so as to project as at 26 between the feed roller 13 and the corrugated roller 14. By the agency of these two rollers the sheet of paper to be folded is drawn in and passed between the rollers 13 and 14 and between the upper guide plate 27 and the lower guide plate 28. The upper guide plate is provided with a deflecting shoulder 29, so that the paper will be directed between the two plates 27 and 28 as the lower plate 28 has its end 30 projecting beyond the end 29 of the upper plate 27. These plates are composed of solid ends and spaced bars between the ends so that the fingers 31 of the stop may travel between these bars and engage the ends of the paper sheets. The position of these fingers, which are carried on a transverse bar 32, is determined by the location of the collar 33 and set screw 34 on the supporting rod 35. This rod is maintained in a position parallel to the paper guide plates 27 and 28 by a bracket 36, which is bolted to the ends of the plates 27 and 28 and to a crossbar between those plates designated 37. It will be understood that the frame 1 and cross-frame 3 are projected upwardly substantially at an angle of 45 degrees as at 56 to form the support for this mechanism, including the plates 27 and 28. While this exact angle is not essential, it is found convenient. Thus, through the agency of the set screw 34 and the collar 33 traveling on the supporting rod 35, the position of the fingers 31 in the slots in the plates 27 and 28 may be adjusted. The angular position of the fingers 31 with respect to the supporting rod may be further adjusted through the following mechanism:

To the collar 33 is pivoted the transverse finger carrying member 32 as at 54. The position of the bar 32 is fixed by the set screw 38 which is carried by the bar 32 and travels in a slot 55 in the end of the member 33, which is opposite to the point where it is pivotally connected to the bar 32. The adjustment of the position of the bar 32 about its pivot 54 is effected by the micrometer set screw 40, which works in a downwardly projecting lug 40^a carried by the outer end of 33. By tightening 38 slightly so that it can still move under the pressure of the screw 40 a fine angular adjustment may be secured and then the set screw 38 can be fastened permanently. This adjustment is often necessary, due to the fact that the end of the paper may not be exactly square.

When the paper is forced between the rolls 13 and 14 into the space between 27 and 28 and its forward end comes in contact with the fingers 31 due to the continued movement of the rear end of the paper 70 under the impulse of the rolls 13 and 14, the paper will buckle at a point where it is unsupported, that is, between the ends 29 and 30 and the point of contact with the paper by the rolls 13 and 14, with the result that as it buckles downwardly it will fold upon itself and the folded portion will be drawn between the rolls 14 and 15, which have corrugated metal surfaces. The paper thus folded will be drawn downwardly until it is inserted in its folded condition between the ends 41 and 42 of the plates 43 and 44, which are similar to the plates 27 and 28. The forward end of the paper will engage with similar fingers 31 85 working in the slots in the plates 44 and 43. The supporting rod and bracket are similar in the lower unit as in the upper unit. When the forward end of the folded paper comes in contact with the fingers 31 90 it will stop and the paper will again buckle downwardly and be drawn between the rolls 15 and 16. The ends of the shafts carrying these rolls 15 and 16 are carried in the blocks 45, with which engage the set screws 46 carried in the frame members 47 so as to adjust the position of the rolls with respect to one another. Helical springs 48 are provided for preventing the turning of the set screws through the jolting or jarring of the machine. Guideways 49 are provided in the frames 47, so that these blocks may slide inwardly and outwardly and move the rolls accordingly to adjust the rolls to the kind of paper being fed through the 105 folder.

In the event that it is desired to impart a single fold to the paper as in Figure 7, making a four-page leaflet, the upper plate 43 is moved forwardly to a position where its end 41 will be so located as to pass the paper directly between the rolls 15 and 16 without the paper going between the plates 43 and 44. The plate 43 is also dropped down upon the plate 44 so that the paper cannot enter between them. In order to effect this the plate 44 is rigidly attached to the crossbar 37^a but the upper plate 43 merely rests upon this transverse bar 37^a and is held in position with respect to the plate 44 by the bolts 50 and wing nuts 51, the bolts traveling in a slot in the plate 43 so that this plate 43 can be shifted forwardly and downwardly when this portion of the machine is to be rendered inoperative or may be shifted backwardly and upwardly when it is to be made operative and held in position by the bolts 50 and wing nuts 51. It will be observed that by varying the relative position of the stops it is possible 130

to secure a variety of folds because the position of the stops will determine what folds are to be made and of what size.

