

(No Model.)

4 Sheets—Sheet 1.

L. C. CROWELL. FOLDING MACHINE.

No. 281,619.

Patented July 17, 1883.

Fig. 1.

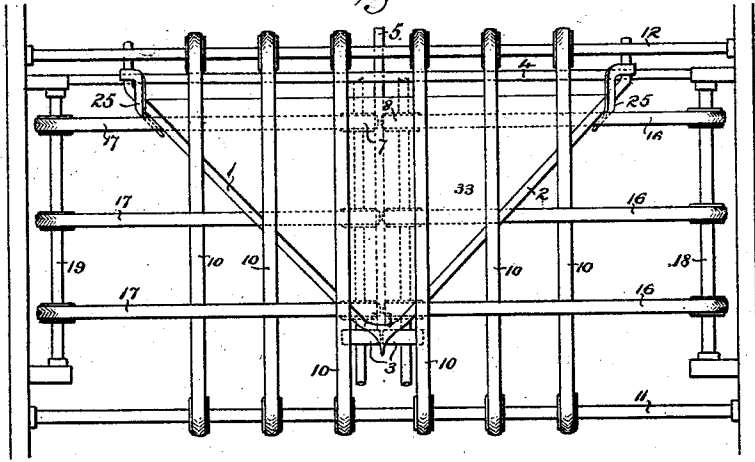


Fig. 8.

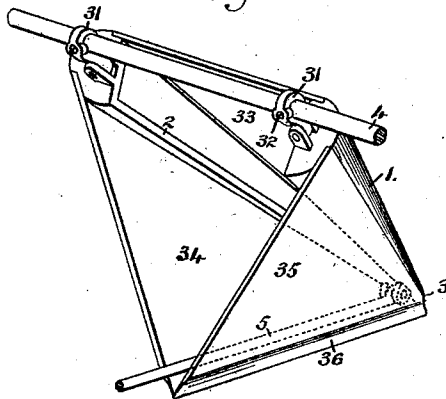
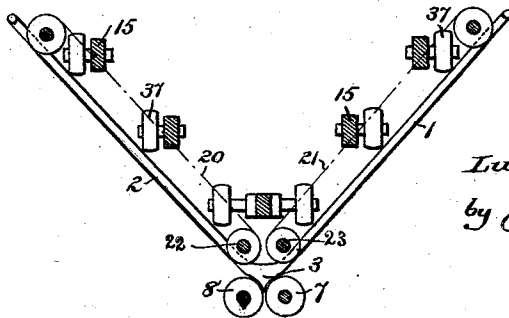


Fig. 5.



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Attys.

(No Model.)

