

(No Model.)

5 Sheets—Sheet 1.

L. C. CROWELL.
FOLDING MACHINE.

No. 331,280.

Patented Dec. 1, 1885.

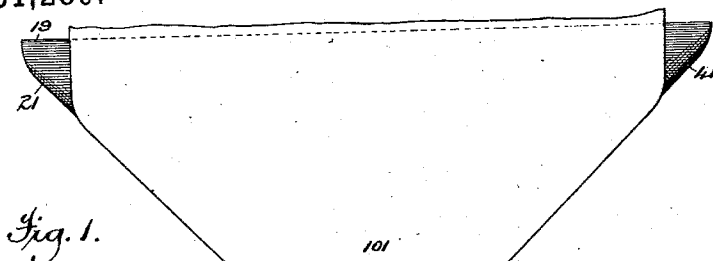


Fig. 1.

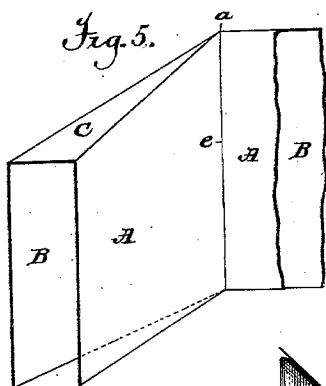


Fig. 5.

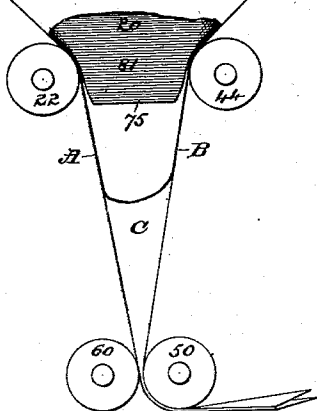


Fig. 2.

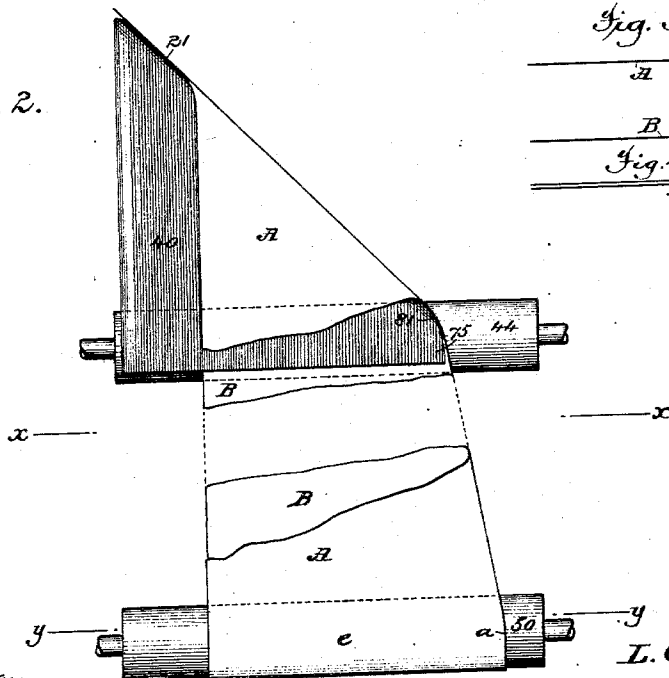


Fig. 3.

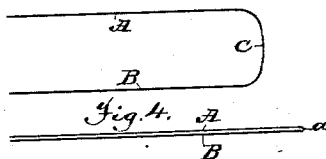


Fig. 4.

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(No Model.)

5 Sheets—Sheet 2.

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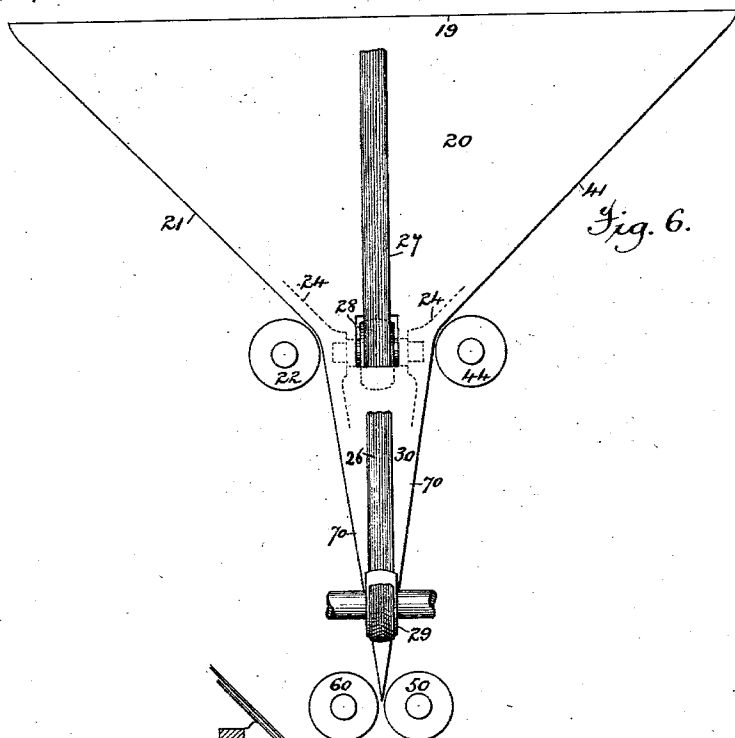


Fig. 6.

