2 Sheets—Sheet 1.

# L. C. CROWELL.

## PAPER-FOLDING AND DELIVERING MACHINE.

No. 188,779. Patented March 27, 1877.

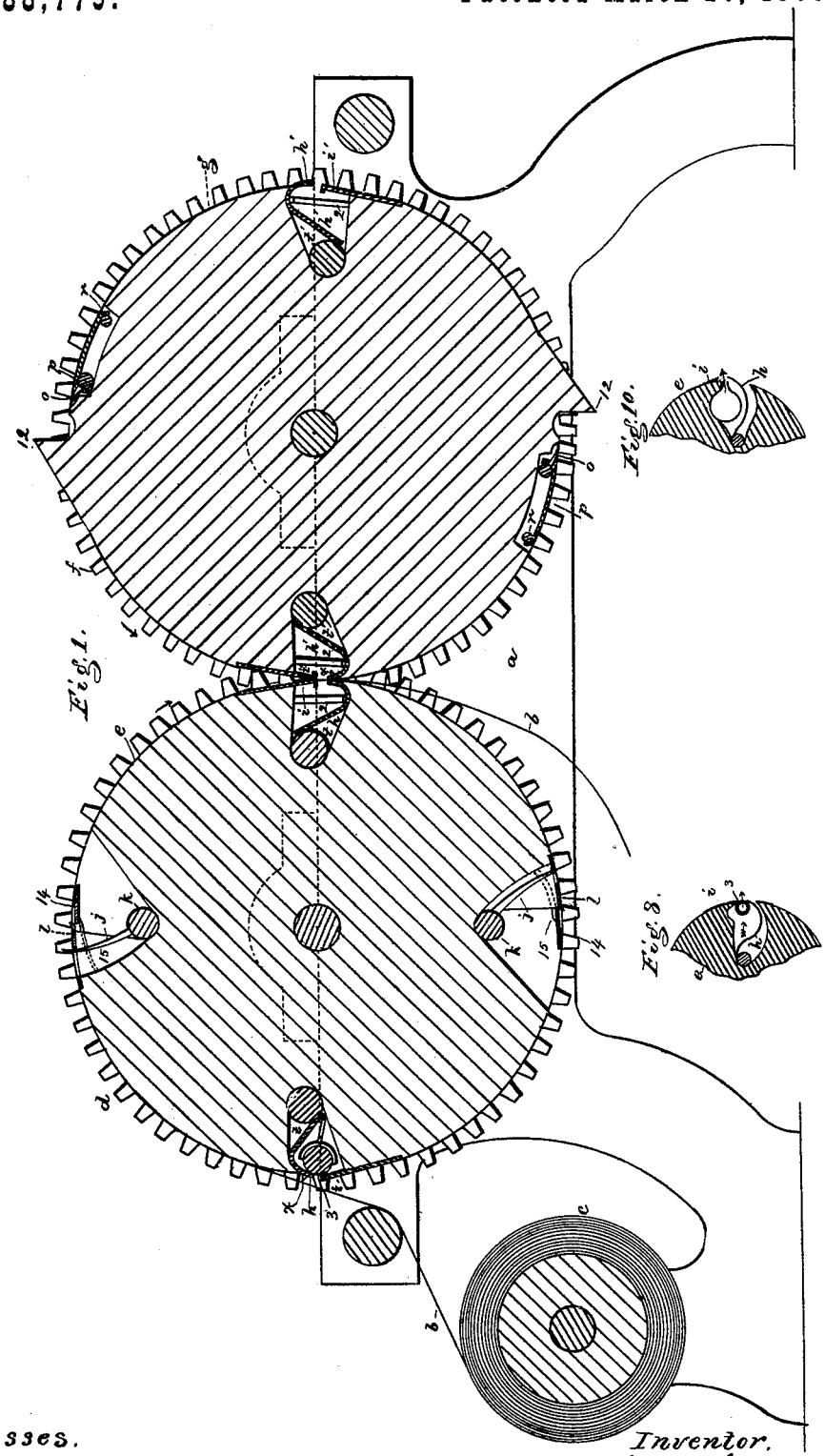

Fig. 1.