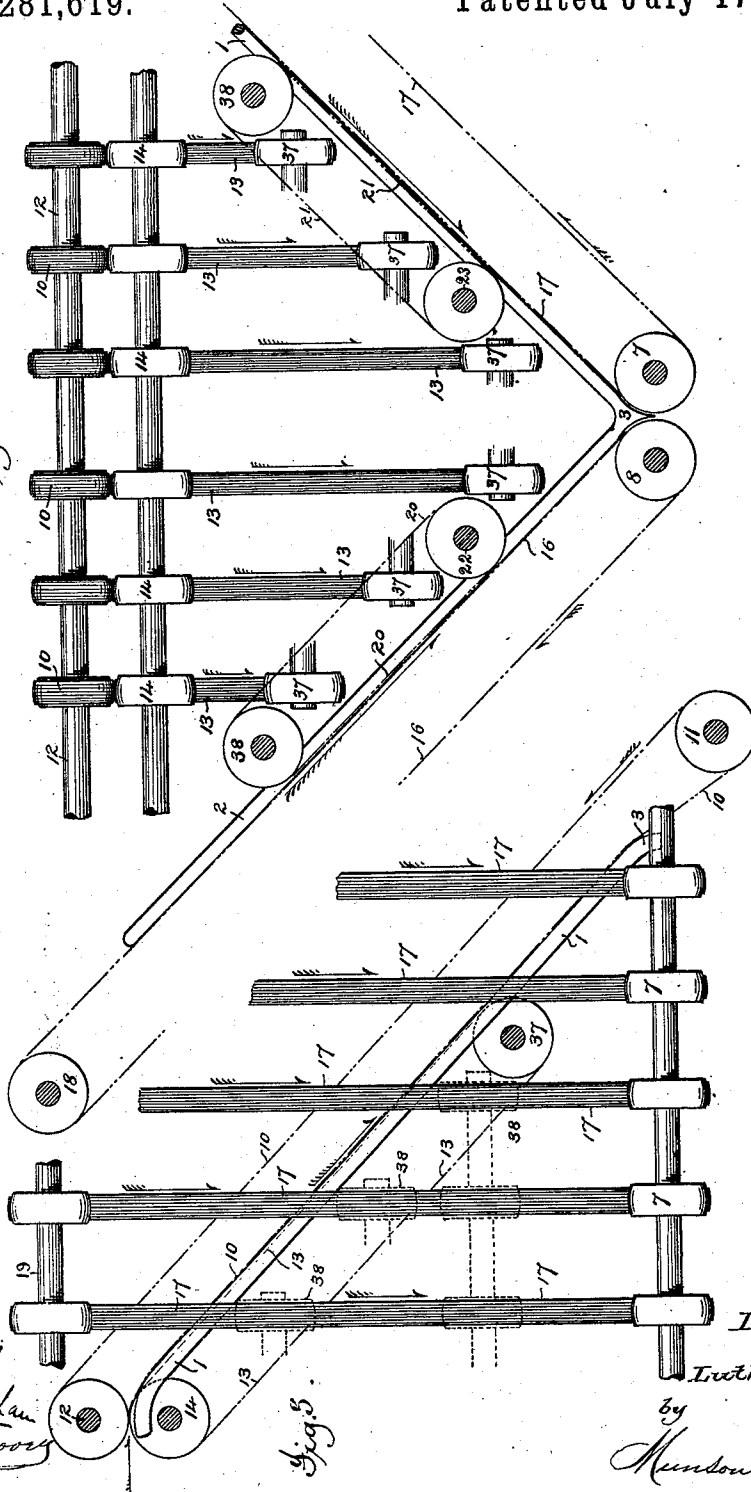
4 Sheets—Sheet 2.

L. C. CROWELL. FOLDING MACHINE.

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Fig. 2.



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Fig. 5.

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4 Sheets—Sheet 3.

L. C. CROWELL.
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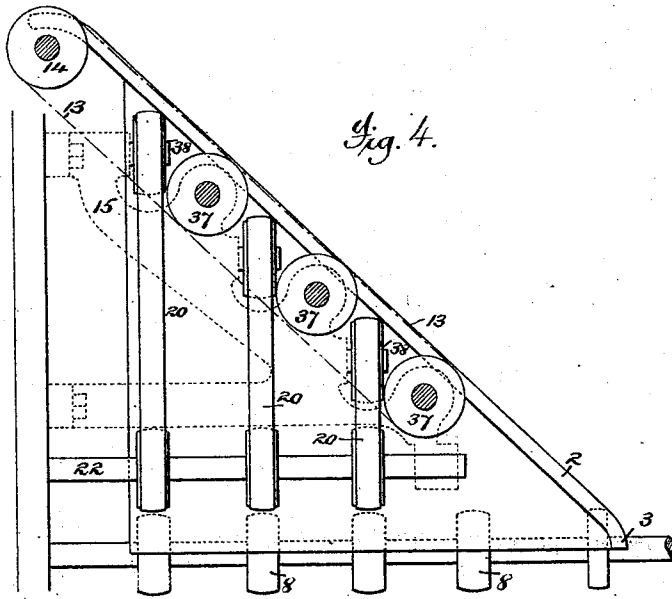


Fig. 4.