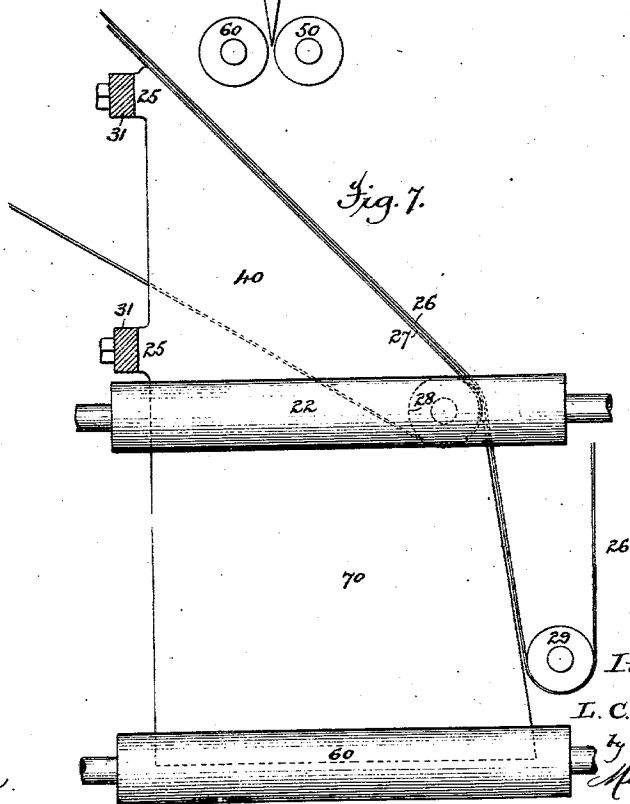


Fig. 7.

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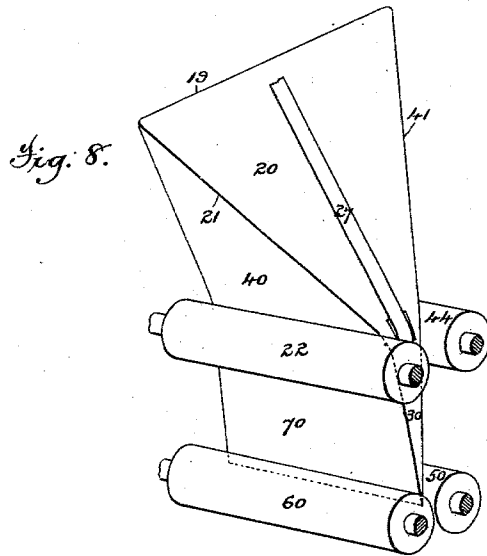
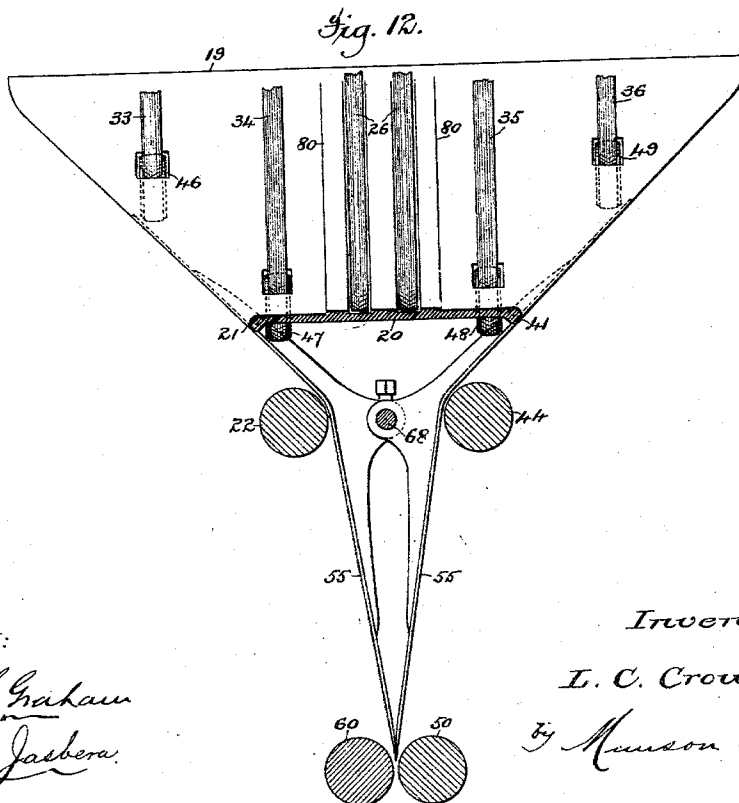
(No Model.)

5 Sheets—Sheet 3.

L. C. CROWELL.
FOLDING MACHINE.

No. 331,280.

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(No Model.)

5 Sheets—Sheet 4.

L. C. CROWELL.
FOLDING MACHINE.

No. 331,280.

Patented Dec. 1, 1885.

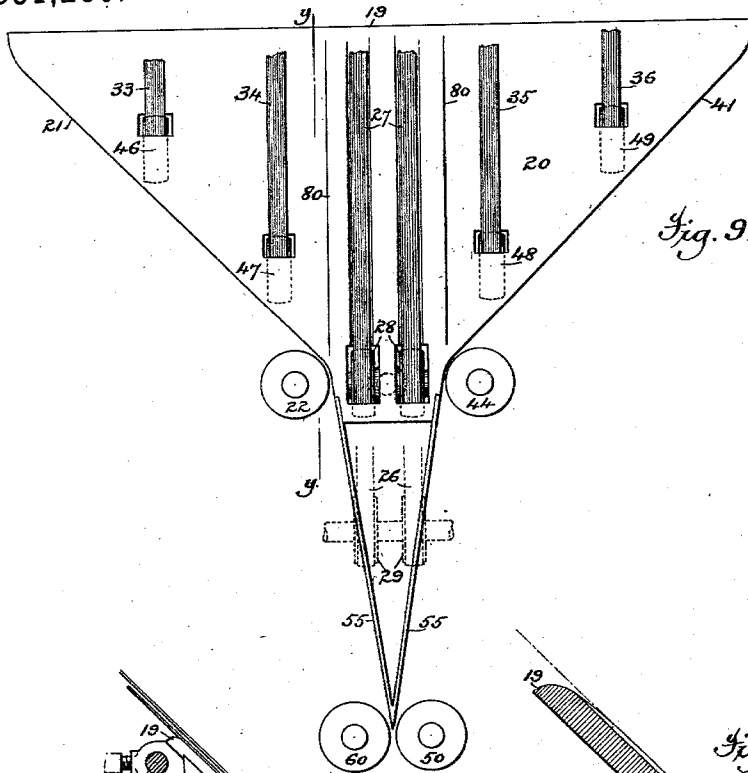


Fig. 9.