Fig. 10.



Fig. 8.

Witnesses.
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2 Sheets—Sheet 2.

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## PAPER-FOLDING AND DELIVERING MACHINE.

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Fig. 2.

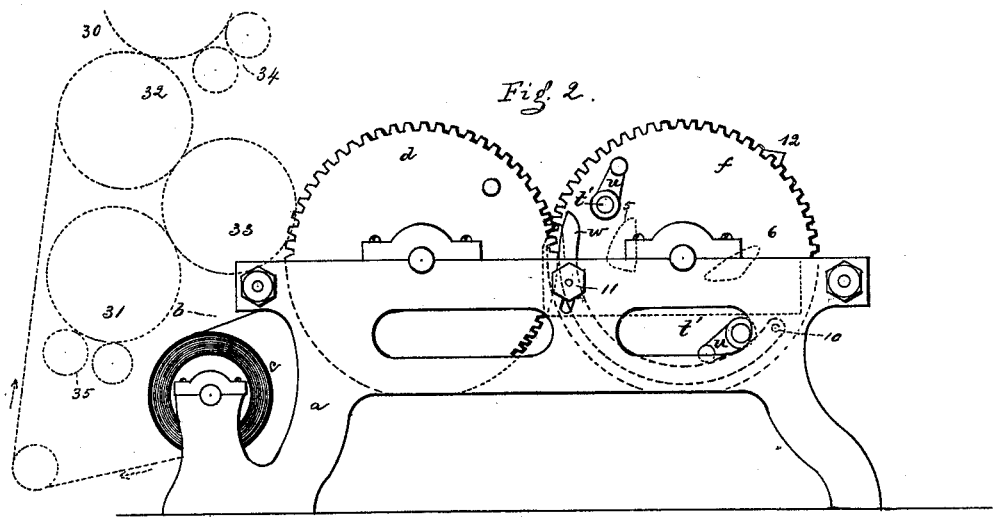



Fig. 3.

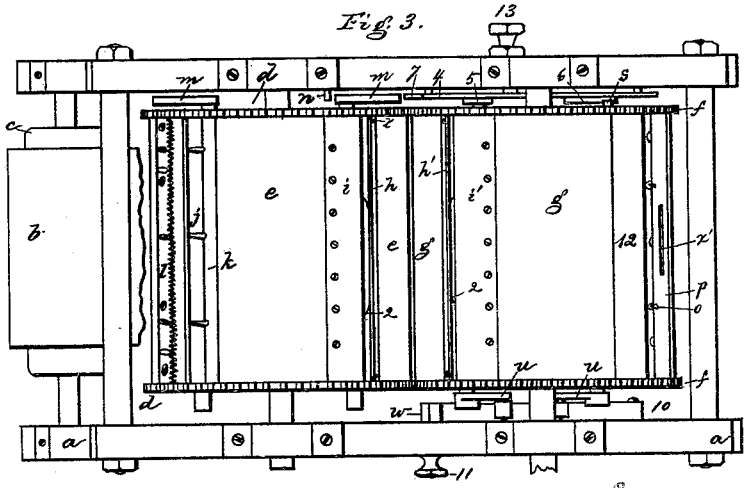



Fig. 4.

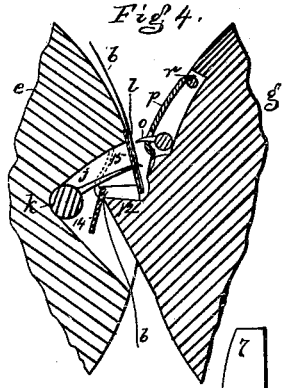



Fig. 5.

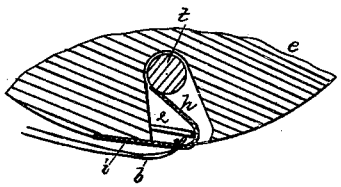



Fig. 6.