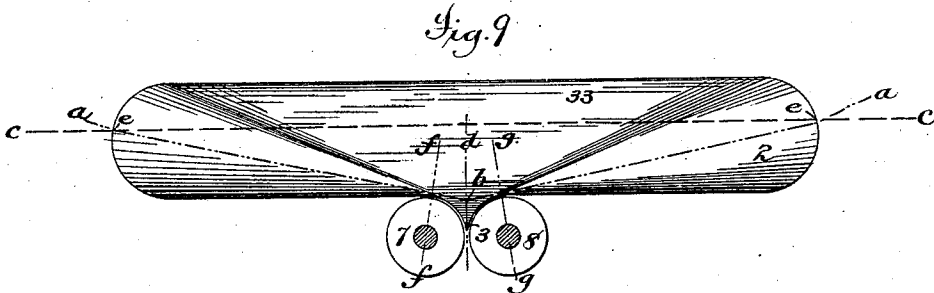


Fig. 9.

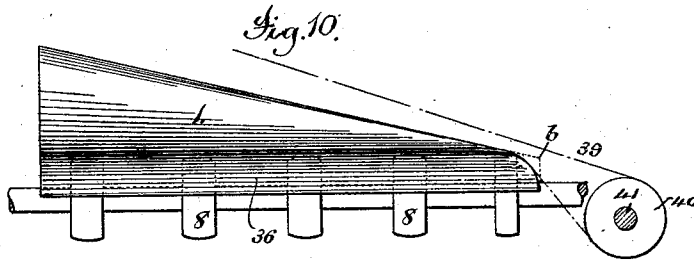


Fig. 10.

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4 Sheets—Sheet 4.

L. C. CROWELL.

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Fig. 6.

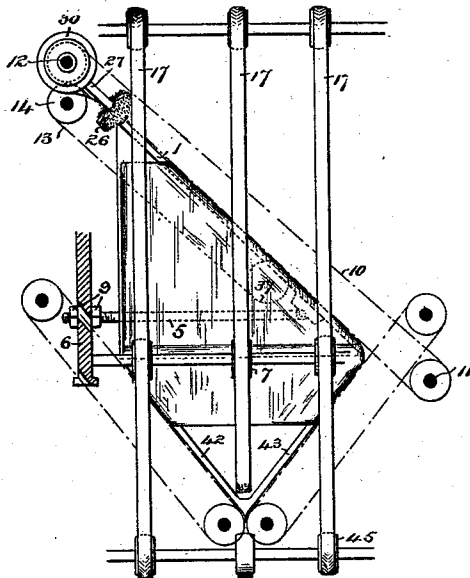
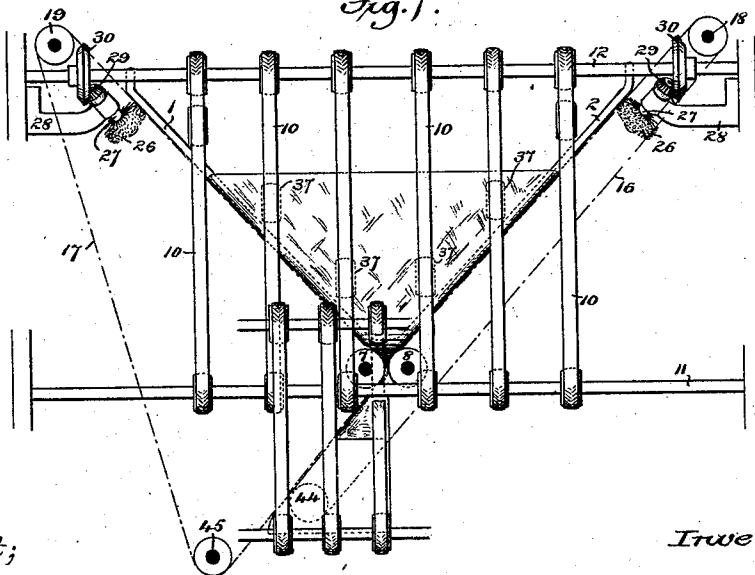


Fig. 7.



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Atty.

UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR TO R. HOE & CO., OF NEW YORK, N. Y.

FOLDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 281,619, dated July 17, 1883.

Application filed December 10, 1881. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing in the city of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Folding-Machines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to the construction of a mechanism adapted to fold longitudinally a web or detached sheets of material passing through it, the forward movement of such web or sheets not being checked or arrested during the process of folding.