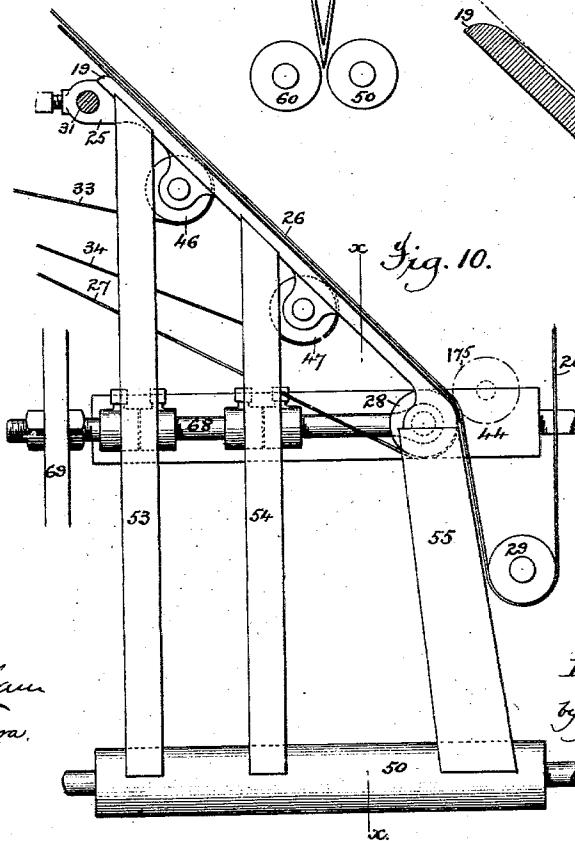


Fig. 10.

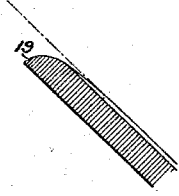


Fig. 11.

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(No Model.)

5 Sheets—Sheet 5.

L. C. CROWELL.
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Fig. 14.

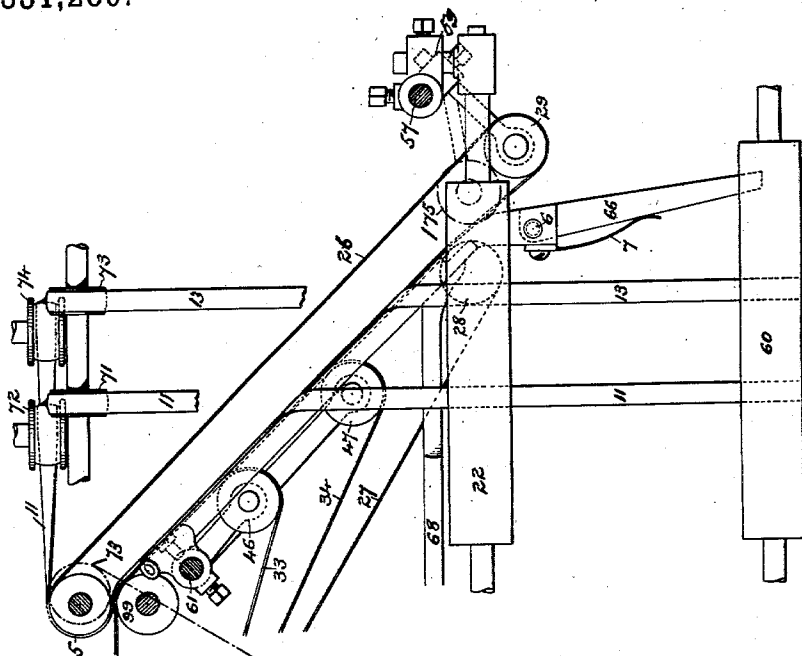
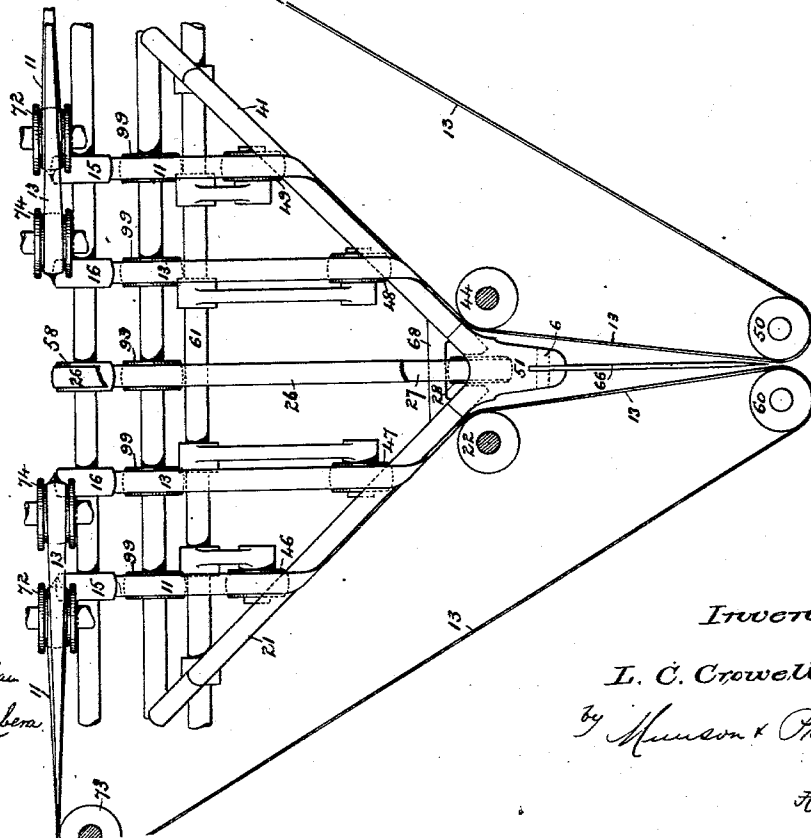


Fig. 13.



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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. 331,280, dated December 1, 1885.

Application filed February 8, 1884. Serial No. 120,116. (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.