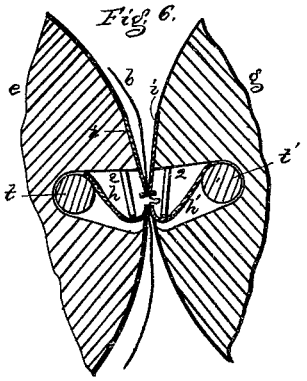
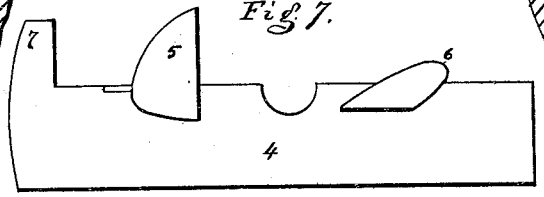



Fig. 7.




Witnesses.
E. C. Perkins
W. J. Pratt.

Inventor.
Luther C. Crowell
per Crosby & Gregory Attys.

# UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN PAPER FOLDING AND DELIVERING MACHINES.

Specification forming part of Letters Patent No. **188,779**, dated March 27, 1877; application filed January 31, 1877.

*To all whom it may concern:*

Be it known that I, LUTHER C. CROWELL, of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improved Paper Folding and Delivering Machine for Printing-Presses, of which the following is a specification:

This invention relates to mechanism for folding or manipulating paper issuing from a printing-press wherein the paper being printed is supplied from a roll, such presses being known as "perfecting" or "web" presses.

This invention has particular reference to the delivery portion of the press, it being adapted to deliver the sheets of paper severed from the web, either straight or folded.

It is customary, in folding a sheet of paper or a newspaper, to employ a blade to introduce the paper between rollers or jaws that complete the fold.

The object of this invention is to dispense with the usual folding-blade.

In this invention two cylinders are employed, they carrying severing and paper-holding mechanism, and devices to gather or pucker the web transversely, such gathered portion of the web thrown or bulged from one cylinder into or between the jaws of the other cylinder being caught, held, and carried to the proper place for delivery.

The invention consists in the combination, with a rotating cylinder, a movable jaw, and a nipping-surface contiguous thereto, of a second cylinder, provided with surfaces to cooperate with the movable jaw, and nipping-surface of the first cylinder, to nip or hold the paper on two lines parallel with each other, and transversely with relation to the length of the web, whereby, by moving the face of the jaw relatively to the surface of the moving cylinder, the paper between the lines where it is held transversely is gathered or puckered transversely of the web or sheet without the assistance of a blade.

I prefer to employ on each cylinder a movable jaw, and a fixed opposing or nipping surface, it acting as the stationary member opposed to the jaw. The nipping-surface is, however, free to yield somewhat toward the center of the cylinder when pressed upon by its counterpart upon the other cylinder. As the cylinders revolve the movable jaws first engage the web of paper transversely and simultaneously on its opposite faces, and then the nipping-surfaces, parallel therewith and contiguous thereto, meet the opposite faces of the web and grasp it transversely, the web being then held at two points or lines parallel each with the other.

In this condition the movable jaws are simultaneously moved with relation to the surface of the cylinder by means of suitable cams or cranks, such movement causing the portion of the web held between the opposing jaws of the two cylinders to be carried toward that portion of the paper held between the opposed nipping-surfaces of the two cylinders, and the paper held between the jaws and nipping-surfaces is gathered or puckered transversely of the web, thereby bulging or forcing it from the curve of the cylinder about which it is passing into an opening or space parallel with the axis of the cylinder, where, by the movement of a jaw, it is grasped, held, and carried to the place of delivery.

This invention is an improvement on the class of folding mechanism shown in my Patent No. 143,674, October 14, 1873, and on that shown in United States Letters Patent No. 186,308.

In connection with the mechanism herein shown, I may use the mechanism shown in the last-mentioned patent to form the second and other subsequent folds in the paper; or may substitute the nipping mechanism herein shown for the blade, which gives the third fold in said patent; or may use other well-known delivery and folding apparatus to form the second and subsequent folds in the newspaper.