The mechanism embodying the present invention belongs to that general class of folding-machines in which the folding is accomplished by what are termed "internal guides" and "external turners," and is, in its general characteristics, the same as that shown in United States Letters Patent No. 233,997, the invention consisting, principally, in the construction and arrangement of the internal guides and in the system of taping constituting the external turners.

It also further consists in certain details of construction and combinations of parts, all of which will be hereinafter fully explained, and particularly pointed out in the claims.

The primary purpose of this folding mechanism is to impart a longitudinal fold to the product of a web-printing machine, either while it is still in the web or after being severed into short lengths or sheets, and to do this at a speed equal to the highest rate at which rotary printing mechanism can be run. It thus not only disposes of the product of the printing-machine, but at the same time so reduces the dimensions of the web or sheets that it or they can be subsequently manipulated by a comparatively small and compact mechanism. As before said, this mechanism is particularly designed for use in connection with printing mechanism; but it is evident that it may be used to fold cloth or other fabrics.

In said drawings, Figure 1 is a plan view of a folding mechanism embodying this invention. Fig. 2 is a rear elevation of the same, showing some of the tapes broken away for

the sake of clearness of illustration. Fig. 3 is a side elevation of the same, showing five, however, instead of three, side tapes. Fig. 4 is a side elevation of Fig. 1, with the exterior tapes removed. Fig. 5 is a rear elevation of the internal guides, showing also the folding rolls or pulleys in end elevation and certain of the tapes and taper pulleys. Figs. 6 and 7 are side and front elevations of the same, showing also a second folding mechanism of the same character combined with the first. Fig. 8 is a perspective view, showing certain modifications to be hereinafter referred to; and Figs. 9 and 10 are enlarged detail views, which will be referred to in describing the principle involved in the construction of the present improved internal turners.

In the different figures the frame of the machine and the gearing by which the moving parts are driven have been for the most part omitted, it being within the skill of any ordinary mechanic to supply such parts in their proper forms and relations to each other.

The folder consists, primarily, of two internal guides or turners, 1 2, so arranged that they form the sides of a triangle, the apex being formed by their meeting ends and the base by the bar 4, to which their diverging ends are secured. The triangle thus formed should have a base equal in length to the width of the sheet or web of material to be folded, and its altitude is preferably equal to its base. These proportions may, however, be varied considerably.

The turners 1 2, which are smooth bars of wood or metal, either in the form of the halves of a divided cone, as shown in Figs. 8, 9, 10, or the form of straight bars, as in Figs. 1, 4, and 5, are supported by the bar 4 (to which, as before stated, their diverging ends are secured, and which is mounted in a suitable manner in the frame of the machine) and the rod 5, which is hinged to their united ends and extends backward, and is secured in the post 6, which is a part of the frame of the machine.

The rod 5 is provided with adjusting-nuts 9, one upon each side of the post 6, by which the position of the apex 3 of the turners can be adjusted with relation to the bite of the rolls 7 8, the turners being so positioned that the

apex 3 lies just above the bite of the folding-rolls, and that the vertical plane passing between said rolls bisects the triangle formed by the turners and the rod 4. The turners are set at such an angle to the rolls 7 8 that the triangle bounded by either one of the turners, the folding-rolls at their point of contact, and a line drawn in a vertical plane from the elevated end of the turner to the folding-rolls will equal one-half the triangle formed by the turners and the bar 4. When the latter triangle is of the proportions heretofore specified, such angle will be about sixty degrees.

It is necessary, as will readily be seen, that, if the angle formed by the meeting ends of the turners is changed, that formed by the turners and the folding-rolls must be correspondingly changed, and vice versa, so that the triangles above named shall always bear the specified relation to each other, in order that the material may be kept taut at all points during its passage through the folder.