10 In said drawings, Figure 1 represents a front elevation, and Fig. 2 a side elevation, of one embodiment of the invention, the folder being especially adapted to operate upon material in web form. Fig. 3 represents the folded material as it appears when cut on the line *x*, and Fig. 4 the same as it appears when cut on the line *y* of Fig. 2. Fig. 5 is a perspective view representing the material as it appears while passing from the primary to the secondary devices of the folder. Fig. 6 represents a front elevation, and Fig. 7 a side elevation, of the same folder when supplied with threading-tapes. Fig. 8 is a perspective view of the folder, one of the threading-tapes being omitted. Fig. 9 represents a front elevation, and Fig. 10 a side elevation, of the folder supplied with tapes, to adapt it to operate upon material in the form of short detached sheets. Fig. 11 is a section thereof on the line *y* of Fig. 9, and Fig. 12 is a sectional elevation on the line *x* of Fig. 10. Fig. 13 represents a front elevation, and Fig. 14 a side elevation, of the folder when composed of bars and plates or of skeleton form.

35 The present improvements relate to that class of folding mechanisms which operate to impart a longitudinal fold to material passed through them on the run, and more particularly to such as consist of an internal guide or former having angular guiding-surfaces and co-operating external turners, by passing between which the material has its sides gradually carried toward each other and finally lapped together, so as to be doubled or folded longitudinally.

45 In the operation of folding paper or other material on the run (say, upon a central line) it will be understood that the opposite sides of the material will have to be guided toward each other in a direction at an angle

to the travel of the central portion of the material for a distance equal to one-half the width of the sheet or web undergoing the folding operation, and that when these sides thus guided have traveled a distance sufficient to cause them to meet each other (it may be their leading edges) the material will be folded together.

In the folders heretofore constructed for producing this longitudinal folding the internal guide has been so formed as to afford turning-edges or side supports converging to a common point, said point determining the line of the longitudinal fold. These side supports or turning-edges are so constructed as to form with each other angles of various degrees, but in all cases have served to distend the paper and support its sides up to nearly the very line of fold, against the action of the external turners, which serve to press upon the paper in the opposite direction—that is, to press the sides together and compel the folding. These devices may therefore be said to operate to change the direction of the travel of the sides of the moving material, to crease or lay the line of its fold, lap the sides together, and cause the lapped sides to take the same direction of travel, all simultaneously. In thus folding the material, the fold-forming point must be the common point of convergence of all that portion of the material that is changing its direction from a flat form to the folded condition which it has when doubled by lapping its sides together; hence it will be observed that the paper must take angular directions of travel that form a common apex, (the folding-point,) which will be sharply defined, and therefore require an abrupt bending of the material, which thus has a great tendency to break or buckle at or near this point. In order to accomplish this longitudinal folding at a high rate of speed without breaking or wrinkling the material at or near the fold-forming point, especially when such material is of two or three plies, it has been found necessary to construct the members of the folder with great nicety, and to adjust them in relation to each other with great accuracy, thus incurring a loss of time and involving expense.

The object of the present invention is to accomplish the longitudinal folding of fabrics on the run by means of internal guides and co-operating external turners, which may be rapidly made and quickly adjusted in working order without necessitating great accuracy of construction, nicety of adjustment, or any considerable expense.

Stated broadly, the invention may be said to consist in a longitudinal folder composed of an internal guide, external turners set a distance apart, and a fold-laying device, these parts being so arranged as to divide the folding operation into two parts. The first part consists in conforming the material by guiding or bending the sides of the web toward each other until the major part or portion of the sides (considered on a transverse line or widthwise) are parallel or substantially parallel without being brought into contact. This causes the central part of the material (or that portion connecting said sides at right angles to the line of their parallelism) to lie or be bent substantially at a right angle to said sides, and it is the distending or bringing of this central portion into alignment with the said side portions, and at the same time bringing the side portions together, whereby the folding is completed, that constitutes the second part of the operation. In this second part of the operation the leading edge of the material is directed onward from the devices which perform the first part to the fold-laying device, at the proper angles to ultimately lay the sides of the material together or bring them into folded contact. It is to be understood that by this method of operation the devices which perform the first part are designed not only to so deflect the sides of the material as to bring the major portions of them into position parallel with each other, but to externally maintain or support their greatest widthwise portion while they are being lapped together or brought into contact to complete the folding operation by the devices of the second part. This widthwise support for the greater portion of the sides is afforded by the turners that bear externally upon said sides in a direction parallel to each other and approximately at right angles to the direction at which the material leaves them; but the central portion of the material connecting the sides has no widthwise support beyond the point lying between said external turners, (or devices of the first part,) as it is last supported on the line between said turners, where it leaves the internal guide in changing its plane of travel in being transformed from a flat to a folded condition, which line of support is a transverse or widthwise bearing or guide afforded by the internal guide and equal in length to dimensions slightly less than the space between the external turners. It will now be understood that during this last part of the operation the forming of the line of longitudinal folding may be aided by a metallic creasing-edge when a two or three ply fabric is being manipulated.

However, as the secondary or fold-laying devices simply presses the sides of the material together, and its line of contact upon the material widthwise is parallel with that of the external turners of the primary devices, the creasing-edge will simply act to guide or bend outward the slack portion of the material whenever such slack is produced by the sides being brought into contact in passing from the external turners to the said fold-laying or secondary device. In thus acting upon the material it will be found that its widthwise support by the external turners is sufficient to resist any pressure the creasing-edge may exert, and hence will prevent the latter from rupturing or distorting the material being folded. In practice, however, it will be found that the elasticity of single-ply material is sufficient to enable the accomplishment of the folding operation without the aid of a "creasing-edge." Thus when the sides of the material have been brought together and the line of fold once formed, the whole tendency of that part of the material that extends from the point of said fold back to the transverse line of support which the central part of the material has between the external turners will be to bend or turn outward, and hence will naturally take the course that most perfectly conduces to the smooth formation of the creased line of fold. It will also be found in practice that any uneven strain which may have been caused (by reason of any slight inaccuracy of adjustment) to either side of the material in its passage through the primary devices, whereby its major portion is conformed or converted from a single plane to two parallel planes widthwise, will be compensated for in the central portion of the material, which will adjust itself evenly and without causing wrinkles or other distortion when free from contact with guides, as it is while passing from the primary to the secondary devices.

