July 7, 1931. R. J. WATERWORTH 1,813,476

SHEET OVERTURNING MEANS FOR PAPER FOLDING MACHINES

Filed April 30, 1929 2 Sheets-Sheet 1

Fig. 1.

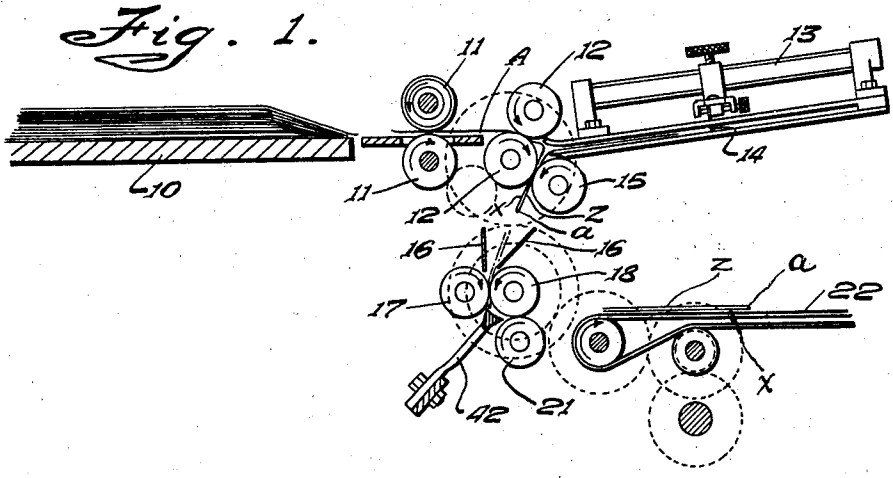
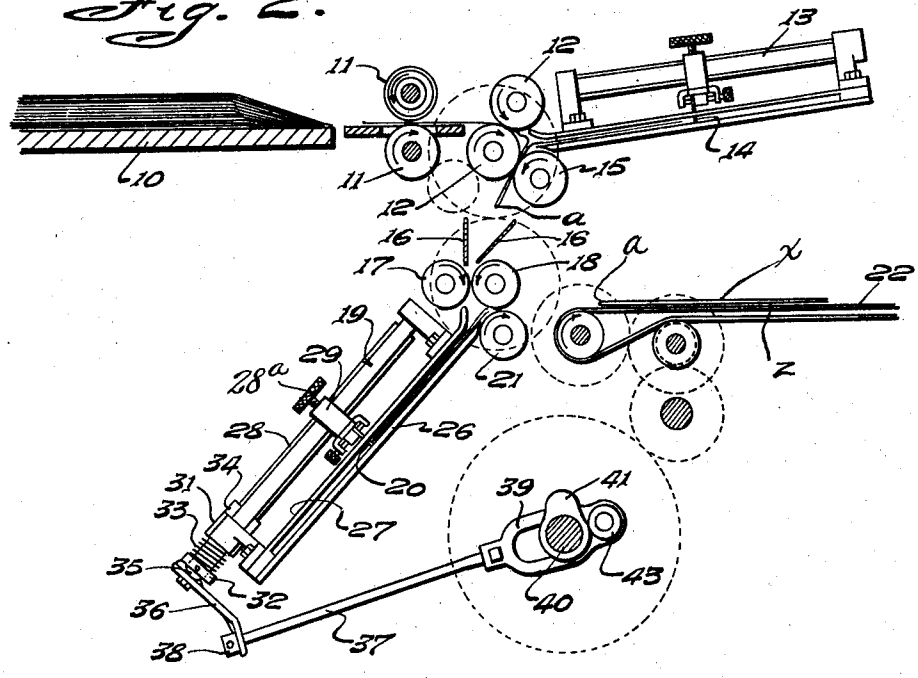


Fig. 2.



INVENTOR.
ROBERT J. WATERWORTH
BY
Watson & Coleman.
ATTORNEY.

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Fig. 3.