In turners of this class as heretofore constructed the turning-edges have extended in right lines to their point of union, which was directly above the bite of the folding-rolls. The position which such point would occupy in the old construction is shown by dotted lines *a a* in Figs. 9 and 10, the point or apex of the turner being at *b*. Now, it is evident that all parts of the web or sheet upon any transverse line, as *c c*, must enter the bite of the folding-rolls together. To do this and yet have the material kept taut, all points of such line must be made to travel exactly the same distance before reaching the bite of the rolls. In the construction just specified the distance traveled by different parts of the material varies, which variation is often so great as to make the machine of such construction inoperative. This difference in the lengths of the paths taken by different parts of the material is well illustrated by dotted lines in Figs. 9 and 10, in which the point *d* upon the line *c c* must pass to the point *b*, and then vertically downward to the bite of the rolls, while the points *e e*, instead of passing to a point, as *b*, directly above the bite of the rolls, and then vertically downward, take a diagonal course along the periphery of the rolls, and thus shorten their paths of travel. When the folding-rolls are of small size and the angle of elevation to the folding-rolls at which the turners are set is considerable, the apex of the turners may be brought so near to the bite of the rolls that this variation becomes of no practical consequence, as is the case in Letters Patent No. 233,997, before referred to. It is, however, often desirable to make the folding-rolls of considerable size, and, in order to economize space, to mount the turners nearly parallel therewith, as in Figs. 9 and 10, in which case the result of the former construction would be to leave the material slack at all points except upon the fold-line, and to make the strain at that point so great as to rupture the web or sheet and render the machine inoperative.

This difficulty is obviated in the present invention by having the folding-edges of the turners extend in right lines only to the point where they approach nearest to the surfaces of the folding-rolls, as represented in Fig. 9 by lines *f f g g*, from which points to the apex 3 they bend downward, following the curvature of the rolls, and inward, so that the upper sides of the ends of the turners have a curvature equal to that of the rolls, as clearly shown in Fig. 10. This construction permits the material passing over the apex of the turners to take a diagonal path of just the same length as that taken by the material which passes over the sides of the turners, as already explained, and insures an equal strain upon all parts of the web or sheet.

Co-operating with the internal guides or turners just described are six series of tapes arranged to form three biting sets, all of which are or may be positively driven, as hereinafter explained, and which together operate to conduct the web or sheet over and around the turners, so as to bring its edges together at the bite of the folding-rolls 7 8. The first of the series is composed of the tapes 10, which pass over pulleys upon the shafts 11 and 12, and are driven by the latter, which is connected by suitable gearing with any convenient source of power. These tapes run in a plane parallel with the upper surface of the turners 1 2 and in close contact therewith. Co-operating with this series of tapes, and completing the first set, is a second series, consisting of the tapes 13, arranged immediately beneath the tapes 10 and passing around pulleys upon the shaft 14, which is geared to the shaft 12, and by which they are driven, and loose pulleys 37, arranged upon studs in the adjustable brackets 15, which brackets may be secured to a plate extending from one turner to the other, said plate being provided with apertures to permit the pulleys to project above its surface; or they may extend to the rear of the turners and be secured to any convenient part of the frame of the machine. The second and third sets of tapes are composed of the series 16 20 and 17 21, the first set of which runs in a plane tangential to the upper side of folding roll or pulleys 8 and under side of turner 2, and the second of which runs in a plane tangential to the upper side of folding roll or pulley 7 and under side of turner 1. The series 16 17 pass around and are driven by the folding-rolls 8 and 7, respectively, which, it is to be remarked, may be composed of series of pulleys, as shown in Figs. 1, 3, 4, and 10, or may be solid continuous rolls, and around pulleys upon the shafts 18 19, set at right angles to the shaft 12, and so located as to bring the tapes into close contact with the turners 1 2. The inner series, 20 21, co-operate with the series 16 17, respectively. They pass around pulleys upon the shafts 22 23, which shafts are or may be geared to and driven by the folding-rolls and loose pulleys 38, mounted upon studs in the adjustable brackets 15, which, as before

said, extend to the rearward, and are secured to some convenient part of the frame of the machine; or these pulleys may be mounted upon brackets carried upon plates secured to the turners, which plates are provided with apertures through which the pulleys project. In addition to these sets of tapes, it may be found desirable sometimes to provide a tape, (see Fig. 10,) which runs over a pulley upon shaft 12 and the pulley 40 upon a shaft, 41, placed below shaft 11. The position of pulley 40 being below the shaft 11 will cause the tape 39 to press against and hold the material snugly to the curved ends of the turners. This completes the system of taping, the operation of which, in connection with the turners 1 2, will now be described.