To further illustrate in a diagrammatic way how this folding takes place I have provided Figure 8. A sheet of paper which I will designate A is in the position just before it starts to bend. The sheet of paper designated B is a sheet which has just bent and is proceeding between the two rollers. The sheet of paper designated C has been folded once and has proceeded to a point just before it is bent a second time. In this view the rolls for the purpose of clearness are spread apart. The sheet of paper in a position marked E is the result of this folding action illustrated in Figure 8.

In Figures 9, 10, 11, and 12 I have shown various folds. It will be understood that this is only a few of a large variety of sizes and shapes of folds which can be secured by my invention. By the invention I have eliminated a large number of parts, rolls and the like, which have made such machines heretofore complicated in construction, expensive to buy and operate and have necessitated specially skilled operators. My invention is adaptable to any office where folding of literature of various sorts is necessary, or in the larger printing shops where large quantities of mail matter must be folded.

The material of the rolls is not essential, but I prefer for the upper feed roll a rubber covering and for the lower rolls a corrugated metal surface. The upper roll 13 has its shaft ends 8 carried in the blocks 52, which rest in the open jaws 53 of the frame, so that the roll may be lifted out when desired for renewal or for the adjustment of the parts. The lower guide plates are carried in a frame or bracket 7.

I desire to comprehend within my invention such modifications as may be necessary to adapt it to varying conditions.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a folding machine, means for guiding a sheet between a sheet actuating means, means for guiding the sheet in a predetermined direction, means for stopping one end of said sheet, said guiding means and feeding means being spaced to permit of the buckling of the sheet and its folding as it is continued in its feeding, means to reverse the direction of said sheet and eject it in folded condition, and a second guiding means which is adjustable either to receive the sheet to permit it to fold a second time, or to exclude the sheet and cooperate in ejecting it directly without further folding, and means for ejecting the sheet.

2. In a folding machine, a feed table, a pair of feeding rollers, spaced guide plates

for receiving the free end of a sheet, means to limit the movement of the sheet between said plates, the end of said plates and the point of contact of said rollers being spaced, a third roller disposed adjacent one of the foregoing rollers with the free ends of said plates between it and the other of said rollers, whereby a sheet fed by the first two rollers will be caused to buckle and then be fed between the second and third rollers, a second pair of spaced plates having their free ends spaced from, but between the second and third rollers and between the second and fourth rollers, a fourth roller associated with the third roller, a second stop associated with said plates, whereby when the sheet buckles the second time it will be fed outwardly between the third and fourth rollers, the upper of said second pair of guide plates being slidable and having an abutment on its free end between the rollers, whereby when it is moved to a point closely adjacent said rollers, the space between the second pair of plates will be closed and the sheet will be fed directly from the second and third rollers to the third and fourth rollers.

3. In a folding machine, a feed table, a pair of feeding rollers, spaced guide plates for receiving the free end of a sheet, means to limit the movement of the sheet between said plates, the end of said plates and the point of contact of said rollers being spaced, a third roller disposed adjacent one of the foregoing rollers with the free ends of said plates between it and the other of said rollers, whereby a sheet fed by the first two rollers will be caused to buckle and then be fed between the second and third rollers, a second pair of spaced plates having their free ends spaced from, but between the second and third rollers and between the second and fourth rollers, and a fourth roller associated with the third roller, a second stop associated with said plates, whereby when the sheet buckles the second time it will be fed outwardly between the third and fourth rollers, the upper of said second pair of guide plates being slidable and having an abutment on its free end between the rollers, whereby when it is moved to a point closely adjacent said rollers, the space between the second pair of plates will be closed and the sheet will be fed directly from the second and third rollers to the third and fourth rollers, and means for adjusting the position of said stops.