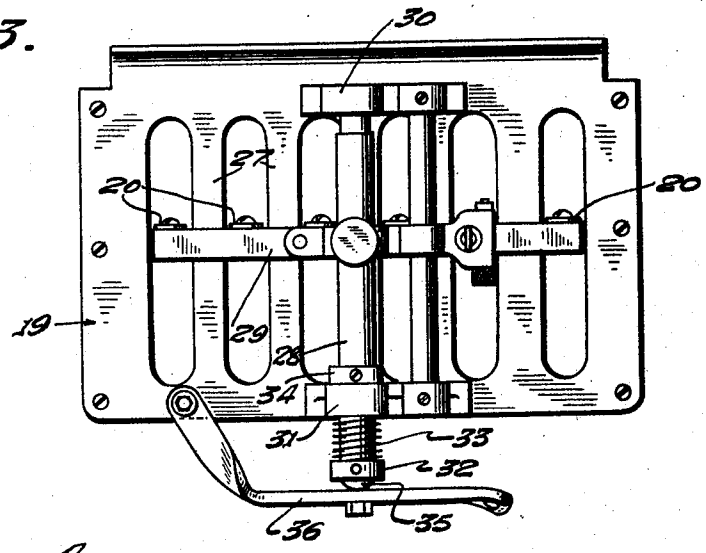


Fig. 4.

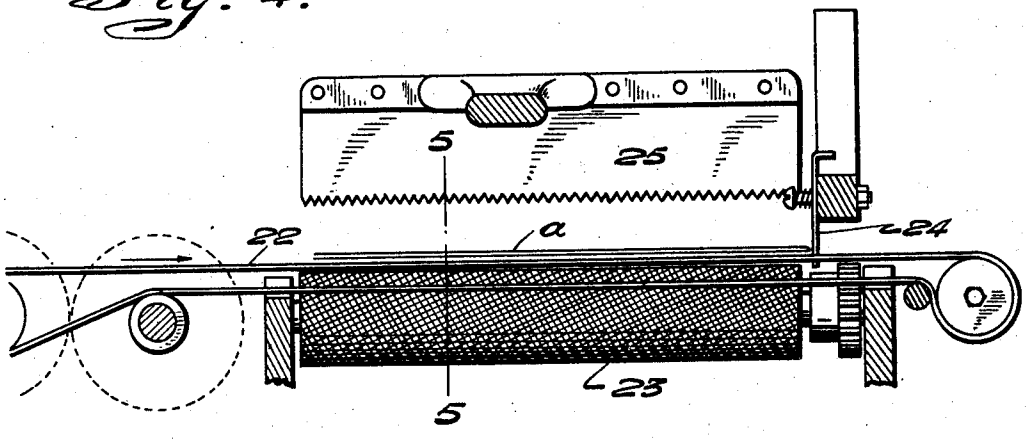


Fig. 6.

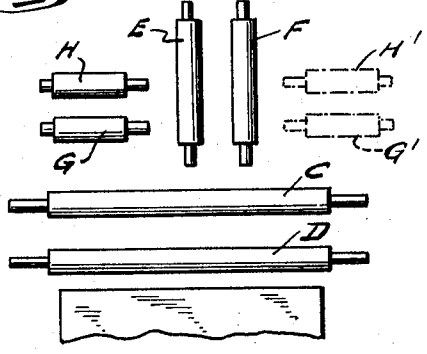
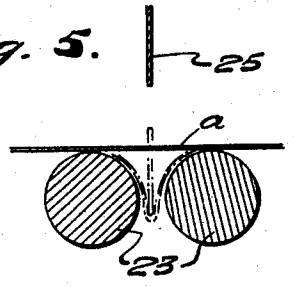


Fig. 5.



INVENTOR.

ROBERT J. WATERWORTH

BY Watson E. Coleman.

ATTORNEY.

Patented July 7, 1931

1,813,476

UNITED STATES PATENT OFFICE

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

SHEET OVERTURNING MEANS FOR PAPER FOLDING MACHINES

Application filed April 30, 1929. Serial No. 359,390.

This invention relates to paper folding machines and particularly to those machines in which the sheet is folded by carrying the edge of the sheet between rollers against a stop, whereupon the continued forward feed of the sheet causes it to bend and the bight or crease thus formed to pass between a pair of folding rollers.

When the sheet is to be folded a plurality of times in such machines, the once folded sheet is carried into position beneath a knife which creases the sheet at right angles to the first named fold and forces the bight or crease of the sheet down between two folding rollers at right angles to the first named folding rollers and in order to again fold the sheet, it is carried between another set of folding rollers disposed at right angles to the second pair of rollers which again folds it at right angles and so on. Thus a sheet may be folded to form two, four, eight or sixteen pages as desired.

It is sometimes necessary in folding the sheet, a second time, that it be folded over toward the right and sometimes that it be folded over toward the left and this requires two different organizations of folding machines in order to accomplish this object.