The leading end of the sheet or web, being inserted between the pulleys upon the shafts 12 14 into the bite of the set of tapes 10 13, will be carried forward toward the apex 3 of the turners 1 2. As soon as the web or sheet has advanced so that its leading corners project beyond the turners 1 2, said corners will be struck by the revolving brushes 26 upon the ends of shaft 27, mounted in brackets 28, and rotated by bevel-gears 29 through engagement with like gears, 30, upon the shaft 12. By these brushes the corners of the web or sheet will be turned downward over the edges of the turners 1 2, so as to be caught in the bite of the tapes 16 20 and 17 21. As the leading end of the sheet or web advances, the corners will continue to be carried downward over the edges of the turner by the tapes 16 20 and 17 21 until, at the time when the leading end reaches the apex 3 and passes from the turner, the corners will be brought together at the bite of the folding-rolls, and the leading end of the web or sheet will be folded. As long as the tapes 10 13 continue to advance the web or sheet along the face of the turners its sides will be carried downward over the edges of the bars 1 2, and it will be longitudinally folded as fast as it passes beyond the apex 3.

It is obvious from the foregoing that in passing over the turners 1 2 the material is not subjected to any strain whatever, it being simply carried by the tapes. This removes all danger of the material being torn or the ink being offset while passing over the turning-edges 1 2, and makes the devices capable of operating successfully upon freshly-printed sheets and the most fragile kinds of material.

The system of taping just described possesses great advantages over the systems heretofore used upon this class of folding mechanisms, in that the tapes all run in right lines, and are consequently easier to arrange, and, passing around no fixed surfaces, are less liable to be thrown from their pulleys.

Instead of the revolving brushes just described, curved guides, as 25, (shown in Fig. 1,) may be used for turning the corners of the material over the edges of the bars 1 2.

In Fig. 8 is shown a modification in the structure of the internal turners, 1 2. In this

case the turning-surfaces, instead of being simply bars, are formed of the halves of a longitudinally-divided cone.

Turning-surfaces of this form will usually be found most advantageous, not only because it is desirable that the curvature of the turning-surfaces should decrease from the apex backward, so that the paper will be deflected gradually, but because when made in this form the two can together be turned to a perfect cone, thus insuring that the two are exact counterparts. In this figure is also shown a means for adjusting the position of the turners with relation to each other. For this purpose they are hinged together at the apex 3 and their diverging ends are hinged to collars 31, capable of sliding upon the bar 4. By means of these collars the ends of the turners 1 2 can be placed at any desired distance from each other, the set-screws 32 affording means for securing the collars in their adjusted positions. The collars 31, instead of being held in their positions by set-screws, may be screw-threaded and work on right and left hand screws cut on bar 4, the bar in such case being made capable of rotation. It is also to be remarked that turners of the construction shown in the other figures may be hinged together and made adjustable with relation to each other in the above-described manner, if it is found desirable to do so. In this figure there are also shown plates 33 34 35, which may in some cases be used instead of the interior tapes 13, 20, and 21. The plate 33 is secured to the turners 1 2 and arranged to be flush with their upper surfaces.

The plates 34 and 35 are secured by their upper edges to the turners 2 and 1, respectively, their lower edges uniting and forming the double-concave guide 36, which serves to conduct the paper down into the bite of the folding-rolls. When the interior tapes are used instead of the plates, a guide of this construction may also be used, it being supported upon the rod 5. These plates, being of polished metal, offer very little resistance to the passage of the paper, so that the outer series of tapes, pressing against the paper as it rests upon the smooth surfaces, will usually be sufficient to carry it over and around the turners. In the organization shown in Fig. 1 plates of this character are used, the interior tapes being omitted.

The plates 33, 34, and 35 may, if it is found desirable, be provided with apertures in which are set anti-friction rolls to aid in the movement of the paper, and these rolls may be provided with tapes, if desirable. This form of construction is shown in Fig. 4. Instead of plates or interior tapes, metal strips or bars may be provided to hold the paper against the exterior tapes.

