UNITED STATES PATENT OFFICE.

SAMUEL CALDWELL FORSAITH, OF MANCHESTER, NEW HAMPSHIRE.

IMPROVEMENT IN PAPER-FOLDING MACHINES.

Specification forming part of Letters Patent No. 147,052, dated February 3, 1874; application filed December 2, 1873.

To all whom it may concern:

Be it known that I, SAMUEL C. FORSAITH, of Manchester, in the county of Hillsborough and State of New Hampshire, have invented certain new and useful Improvements in Paper-Folding Machines, of which the following is a specification:

My improvements relate to machines for folding paper, particularly newspapers; and consist in a novel construction, combination, and arrangement of parts, which have for their object to generally improve the operation of the machine, as will be fully hereafter set forth.

Figure 1 is a perspective view of my machine with some of the details omitted. Fig. 2 is a vertical transverse section, showing the parts embodying my improvements. Fig. 3 is a front view of a portion of the upper part of Fig. 2. Fig. 4 is a sectional view of Fig. 3 taken on the line x x. Fig. 5 represents a rear view, with details, of the rollers K L, Fig. 2. Fig. 6 is a sectional view of Fig. 5 taken on the line y y; and Fig. 7, Sheet 2, is a portion of the first folding-knife.

The drawings do not contain all the details shown in the model, it being deemed unnecessary to illustrate the minutiae of the machine to the confusion of the drawings, and the figures relate principally to my improvements and the parts immediately connected therewith. For a conception of the elements of the machine, reference may be had to the perspective drawing.

A A B B represent the framing of the machine. C is the table; D E, the first pair of folding-rollers; F, the folding knife or blade, operating, in conjunction with these rollers, to effect the first fold. G is the inclined table, down which the once-folded sheet slides, and is stopped by gages or stops a a, secured to the lower part of the table. H I is the second pair of folding-rollers; J, the folding knife or blade, operating, in conjunction with these rollers, to effect the second fold, which is made at right angles to the first. K L is the third pair of folding-rollers. b b are retaining-bars for holding the sheet up to the rollers for the operation of their folding-knife, (not shown in the drawings,) which effects the third fold in a manner similar to the other two. M is the driving-shaft, on which are secured the bevel-gear for imparting motion to the various parts of the machine. The wheel and pinion c and d drive the second pair of rollers through the shaft and pinion e e. The cam f reciprocates the plunger V of the packing-trough through the arm and rod g and h. The wheel and pinion i and j give motion to the rocker-shaft k, through the crank l on the shaft m, and the connecting-rod n, connected with the crank l and segmental slotted arm o attached to the shaft k. To each end of this shaft k is secured an arm or lever, N, the upper extremities of which levers are connected, by means of the connecting-rods p p, with the blocks q q, sliding on the ways r r. These blocks q q carry the nippers t t. The nippers are operated in the usual way, by stationary stops, against which projecting-arms on the extremity of the nippers strike, to open and close them upon the sheet.

It will be perceived that, as the crank l revolves, the nippers will receive a reciprocating motion through the connecting-rod n, segmental slotted arm o, shaft k, arms N, and connecting-rods p. It is often necessary to alter the extent of travel of the nippers to accommodate different-sized sheets, and to accomplish this adjustment the block which pivots the connecting-rod n to the arm o can be, by means of the screw u, depressed or raised, so as to be at different distances from the shaft k, and thus give different amounts of motion to the arms N. This will be readily understood by reference to Fig. 2.

The first folding-knife, F, is provided on its lower edge with a number of serrations or sharp teeth, a a, and on the paper being struck by this knife, as it is inserted between the rollers, a line of incisions is made in the sheet along the line of fold, and in reading the sheet, instead of having to open it up and turn it inside out, all that is necessary is to pass the hand between the sheet, which is held together only at the points left uncut by the knife, and these points giving away, the sheet can be readily opened and read. This same kind of knife will be used for the second fold, when it is desired to incise that fold in the same way as the first fold.

In the passage of the sheets between the
rollers and along the table for the second fold difficulty is sometimes had by the friction of the paper upon the table when it first strikes the table by causing one side or portion of the sheet to drag more than the other, and thus displace itself for the proper line for the second fold, as it slides down the table. To obviate this and render the delivery of the folded sheet in a proper manner to the table certain, I employ milled wheels or disks \( P \), which are placed on a shaft, \( q \), situated immediately under the rollers. These wheels are situated at regular distances apart on their shaft, and run in grooves turned in the rear roller, while they come very nearly in contact with the front roller. They are driven in the proper direction by a gear, \( Q \), on the shaft of the front roller, which meshes with a gear, \( R \), on their shaft, and it will be seen, from the direction in which the disks and rollers revolve, that the sheet could not be obstructed in its passage. These rollers serve the double purpose of relieving the once-folded edge of the sheet from friction upon the table, and propel the sheet to its position for the second fold with regularity and certainty.

The rollers \( s s \) are situated under the table \( G \), and their circumference protrudes through slots in the table, slightly above its upper surface, so as to readily act on the sheet. They (the rollers) are driven by bands connected with each other, and the small pulleys on the shaft \( e \).