The object of my invention is to provide means forming part of the folding machine itself whereby a sheet of paper after having been folded once can be turned over with reference to itself so that the succeeding fold at right angles will be made on the opposite side of the sheet than that of the normal way of folding when these means are not included in the folding machine or in other words, to provide means to effect folds with the opposite side of the sheet out to that obtained in the ordinary way of folding, and a further object is to provide a structure of this character whereby the same machine may be used for either regular book folding and like work or for a newspaper style fold without any rearrangement of the folding rollers other than is required in any standard book folding machine.

A further object is to provide an attachment which may be readily applied to ordinary book folding machines and machines for doing like work and which will act to turn a once folded sheet over before it is again folded, this attachment being readily disconnected or rendered inoperative without detachment to permit the sheet to pass to the second and third folding devices or second and third right angle folders without being turned over and in the usual manner.

Other objects will appear in the course of the following description.

My invention is illustrated in the accompanying drawings, wherein:—

Figure 1 is a diagrammatic elevation partly in section of a combination of paper folding rolls for folding a sheet of paper once and showing the tapes carrying the sheet to a right angle folder;

Figure 2 is a like view to Figure 1, but illustrating my improvement in use for the purpose of reversing or overturning the sheet of paper;

Figure 3 is a top plan view of a grid equipped with my improvement;

Figure 4 is an elevation of the right angle folder used in connection with the construction shown in Figures 1 and 2;

Figure 5 is a section on the line 5—5 of Figure 4;

Figure 6 is a diagrammatic representation of a folding machine;

In the figures, I have illustrated portions of an ordinary and well-known folding machine and I have omitted all those parts which are common and well-known and which do not especially coact with my invention. In these drawings, (see particularly Figure 2,) 10 designates the table from which the sheets are fed to the folding machine. 11 designates a pair of rollers which cause the sheet to pass to a second pair of rollers 12. These rollers feed the sheet into a folding grid of the usual character found on folding machines and designated generally 13. This grid carries the adjustable stop 14 as usual and when the edge of the paper fed forward by the feed rollers 11 and 12 engages this stop 14, the forward feed of the paper causes it to crease and it passes between the lowermost roller 12 and a companion roller 15 which folds the paper A at *a*. The paper

then passes downward through guides 16 between the feeding rollers 17 and 18 and may pass into a second grid 19 (see Figure 2) carrying the usual stop 20.

At this point the folded sheet is fed down into the grid until its bight end *a* reaches the stop 20. The feeding action of the rollers 17 and 18 acts to crease the sheet and cause it to pass between the roller 18 and a roller 21. The sheet is then carried on to the usual tapes 22 whereby it is carried to a right angle folder consisting of a pair of rollers 23 (see Figures 4 and 5) disposed at right angles to the rollers 17, 18 and 21. The paper comes against a stop 24 and a knife 25 moves downward upon the paper, creases it and forces the crease of the paper in between the rolls 23 so that a right angle fold is made in the paper. After passing through the rolls 23, the paper may be again carried by tapes not shown to a second right angle folder comprising rolls such as 23 and a knife such as 25, these last named rolls being at right angles to the rolls 23 and the folded paper is again creased and folded at right angles to the second fold.

The combination of folding rolls, the knife 25, the stop 24, etc., is old and forms no part of my present invention except insofar as my attachment which forms subject-matter of this invention affects the folding of the paper particularly by the rollers 23 and the knife 25.

The grids 13 and 19 have the standard construction, except as illustrated, particularly with regard to the grid 19. In the grid 19 there is a lower plate 26, longitudinally extending bars 27 spaced from the plate 26, a longitudinally extending guide 28, a cross head 29 mounted upon the guide, this cross head having means for supporting the stop members 20 which extend down through the apertures of the grid 27. This, as before remarked, is a standard construction.

The cross head 29 is slidable longitudinally upon the supporting rod 28 and is held in adjusted position by a set screw 28^a. The cross head, therefore, may be shifted along the rod 28 and held in any desired position. This rod is supported for sliding movement in bearings 30 and 31, see Figure 3. The rod extends beyond the bearing 31 and carries a head 32 and is forced downward by means of the coiled compression spring 33 disposed between this head 32 and the bearing 31. A stop 34 limits the downward movement of this rod 28. The rod 28 at its lower end is formed with a rounded head 35 and pivotally mounted upon the grid 27 is a lever 36 which bears against this rounded extremity of the rod 28. This lever 36 at its end is angularly bent and apertured for the passage of a connecting rod 37 having a removable collar or head 38 at one end and at the other end provided with a longitudinally slotted yoke 39 through which the usual cam shaft 40 passes. This cam shaft is present on this type of machine and carries a cam 41 and operates the knife 25 previously referred to. I have not attempted to illustrate the manner in which the cam 41 reciprocates the knife inasmuch as this is well-known and forms no part of my invention.