As before stated, the machine constructed as above described is capable of operating upon either a web or detached sheets of material; but when it is designed to operate upon a web only, a portion or even all of the tapes

may be dispensed with. It will, however, usually be found more advantageous to retain a sufficient number to aid in conducting the leading end of the web around the turners and into the bite of the folding-rolls. The web of paper may be received by this folding mechanism as it passes from the printing mechanism, and if it is desired to fold the web twice longitudinally to reduce it to one-fourth its original width, it may be operated upon by two of these mechanisms in succession, after which the web may pass to other mechanisms to be cut into sections and further folded. One way in which two of these folders may be arranged so as to operate in succession upon the web is shown in Figs. 6 and 7. This is done by placing the second folding mechanism, which is of one-half the size of the first, in such position that as the once-folded web passes from the folding-rolls 7 8 it will be conducted over the turners 42 43 of the second folder. In this case the tapes 16 will, instead of passing around the roll 8, pass between rolls 7 and 8, and, continuing downward, return around the pulleys 44, which correspond to the pulleys 37 of the first folder, and thus form one series of the interior tapes of the second folder. In this case the tapes 16 will be driven from shaft 18 instead of by the folding-roll 8. The tapes 17, instead of returning around the roll 7, will likewise pass between rolls 7 and 8 and return around pulleys upon a shaft, 45, corresponding in the second folder to the shaft 11 of the first, and thus form one series of the exterior tapes for the second folder. These tapes will in this case be driven from the shaft 19 instead of by roll 7. This folding mechanism may also be arranged to receive and operate upon the sheets as they are delivered from another folding mechanism; or it may be arranged in any relation to other folding mechanisms or to cutting or associating mechanisms which may be found desirable.

What I claim is—

1. In a folding-machine, the interior guide or turner having the two converging turning-surfaces, as 1 2, which unite to form an apex, as 3, said surfaces being bent at the apex in two directions, so as to form under concave surfaces and a front convex surface, the curvature of both being the same, substantially as described.

2. In a folding-machine, the combination of a pair of folding-rolls, as 7 8, with an interior guide or turner, consisting of two converging turning-surfaces, as 12, which unite at an apex, as 3, at the bite of the folding-rolls, said surfaces being bent at the apex, so as to present a convex front the curvature of which is the same as that of the folding-rolls, substantially as described.

3. The combination of the interior guide or turner, consisting of two converging turning-surfaces, as 1 2, which unite and form an apex, as 3, at the bite of the folding-rolls, said surfaces being bent at the apex, so as to present a convex front the curvature of which is the same as that of the folding-rolls, with means for conducting a web or detached sheets over and around said turner, all substantially as described.

4. The combination of the interior guide or turner, consisting of two converging turning-surfaces, as 1 2, which unite and form an apex, as 3, at the bite of the folding-rolls, said surfaces being bent at the apex, so as to present a convex front the curvature of which is the same as that of the folding-rolls, with folding-rolls, as 7 8, and means for conducting a web or sheets of material over and around said turner, all substantially as described.

5. The combination of the turning-surfaces, as 1 2, and the revolving brushes, as 26, substantially as described.

6. The combination of the interior turner, consisting of the two converging turning-surfaces, as 1 2, and the three independent series of exterior tapes, as 10, 16, and 17, substantially as described.

7. The combination of the interior turner, consisting of the two converging turning-surfaces, as 1 2, the three independent series of exterior tapes, as 10, 16, and 17, and the series of interior tapes, as 13, substantially as described.

8. The combination of the interior turner, consisting of the two converging turning-surfaces, as 1 2, the three independent series of exterior tapes, as 10, 16, and 17, and the two independent series of interior tapes, as 20 21, substantially as described.

9. The combination of the interior turner, consisting of the two converging turning-surfaces, as 1 2, the three independent series of exterior tapes, as 10, 16, and 17, and the three independent series of interior tapes, as 13, 20, and 21, substantially as described.

10. The combination of two longitudinal folders, arranged, substantially as described, so as to operate in succession upon the material, with two sets of tapes, as 16 17, arranged substantially as shown, to co-operate with both folders.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:

COLERIDGE A. HART,
ANTHONY N. JASBERA.