4. In a folding machine, a feed table, a pair of feeding rollers, spaced guide plates for receiving the free end of a sheet, means to limit the movement of the sheet between said plates, the end of said plates and the point of contact of said rollers being spaced, a third roller disposed adjacent one of the foregoing rollers with the free ends of said

plates between it and the other of said rollers, whereby a sheet fed by the first two rollers will be caused to buckle and then be fed between the second and third rollers, a second pair of spaced plates having their free ends spaced from, but between the second and third rollers and between the second and fourth rollers, a fourth roller associated with the third roller, a second stop associated with said plates, whereby when the sheet buckles the second time it will be fed outwardly between the third and fourth rollers, the upper of said second pair of guide plates being slidable and having an abutment on its free end between the rollers, whereby when it is moved to a point closely adjacent said rollers, the space between the second pair of plates will be closed and the sheet will be fed directly from the second and third rollers to the third and fourth rollers, means for adjusting the position of said stops and means for adjusting the angular position of said stops.

5. In a folding machine, a feed table, a pair of feeding rollers, spaced guide plates for receiving the free end of a sheet, means to limit the movement of the sheet between said plates, the end of said plates and the point of contact of said rollers being spaced, a third roller disposed adjacent one of the foregoing rollers with the free ends of said plates between it and the other of said rollers, whereby a sheet fed by the first two rollers will be caused to buckle and then be fed between the second and third rollers, a second pair of spaced plates having their free ends spaced from, but between the second and third rollers and between the second and fourth rollers, a fourth roller associated with the third roller, a second stop associated with said plates, whereby when the sheet buckles the second time it will be fed outwardly between the third and fourth rollers, the upper of said second pair of guide plates being slidable and having an abutment on its free end between the rollers, whereby when it is moved to a point closely adjacent said rollers, the space between the second pair of plates will be closed and the sheet will be fed directly from the second and third rollers to the third and fourth rollers, means for adjusting the position of said stops, means for adjusting the angular position of said stops, and means for adjusting the position of some of said rolls.

6. In a folding machine, means to guide sheets between rollers, an upper and lower roller, a pair of spaced guiding plates disposed at an angle to the path of the sheet between the rollers, the ends of said guide plates being spaced from the point of feed of the rollers, said guide plates having a plurality of slots therein, a plurality of stop fingers inserted in said slots, and a third roller associated with the lower of the afore-

mentioned rollers, means below the second and third rollers at an angle to the line of feed therethrough consisting of spaced guide plates oppositely disposed to the first set of guide plates, but in a parallel plane thereto and having similar slots and stop fingers, means for adjusting the upper guide plates relatively to the lower guide plates, and a fourth roller associated with the third roller and directly beneath said third roller.

7. In a folding machine, feed rollers, spaced guide plates having slots therein, means for adjusting said guide plates relatively to one another, a plurality of stop fingers in said plates, a supporting rod carried by said plates, a supporting collar on said rod, a bar supporting said fingers and pivoted to said collar and a fine adjustment screw adapted to adjust said fingers with respect to said collar, and means to fix the position of said fingers when adjusted.

8. In a folding machine, means to guide sheets to a feeding means, consisting of a rubber roller and a corrugated metal roller, spaced guide plates to guide the free end of the sheet upwardly, means to adjust one of said plates relatively to the other, means to stop the free end of the sheet to cause it to buckle while its rear end is still being fed, corrugated metal rollers for receiving the buckled portion and feeding the sheet in its folded condition.

9. In a folding machine, feed rolls, a movable upper guide plate having an abutment on one end, a stationary guide plate spaced therefrom, a bar across the end of said second plate adapted to space the first plate therefrom and detachable clamping means adapted to hold said plates in engagement with one another or in spaced relationship.

10. In a folding machine, feed rolls, a movable upper guide plate having an abutment on one end, a stationary guide plate spaced therefrom, a bar across the end of said second plate adapted to space the first plate therefrom, and detachable clamping means adapted to hold said plates in engagement with one another or in spaced relationship, said plates having a plurality of slots therein, stop fingers projecting in said slots, a supporting rod, and means to adjustably support said fingers on said rod.

11. A pair of guide plates for a folding machine, means for supporting said plates, means for adjusting one plate relatively to the other plate, said adjustable plate having an abutment, whereby when the adjustable plate is in extended position relatively to the other plate, the abutment thereon will form a stop and when in retracted position will leave a space between said plates for the passage of paper therebetween.

In testimony whereof, I affix my signature.
ROBERT J. WATERWORTH.