Where a sheet is to be once folded and passed on to the tapes 22, a stop or deflector shown in Figure 1 and designated 42 is mounted between the rollers 17 and 21 so that the bight end *a* of a sheet passing between the rollers 17 and 18 will be deflected between the rollers 18 and 21 and this once folded sheet will be carried on to the tapes 22 to be folded at right angles by the knife and rollers 23 and 25 which has been previously described. Now with this deflector 42, the face of the sheet designated X will come in contact with the tape and when the first right angle fold is made, this face X will be the interior face of the folded sheet.

Assuming that it be desired that the face Z shall be disposed against the tapes so that the face X shall be the interior of the folded sheets, then the deflector 42 is, of course, removed and the rod 37 connected up by means of the head, nut or collar 38 with the lever 36. Now as the folded sheet A is carried downward between the rollers 17 and 18, the bight *a* of the sheet will pass down into the grid and lodge against the stop 20. At this time, the stop 20 is lowered, the cam 41 being away from the roller 43 so that the folded sheet can pass fully down into the grid and can entirely escape from the rollers 17 and 18. As soon as the cam 41 strikes the roller 42, however, the rod 37 will pull upon the lever 36 and this will force the rod 28 upward against the action of the spring 33 and this will carry the stop 20 upward, forcing the open end of the folded sheet up between the rollers 18 and 21 and the folded sheet is then carried over on to the tapes 22 to form the first right angle fold previously referred to. As soon as this folded sheet has been shifted over on to the tapes 22, the cam 41 has escaped the roller 43 and the spring 30 forces the rod 28 and the stop 20 back ready to receive the next succeeding sheet. By this means, it will be seen that the sheet is overturned. If it be not desired to turn the sheet but to use the grid 19 in the usual and normal manner, the collar or nut 38 is entirely taken off of the rod 37, whereupon the rod 37 reciprocates freely through the opening in the lever 36, and of course, has no effect upon the rod 28 and no effect upon the action of the grid, or in other words, the grid, in case a grid is used, then acts in its normal way to cause a refolding of the sheet passed down into the grid.

In Figure 6, there is diagrammatically shown a paper folding mechanism consisting of a plurality of pairs of paper forwarding and folding rollers such as are commonly

found in certain types of paper folding mechanism. In this diagram, the rollers C and D may be considered to be the rollers 12 and 13 for example from which a once folded sheet is discharged by any suitable means on to the rollers E and F. These rollers E and F may be considered to be the same as rollers 23 and between which a knife operates to fold the sheet as illustrated in Figure 5. After the sheet has been folded by the rollers E and F, the folded sheet passes to the rollers G and H which are designed to again fold the sheet as it comes from the rollers E and F. This arrangement of rollers is common and well-known. Now with this arrangement of rollers and with the rollers G and H on the left hand side of the machine as shown in full lines in Figure 6, it is possible to fold only in one direction, that is, with one side of the paper outside and impossible to fold the sheet so that the other side of the paper will be outside after it is folded. If it is desired to fold the sheet so that the other side of the paper will be outside, then a machine must be used having the folding rollers G′, H′ on the right side of the machine as shown in dotted lines in Figure 6. This is for the reason that ordinarily in machines now known to me, there is no means disposed between rollers C, D, and E, F, whereby the sheet may be "overturned". If, however, the overturning means shown in Figure 2 is used, the sheet may be overturned or completely reversed before it passes to the folding rollers E and F and hence the rollers H and G do not have to be shifted to the dotted line position nor to secure a reversal of the fold on the sheet. Thus it makes it possible, with my mechanism, to so fold the sheet that either the printed side of the sheet will come outward or the printed side of the sheet will come inward and without the necessity of using two separate machines, one of which has the folding rollers G and H upon the left hand side of the machine and the other having folding rollers G′ and H′ on the right hand side of the machine.

It is to be particularly understood that while I have illustrated a reciprocating stop in one situation, that is so disposed as to take the folded sheet after it has been acted on by the first grid and over-turned to reverse this sheet, yet this over-turning attachment or grid with the reciprocating stop may be used with any grid of a series of grids and the different combinations of folding and feeding rollers used in connection therewith. In other words, while I have only shown one arrangement or disposition of my sheet turning means, yet I do not wish to be limited to this specific arrangement or this position of the over-turning means and the general combination, nor to the details of construction of said over-turning means. It is also to be understood that this over-turning means may be used for over-turning sheets that have been folded more than once and may be used in any position in a series of folding devices. By using this over-turning device, I can use the machine which is only suitable for book or folder work or work of like character to fold newspapers or work of a like character; newspaper folds or folds of like character being made in an opposite direction to book folds and the like.