Other features of the invention will be found in the combination, with the internal guide and external turners, of a fold-laying device; also, a fold-creasing device interposed between the former and the latter.

The invention also includes a construction of the internal guide, whereby it is provided with a continuous surface between its guiding-edges and also beyond them.

It also consists in the combination, with the continuous-surfaced internal guide, of carrying tapes, whereby the leading in or threading of the end of a web is effected.

The invention comprehends the combination, with the internal guide, of carrying tapes, whereby the folder is best adapted to the manipulation of detached sheets.

The invention also includes the combinations of parts, hereinafter too fully set forth to need preliminary description.

Referring now to the drawings for an understanding of the many embodiments of the invention embraced herein, and first considering the simpler or continuous-surface form

of the internal guide shown in Figs. 1 and 2, it will be found that the primary part of the folder, or what has been termed the "internal guide" or "conformator," is provided with two guiding or supporting edges or surfaces, 21 41, that are diametrically opposed, but extend forward in converging directions. Instead of meeting at a common point, as in former constructions, they terminate a considerable distance apart, and are united transversely by a guiding-surface, 81. The guiding surfaces or edges 21 41 support, respectively, the major part of each side of the material undergoing folding, while the guiding-surface 81 supports the central portion, or that part connecting the sides. These converging angular guiding surfaces or edges 21 41 form the guiding edges or surfaces over which the material is bent to bring its sides toward each other or into a condition of parallelism, whereby the greater portion of their diversion from one plane into parallel positions, considered widthwise, is accomplished, and their further mutual approach to a condition of contact necessary in folding may be most readily effected, and the transverse guiding-surface 81 acts as the support for the central portion of the material that forms in the primary part of the folder the small widthwise portion that has ultimately to be changed in its position to complete the folding. The external turners, 22 44, are of the same general structure as in former constructions; but instead of being placed in such relation to the internal guide as to complete the folding operation in connection with it, they are set a distance apart with their centers opposite, or nearly so, to the line of the transverse guiding surface or edge 81, and therefore operate with the internal guide only to perform what has been described as the primary or first part of the folding operation—that is, conform the material into the shape shown by the diagram of Fig. 3.

The fold-laying device is shown as consisting of a roller, as 50, (it might be two, as 50 60,) the function of which is to lay the sides of the material together, as appears by the diagram, Fig. 4. If the contact of the sides of the material is to be effected by straining the material over one surface, as appears by the direction given it around roller 50 in Fig. 1, the roller 60 may obviously be omitted; but if the material is to continue a straight onward course, the two rollers 50 60 will properly confine the two sides and sufficiently crease the fold-line without compressing the sides together, which latter is objectionable when freshly-printed paper is operated upon. A suitable number of pulleys on a shaft would of course be the equivalent for each of these rollers, and although desirable that the fold-laying device shall rotate, it is perfectly practicable to use a bar or bars for the purpose. It is therefore to be understood that the term "fold-laying device" whenever used is to mean one or two such rollers, or their equivalent pul-

leys, or one or two stationary turning-surfaces. The function of this fold-laying device may be further explained to be to lay the opposite sides of the material together by stretching them respectively from their somewhat wide separation or parallelism where they leave the external turners, 22 44, and the internal guide to a condition of contact when they pass the fold-laying device, between which sets of devices the material (in the embodiment under consideration) is free from contact with either an internal or an external device, and may therefore adjust itself so as to produce a perfectly-smooth fold in passing the fold-laying device.

In the structure shown in Figs. 1 and 2 the conformator or internal guide is shown as constructed from a sheet-metal plate bent into shape. It is thus given a form that produces the angular-converging guiding surfaces or edges 21 41 and the transverse guiding-surface 81, all of which are united by a body-plate, 20, that provides a base, 19, at least as long as the material to be folded is wide. From the guiding edges or surfaces 21 41 the plate is bent at approximately right angles and forms sides 40, the conformator thus affording a continuous bearing-surface widthwise for the material up to the point where the material passes over the external turners. The plate is also extended beyond the guiding surface or edge 81, and its advanced portion is bent downward, as is shown in Fig. 2, so as to form a nose, 75, that is removed from the pathway of the paper, or, in other words, forms a rounded surface that will enable the material to run smoothly over it; but neither this extension nor the provision of the body 20 or sides 40 are requisite, as will hereinafter appear, although they form a support on which the material may smoothly lie, and over which it may evenly run, and also protect it from being broken by accidental or other contact of bodies with it. The internal guide may be secured by common means in an appropriate position to receive the material to be folded, the angle shown being a convenient one, and the external turners, 22 24, and fold-laying device will be suitably fixed to rotate or not, as the case may be. No frame-work or hearings for them are shown, as that may be readily constructed by an ordinary mechanic.

For a more convenient understanding of the operation of this folding mechanism the material will be followed in its course through the same. It is spread widthwise over the base 19, and moved forward over the conformator or internal guide. As its leading edge travels onward, the sides A B of the material will be bent over the guiding-edges 21 41, and form angular bends drooping beyond them, which angular bends will progressively increase in extent and in their approach toward each other as their leading edge advances toward the external turners, 22 44. As the leading edge reaches the said turners 22 44, the major portions of the sides of the material,

considered widthwise, will have traveled toward each other and been diverted from a straight line and conformed, as shown in the diagram, Fig. 3, so as to be parallel, which parallelism is the relative position that that portion of them will occupy when ultimately lapped or folded, although the sides will be close together, as in diagram, Fig. 4. The central portion, C, of the material uniting these parallel portions of the sides is stretched across the guiding-edge 81, and thus constitutes a comparatively small portion of the material remaining to be bent out or distended and added in equal parts as extensions of the parallel sides to accomplish the lapping thereof and complete the folding operation. From this position the material is carried forward, and the leading edges of its sides are laid together by being passed between the fold-laying devices 50 60, or bent around one of them. This (see Fig. 5) causes the parallel portions of the material to converge from their separated position at the external turners at angles that unite at the fold-laying device, and the said central portion to progressively decrease its widthwise extent from the edge 81, where it leaves the internal guide, to the fold-creasing point *a*, where its dimensions are lost. The entire sides A B of the material are thus lapped together and the longitudinal folding completed. In this operation the said central portion, C, has been gradually distended or straightened out, so as to lie parallel with the adjacent sides (as in Fig. 4) in passing from the internal guide to the fold-laying device; and since the said central portion of the material is unconfined between said devices it is consequently free to move in all directions, and hence may accommodate itself to the taking up of any slackness, and to compensate for any straining, and thus secure the formation of a perfect and regular folded line, and, preventing any buckling of the material near such folded line, will therefore enable the sides to lie smoothly together.