The paper having arrived in its proper position on the stops \( a \), it is struck between the rollers \( H I \) by the knife \( J \), and these rollers deliver the now twice-folded or quarto sheet between the bars \( b b \) and third pair of rollers \( K L \), between which rollers it is struck by a knife (not shown) similar to the ones \( F \) and \( J \). On the other side than that shown in the perspective of these rollers is an arrangement of milled wheels, \( P P \), for the same purpose as those connected with the first pair of rollers, viz., to deliver the sheets properly, only in this instance the sheet is to be delivered in an inclined position to the packing-trough \( T \), and for this reason two shafts carrying milled wheels are arranged around the lower roller, so as to hold the sheet in proper position until it has been introduced or partially introduced into the packing-trough. The milled wheels are journaled in adjustable frames \( U U \), and can be moved to or away from the roller by means of the slotted bar or yoke \( W \), and are driven by the gears situated on the upper extremity of their shafts, which gear with a wheel on the lower roller. The sheet, now thrice folded or octavo, having been prepared in the packing-trough \( T \), between the packer \( V \) and retaining star-wheel \( W \), is pushed forward by the packer \( V \), and, coming in contact with one of the arms of the star-wheel \( W \), turns the latter the distance of one arm, the pawl \( X \) acting in the ratchet-teeth on the star-wheel to prevent any motion in the reverse direction, and it will readily be perceived that at each stroke of the packer a sheet is added to the pack, which is prevented from returning by the arms of the wheel \( W \).

By reference to Fig. 5, it will be seen that the packer has a slot to allow of its passing the arms of the star-wheel without coming in contact with them, and if a sheet should fail to be received in front the wheel would not be revolved.

The table \( C \) is secured to side frames \( A \), which are pivoted to the side frames of the machine at \( A \), and which have stops \( b b \) to act against the top and side of the side frames \( A A \). By this arrangement the forward edge of the table can be depressed or elevated to bring the edge of the sheet of paper between the nippers.

From the foregoing it will be understood that I employ a knife with a sharp-toothed edge for making incisions in the paper along the line of the first and second fold, for the purpose of convenient opening and handling while reading; that I also employ a block running in a slotted segment-arm, to which is attached the connecting-rod imparting motion to the nippers for seizing and bringing the sheet in position over the first folding-rollers, and that I regulate the travel of these nippers by means of a screw, which regulates the distance of the block from the center of motion of the arms operating the nippers—bars; that I use milled wheels placed under or alongside of the folding-rollers, for the purpose of delivering the sheets from the rollers in proper position for their passage upon the table, or for entering the packing-trough; that I provide friction-rollers on the inclined table to aid and insure the descent of the sheet to the stops; and that I use a packing device to prevent the sheets returning with the packer, consisting of a star shaped or armed wheel, which is prevented from turning in the reverse direction by a pawl and ratchet; and that the table is pivoted to the side frame of the machine, and provided with stops, by which means it can be regulated to suit the nippers; and which devices and arrangements tend greatly to improve the machine and render its operation much more perfect and satisfactory.

In the manipulation of the paper, after it passes the first rollers, I avoid any friction thereon resulting from its sliding upon or against opposing or resisting surfaces. The revolving wheels for each of the rollers bear upon and assist the paper in its passage through the machine, and assist in preserving the integrity of the folds in the sheet, which cannot be done where the sheet in its flight or passage through the machine is resisted by frictional surfaces.

I am aware that serrated or saw edged knives and needle-points have long been used to make and register the first fold in paper-folding machines, examples of which may be seen in both English and American patents, and I disclaim such a device per se. I am also aware that rollers have been used for car-
rying sheets of paper in their passage through printing, paper making, and other machines, and I disclaim such a device per se.

Having thus fully described my improved machine, what I claim as new therein, and desire to secure by Letters Patent, is—

1. The combination, with the first folding-rollers, of a vibrating toothed knife, arranged to partially cut the sheet in the line of first fold, constructed and operating substantially in the manner and for the purpose described and specified.

2. In combination with the first folding-rollers, the revolving roughened wheels for delivering the sheet upon the inclined table for its second fold, constructed and operating substantially in the manner described and specified.

3. In combination with the inclined table and second folding-rollers, the positively-revolving rollers projecting through the inclined table to deliver the sheet into position for the second fold, substantially in the manner described and specified.

4. In combination with the third folding-rollers, the two sets of revolving roughened wheels arranged in co-operative relation with the rollers to deliver the folded sheet to the packer-trough, substantially in the manner described and specified.

5. The arrangement of the rotating roughened rollers for the third pair of rollers in a yoke, so that they may be adjusted throughout their length at one end in proper relation with the folding-rollers, substantially in the manner described and specified.

6. In combination with the packer-trough and reciprocating packer-head, a revolving armed wheel, to retain the packed sheets in proper position to be fed along the trough, substantially in the manner described and specified.

7. The revolving armed wheel suspended upon a vibrating arm, so that it can be readily adjusted relatively to the reciprocating packer-head, substantially in the manner described and specified.

8. In combination with the reciprocating nippers, the slotted arm, and screw-connections for adjusting the relative movements of the nippers, substantially in the manner described and specified.

9. In combination with the reciprocating nippers, the vibrating table for relative adjustment of the sheet to the nippers, substantially in the manner described and specified.

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Witnesses:
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