I claim:—

1. In a paper folding machine, in combination, paper folding means, means adapted to forward the paper to the folding means with one of its faces uppermost, and means, adjustable to overturn the paper prior to its passage to the folding means to thus present the paper thereto with its other face uppermost.

2. In a paper folding machine, means for giving one or more parallel folds to a sheet of paper, means for folding the sheet at right angles to the folds first formed, and means disposed between the first and second named folding means adapted to forward the paper to the second named folding means with either side of the paper uppermost.

3. In a paper folding machine, means for giving one or more folds to a sheet of paper, means for folding the paper at right angles to the folds first formed, and means disposed between the first and second named folding means acting to overturn the paper prior to its passage to the second named folding means.

4. In paper folding means, paper overturning means including a grid and feeding and discharge rollers therefor, and means associated with the grid permitting a folded sheet to be fed into the grid to the full depth of the sheet and then positively forcing the sheet out of the grid into engagement with the discharging rollers.

5. In a paper folding machine, paper overturning means including a grid having a longitudinally shiftable stop, feeding and discharge rollers therefor, and means for reciprocating the stop to thereby permit a folded sheet to be fed into the grid to the full depth of the sheet when the stop is retracted and forced out of the grid by an outward movement of the stop into engagement with the discharge rollers.

6. In a paper folding machine, means for giving one or more parallel folds to a sheet of paper, means for folding the sheet at right angles to the folds first formed, and a grid disposed between the first and second named folding means and having feeding and discharged rollers associated therewith, said grid having a stop movable along the grid toward or from the mouth thereof, releasable means for holding the stop in any adjusted position, and means for reciprocating the stop when released to thereby permit a folded

sheet coming from the first-named folding means to be fed into the grid to the full depth of the grid when the stop is retracted and forced out of the grid and into engagement with the discharging rollers by an outward movement of the stop.

7. In a paper folding machine, a grid having a longitudinally extending guide bar, a sheet stop adjustable along the guide bar, the guide bar being mounted for longitudinal movement on the grid and disconnectable means for reciprocating the guide bar.

8. In a paper folding machine, a grid having a longitudinally extending guide bar, a sheet stop adjustable along the guide bar, the guide bar being mounted for longitudinal movement on the grid, a spring urging the guide bar to a retracted position, a lever mounted upon the grid and engageable with the end of the guide bar to reciprocate the same, and means for oscillating the lever including a rod extending freely through the lever and having a removable stop at one end engageable with the lever and a constantly rotating member reciprocating said rod.

9. In a folding machine, a grid having an under plate and an upper plate, the upper plate being longitudinally slotted, supports mounted upon the upper plate, a guide rod mounted in said supports for reciprocating movement, a stop adjustable upon the guide bar and having portions extending through the slots of the upper plate, a spring urging the guide bar to a retracted position, means limiting the retracted movement of the guide bar, a lever mounted upon the grid and bearing against the end of the guide bar, a rod extending loosely through said lever and provided on one end with a stop engageable with the lever, the rod carrying a yoke and a tappet roller, and a cam shaft passing through said yoke and having a cam engaging with the roller.

10. In a paper folding machine, a grid, three rollers disposed at the entrance end of the grid and acting to feed a sheet of paper toward the grid and then away from the grid, a conveyor upon which the paper sheet is discharged, folding means disposed at right angles to the rollers and associated with said conveyor whereby to fold the sheet at right angles to the fold produced by the rollers, a creasing knife associated with said second named folding means, a shaft, a stop associated with the grid, and means for causing the reciprocation of said stop toward or from the mouth of the grid including a cam mounted upon said shaft and a member reciprocated by said cam.

11. In a folding machine, two sets of folding means, one disposed at right angles to the other, means for receiving a folded sheet from the first named folding means with its bight end forward, and discharging it on to the second named folding means with the edges of the sheet forward and the bight of the sheet rearward.

12. In a paper folding machine, a grid having a longitudinally shiftable stop, means whereby the stop may be held in adjusted position against longitudinal movement with relation to the grid or released for free longitudinal movement, and disengageable means for causing a reciprocation of the stop when so released.

In testimony whereof I hereunto affix my signature.

ROBERT J. WATERWORTH.