In Figs. 6 to 8 the internal guide, having the continuous surface formation constituted by a bent metal plate that provides the guiding surfaces or edges 21 41, united by a body-plate, 20, and having side plates 40, is shown as provided with a tapering guide that extends from the external turners, 22 44, to and terminates near the point where the two sides of the material are lapped together in passing over one or between both of the fold-laying devices 50 60. The body-plate 20 and the side plates 40 are continued to form said tapering guides by an elongated top plate, 30, and side plates 70, extending at right angles therefrom. This tapering guide simply acts to prevent the paper from being distorted, broken, or misdirected by external force—as by accidental blows or currents of air—and though advantageous in these respects forms no essential part of the devices necessary to perform the folding operation; but its extremity performs the function

of the fold-creasing device, hereinbefore alluded to, and hereinafter explained.

A longitudinal folder will be best adapted to the threading of the material in the condition of a long sheet or web by providing it with leading-tapes 26 27, the latter being a set that extend from the source of supply of the material (it may be the base-line 19) and run in contact with the body 20 of the conformator and return through an opening in said body 20 (near the turners 22/44) over a pulley, 28, hung beneath said body 20. The upper tape, 26, extends parallel with the tape 27 and as far as the pulley 28 in contact with said tape; but from this point said tape 26 extends for a distance in contact with the top plate 30 of the tapering guide, and returns over a pulley, 29, to another returning-pulley. (Not shown.) Such tapes, nipping the material between them, will operate to carry the same through the folder and introduce the doubled leading edge of the same to the fold-laying devices 60 50, which, if rollers, will continue the feed; but this tape 26 need not bear upon the material beyond the guiding-edge 81, as is exemplified in Fig. 14.

If the apparatus is to fold long webs, the fold-laying device may be a roller, 50 or 60, or a rigid bar, preferably with rounded edge; but in the use of a single device, of course, a pair of nipping feeding-rollers will have to be placed in advance of the fold-laying device to insure the onward travel of the web. In the case of short sheets it will be desirable to use the rollers 50 60 as fold-laying devices, since they will also operate as feeding devices.

The internal guide in Figs. 6 and 7 is shown as supported by arms 25, that are bolted to cross-bars 31 of a frame-work, and the pulley 28 is shown with a shaft journaled in knees 24, secured to the internal guide. The pulley 29 will be supported in an arm properly secured to some part of the frame-work in a common manner.

The function of the tapes 27 26 (the latter being omitted for clearness of illustration in Fig. 8) is to nip the central portion of the web introduced into the folder, and thus aid in carrying its leading edge onward, thereby facilitating the operation of threading the apparatus, as well as facilitating its onward travel during the folding operation.

In practice it has sometimes been found that the formation of a longitudinal fold by passing a web or sheets over an internal guide, whereby the sides of the sheet or web are brought together, causes the central part of the web or sheets, while stretched in a true plane between the guiding or turning edges or surfaces 21 41, to have a tendency to wrinkle, to overcome which and insure a carrying hold between the upper and lower tapes I have provided the internal guide with a centrally-raised surface, 80. (See Figs. 9, 11, 12.) This raised portion may be formed by a solid portion of the plate 20, as in said figures; or it may be formed,

where the guiding edges or surfaces 21 41 are not connected by a continuous surface, as 20, by raising the path of travel of the central tapes or by a simple bar, the function to be performed being the raising of the central portion of the web or sheet, so that it shall travel in a plane slightly higher than that in which the major portion of the opposite sides of the web or sheets travel. In practice, however, it has been found that a number of tapes arranged to support the web at various points of its width greatly facilitate the travel of the web, and where it is printed upon prevents its freshly-printed surfaces from being smirched.

In Figs. 9, 10, and 12 these under tapes consist, in part, of a central pair, (marked 27,) which, although duplex, are in effect but a duplication of the tapes 27, shown in the preceding figures and in Figs. 13 and 14, as are their pulleys 28. Their companion tapes 33 34 35 36 are arranged at proper points to underlie the web and support it throughout its width, and they run, respectively, over pulleys 46, 47, 48, and 49, that are journaled in hangers which depend from the under side of the plate 20. In connection with these tapes it is desirable to use a pair, 26, (shown in dotted lines in Fig. 9,) running over pulleys 29, and operating, as does the tape 26 in Fig. 6, to insure a perfect run. The tapes 33 34 35 36 may be more or less in number, according to circumstances.

In Fig. 12 the guiding edges or surfaces 21 41 are shown as formed of a thick body, made continuous with the connecting-body 20 by casting. Practically it is preferable to form these guiding-surfaces 21 41 of metal bars, and to make the body 20 of sheet metal. Both may, however, be made of wood, or the former of metal and the latter of wood. Whatever the material may be, the raised portion 80 may be integral with the body 20 or applied separately, and it should vanish as the guide 81 is approached and at its rear end, as shown in Figs. 9 and 11, thus forming a bearing that is slightly curved longitudinally.

In Figs. 9 and 10 (and also in the case of the structures shown in Figs. 1 and 12) the top plate or body 20 of the internal guide is shown as terminating just in advance of a line drawn through the centers of the external turners, 22 44, and its extremity or nose should be turned down, as hereinbefore explained. The top plate of the tapering guide or extension between said turners and the fold-forming devices is also omitted, as are the side plates, 40 and 70. In place of said side plates, 40 and 70, a number of flat bars, 53 54 55, duplicated on opposite sides, (see Figs. 9, 10, and 12,) are provided. The side bars 53 54 simply steady and prevent displacement of the sides A B of the material, and the bars 55 form the creasing-edge, hereinbefore alluded to, but particularly hereinafter explained. These side bars are secured to a rod, 68, that supports the pulleys 28 and also the forward end of the internal guide, and is attached at its rear end to the frame

69 by means of nuts, as appears in Fig. 10. All of these bars may be omitted, yet they serve, as do the side plates, 40 and 70, to prevent interference with the proper run of the material to the fold-completing devices 50 60. The front bars, 55, like the side plates 70 and the top plate 30, are inclined outward, as appears in Fig. 10, so as to follow the line assumed by the material as its sides approach each other in the formation of the fold.

In the folding of short sheets it is necessary to provide sufficient tapes to guide the leading edge forward and to compel the sides of each sheet to bend over the guiding-surfaces 21 41, and pass over the inside surface of the external turners, 22 44; and it is now to be remarked that although these outside tapes are alone shown in Figs. 13 and 14, it is to be understood that they may be applied to any of the other constructions of folder herein described, or to any equivalent construction.

It has been intimated that the internal guide is essentially formed of the guiding surfaces or edges 21 41. A practical embodiment of the folder having such an internal guide is shown in Figs. 13 and 14, which will now be described. These guides consist of bars 21 41, joined together at their converging ends by a head, 51, and supported at their diverging ends by a base bar or rod, 61, which bar or rod and the bar or rod 68 are supported from a suitable frame-work of the machine. The base 19 of the internal guide finds its equivalent in the pulleys 99. In this embodiment the side bars 55 and side plates 70 and top plate 30, forming an extension of what has been called the "conformator," have as an equivalent protection device a central plate, 66, that extends from the head 51, and projects angularly forward nearly to the nipping or central point between the fold-laying devices 50 60, and forms a fold-creasing device. It is preferably pivoted, as at 6, in the head 51, it being considerably pressed outward by the spring 7.

The under tapes and their pulleys shown and described with reference to the construction shown in Figs. 6, 7, 9, and 10 are embodied herein, as is shown by the letters of reference repeated in these figures, the pulleys 46, 47, 48, and 49 being shown as mounted in hangers supported by the rod 61. Of the outside tapes shown, the central one, 26, like its counterpart in the other figures, runs in contact or co-operation with the under tape, 27, and returns over a pulley, 29, in this instance mounted in a hanger, 59, adjustably supported on a shaft, 57, (see Fig. 14,) and in this case the rear returning-pulley, 58, is also shown. (See Fig. 13.) The remaining upper tapes, 11 13, are arranged as follows: The tapes 11, duplicated on opposite sides of the center, respectively co-operating with the tapes 33 36, (see Figs. 9, 10, and 12,) run from pulleys 15, pass over pulleys 99, from which they are stretched in contact with the said tapes 33 36, run over the

guiding-edges 21 41, over external turners, 22 44, and, returning around the fold laying or completing devices 60 50, pass over pulleys 71 and 72 to the pulleys 15. The tapes 13, in like manner duplicated on opposite sides of the center, respectively co-operating with the tapes 34 35, run from pulleys 16, pass over pulleys 99, from which they are stretched in contact with the said tapes 34 35, run over the guiding-edges 21 41, over the external turners 22 44, and return over the fold-completing devices 60 50, and pass over the pulleys 73 74 to the pulleys 16.

With any one of the structures of this folder there may be combined a slit, 175. (See Figs. 10 and 14.) It is preferably mounted in an adjustable arm extending from the rod 57, but may be hung in any approved manner, so as to slit the material when partially folded, being made to cut upon a bearing-surface upon the folder, or by running in a groove in the folder, as may be preferred.

The creasing device, which has hereinbefore been spoken of as constituted by the plates 70, united by a top plate, 30, as in Figs. 6, 7, and 8, by the plates 55, as in Figs. 9, 10, and 12, and by the elastically-seated plate 66, as in Figs. 13 and 14, simply extends its forward end to the place where the fold *a* should be regularly formed, and, especially with two or more plies of material, is useful not only to aid the formation of such fold, but by the upper edge of its body operating to prevent the central portion, C, of the material from sagging down, and thus inducing wrinkling. Any of these forms or a structure performing equivalent functions will be embraced by this branch of the improvements.

It has been said that the angular guiding-edges 21 41 are essentials, and it has been stated that the guiding-edge 81 of the internal guide forms a bearing-surface upon which the central portion, C, of the material rests for a support as it leaves the internal guide. This guiding-edge 81 is especially useful, and while it is to be remarked that it may be a straight line or slightly curved, it is to be observed that it may be omitted without affecting the efficiency of the folder. Thus, instead of the internal guide being constructed so as to provide this guide at or near a line drawn through the centers of the turners 22 44, its surface may be depressed or cut away at that point, and the last bearing of the central portion, C, of the material be found on some line, either straight or curved, and positioned some distance to the rear of said turners, or in the case of the structure of the guiding-edges 21 41, (shown in Fig. 13,) be constituted solely by the support they afford, when extended to have contact with the material up to the point where the major portion of its sides A B naturally leaves them in being stretched over the external turners, 22 44.

Variations of the angular relation of the fold-laying device with respect to the internal guide may be made and the present inventions

be involved—such, for instance, as are contained in the following United States Letters Patent, viz: No. 233,997, dated November 2, 1880; No. 240,235, dated April 19, 1881; No. 259,979, dated June 20, 1882, and No. 276,672, dated May 1, 1883.

The angular guiding surfaces or edges 21 41 may sometimes be omitted when handling paper or cloth in the web, but in that case the guiding-edge 81 will be retained. In some instances the turners 22 44 may vary from parallelism and occupy coequal angles of divergence from a central line.

The spring-seated fold-creasing device may be combined with any of the forms of longitudinal folders illustrated in the aforesaid patents.

In all of the forms shown and described the external turners, 22 44, and the fold completing or laying devices 50 60, are shown as arranged in a horizontal position, and the turnlag or guiding edges 21 41 as arranged at an angle of about forty-five degrees thereto, and this is the preferred arrangement. The external turners and the fold-completing device may, however, be arranged in a different position, and the angle of the guiding-edges of the internal guide may be varied widely without departing from the invention.

What I claim is—

1. A longitudinal folder consisting of an internal guide, two external turners set a distance apart, and a fold-laying device, substantially as described.

2. In a longitudinal folder, the combination, with an internal guide, of two external turners set a distance apart, whereby the major portions of the sides of the material, considered widthwise, are brought into parallel positions, but not into contact, substantially as described.

3. A longitudinal folder consisting of an internal guide having converging guiding edges or surfaces which do not meet, external turners set a distance apart, and a fold-laying device, substantially as described.

4. In a longitudinal folder, the combination, with an internal guide having converging guiding edges or surfaces that do not meet, of co-operating external turners set a distance apart, whereby the major portions of the sides of the material, considered widthwise, are brought into parallel positions, substantially as described.

5. A longitudinal folder consisting of an internal guide having converging guiding edges or surfaces that do not meet and a guiding-surface, as 81, connecting the same, external turners, and a fold-laying device, substantially as described.

6. In a longitudinal folder, the combination, with an internal guide having two converging guiding edges or surfaces that do not meet and a guiding-surface, as 81, connecting the same, of external turners, whereby the major portions of the sides of the material, considered widthwise, are brought into and sup-

ported in parallel positions and the central portion at right angles thereto, substantially as described.

7. In a longitudinal folder, the combination, with external turners set a distance apart, and by which the major portions of the sides of the material, considered widthwise, are brought into and supported in parallel positions, but not in contact, of a cross-support, as 81, between said turners for the central portion of the material, and a fold-laying device for distending the central portion of the material and bringing the sides into contact to complete the folding, substantially as described.

8. The combination, with external turners set a distance apart, of a fold-laying device and a fold-creasing device, substantially as described.

9. The combination, with an internal guide and external turners operating to support the major portions of the sides of the material, considered widthwise, in parallel positions, but not in contact, of a fold-laying device operating to bring said sides together, and a fold-creasing device for distending the central portion of the material and aiding the formation of the fold-line, substantially as described.

10. The combination, with an internal guide having converging guiding surfaces or edges and a guiding surface or edge, as 81, connecting the same, of external turners, a fold-laying device, and a fold-creasing device, substantially as described.

11. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and a supporting-body, 20, of external turners, 22 44, set a distance apart, substantially as described.

12. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting-sides 40, of external turners, 22 44, set a distance apart, substantially as described.

13. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41, supporting-body 20, and sides 40, of external turners, 22 44, set a distance apart, substantially as described.

14. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and a supporting-body, 20, of external turners, 22 44, substantially as described.

15. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and supporting-sides 40, of external turners, 22 44, substantially as described.

16. A longitudinal folder, consisting of the combination, with an internal guide composed

of a sheet or plate that provides the guiding edges or surfaces 21 41 81, a supporting-body, 20, and sides 40, of external turners, 22 44, substantially as described.

17. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and a supporting-body, 20, of external turners, 22 44, set a distance apart, and a fold-laying device, substantially as described.

18. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting-sides 40, of external turners, 22 44, and a fold-laying device, substantially as described.

19. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting body 20 and sides 40, of external turners, 22 44, and a fold-laying device, substantially as described.

20. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and a supporting-body, 20, of external turners, 22 44, and a fold-laying device, substantially as described.

21. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and supporting-sides 40, of external turners, 22 44, and a fold-laying device, substantially as described.

22. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81, a supporting-body, 20, and sides 40, of external turners, 22 44, and a fold-laying device, substantially as described.

23. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and a supporting-body, 20, of external turners, 22 44, and a fold-creasing device, substantially as described.

24. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting-sides 40, of external turners, 22 44, and a fold-creasing device, substantially as described.

25. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting-body 20 and sides 40, of external turners, 22 44, and a fold-creasing device, substantially as described.

26. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and a supporting-

body, 20, of external turners, 22 44, and a fold-creaser, substantially as described.

27. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and supporting-sides 40, of external turners, 22 44, and a fold-creaser, substantially as described.

28. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81, a supporting-body, 20, and sides 40, of external turners, 22 44, and a fold-creaser, substantially as described.

29. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and a supporting-body, 20, of external turners, 22 44, and a fold-laying device and a fold-creaser, substantially as described.

30. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting-sides 40, of external turners, 22 44, and a fold-laying device and fold-creaser, substantially as described.

31. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the converging guiding edges or surfaces 21 41 and supporting-body 20 and sides 40, of external turners, 22 44, and a fold-laying device and fold-creaser, substantially as described.

32. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and a supporting-body, 20, of external turners, 22 44, and a fold-laying device and fold-creaser, substantially as described.

33. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81 and supporting-sides

40, of external turners, 22 44, and a fold-laying device and fold-creaser, substantially as described.

34. A longitudinal folder consisting of the combination, with an internal guide composed of a sheet or plate that provides the guiding edges or surfaces 21 41 81, a supporting-body, 20, and sides 40, of a fold-laying device and fold-creaser, substantially as described.

35. The combination, with a longitudinal folder consisting of an internal guide, external turners, and a fold-laying device, of a spring-seated fold-creasing device, substantially as described.

36. The combination, with the internal guide having the converging guiding surfaces or edges 21 41 and external turners set a distance apart, of the body-tapes 33 34 35 36 and 11 13, substantially as described.

37. The combination, with the internal guide having the converging guiding surfaces or edges 21 41 and external turners set a distance apart, of the tapes 26 27, substantially as described.

38. The combination, with the internal guide having the converging guiding surfaces or edges 21 41 and external turners set a distance apart, of the tapes 26 27 33 34 35 36 and 11 13, substantially as described.

39. The combination, with the internal guide having the converging guiding surfaces or edges 21 41 and external turners set a distance apart, of the slitter 175, substantially as described.

40. The combination, with external turners, of an internal guide having a raised surface, 80, or its equivalent raised tapes, substantially as described.

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

LUTHER C. CROWELL.

Witnesses:

T. H. PALMER,
J. A. HOVEY.