Figure 1 represents, in transverse section, sufficient of this improved folding or delivery mechanism to explain its operation and connection with a perfecting or web press; Fig. 2, a side view thereof; Fig. 3, a top view; Fig. 4, an enlarged detail of the paper-holding device, the machine being adapted to deliver unfolded sheets; Fig. 5, an enlarged detail, showing a sheet held between the jaw and nipping-surface; Fig. 6, an enlarged detail, showing the jaws and nipping-surfaces just as they have puckered or gathered the web

transversely, the gathered portion being shown as projected into the opening made in one cylinder and between a jaw and nipping-surface. Fig. 7 represents a detail of the cams employed when the cam operating the nipping mechanism is out of contact to operate the holding devices, so as to pass the end of the sheet from one to the other set of pins; and Figs. 8 and 10 are modifications to be referred to.

It has been considered unnecessary to show the press-cylinders. They may be of any usual or desired construction common to perfecting or web presses.

The frame-work *a* may be of any proper shape to sustain the working parts. To illustrate the operation of the invention the web of paper, *b*, to be folded is shown as contained upon a roll, *c*. In practice, such web will issue printed upon both sides from the press, and the toothed wheel *d* of cylinder *e* will be driven, preferably, from a toothed wheel on the shaft of the usual blanket or impression cylinder. The toothed wheel *d* engages the toothed wheel *f* upon and operates cylinder *g*. Cylinder *e* is shown as provided with two sets of jaws, *h*, and nipping-surfaces *i*, and the cylinder *g* with two corresponding sets of jaws, *h'*, and nipping-surfaces *i'*. The cylinder *e* has two sets of holding devices, composed of pins or hooks *j*, adapted to penetrate the paper, and be withdrawn therefrom at the proper time by the action of a rocking or other shaft, *k*, or other suitable operating device. The pins *j* of cylinder *e* are protruded through openings in the member *l* of the web severing or cutting devices to engage the web, or are withdrawn to free the paper or web, by the action of the shaft *k*, it being provided with an arm, *m*, which, at each revolution of the cylinder, meets a stud, *n*, that rocks the shaft and withdraws the pins from the paper, a suitable spring returning the pins through the slots or holes in the plate *l*. The cylinder *g* has holding devices, consisting of a shaft with pins *o* extended through holes in a pivoted plate, *p*, having attached to its shaft or axis *r* an arm provided with a stud, *s*. The normal position of this plate *p* is as represented in Fig. 1, when the paper is being delivered folded, it then being held down by a suitable spring connected therewith, or with the shaft of the plate or its arm. The printed web, after passing the type-cylinder, is impaled on the pins or hooks *j*, and by them carried forward and wrapped about the cylinder *e*. When the cylinder *e* reaches the position shown in Fig. 1, the arm *m* (see Fig. 3) of the rock-shaft *k* meets the stud *n*, and moves the rock-shaft and hooks or pins, and causes them to be withdrawn from the web, as represented at the lower side of the cylinder *e*, Fig. 1. In this position the free end of the web is discharged from the hooks.

The jaw *h'* of the folding mechanism of cylinder *g* is curved at its outer face, is made of spring metal, and is attached to a rock-shaft, *t'*, provided with an arm, *u*, adapted to be operated by a cam, *w*, pivoted at 10, and made adjustable, so as to operate or not operate the arm, and, consequently, the jaw, by means of a set-screw, 11. The jaws of cylinder *e* are constructed as described of the jaws of cylinder *g*, except that the arm *u* is dispensed with, and that the face of each jaw has a pin or pins, *x*, (see Fig. 1,) to enter a corresponding hole in the jaw of cylinder *g*. The nipping-surfaces *i i'* are flat smooth surfaces. The end of each jaw is held pressed away from the ends of the plates of the nipping-surfaces by means of a suitable spring, 2. The rounded outer surfaces of the jaws *h h'* project far enough to keep up the circle of the peripheries of the cylinders *e g*, and, preferably, they will extend a little beyond the peripheries of their carrying-cylinders, so that the jaws, when they meet opposite sides of the web, will engage it firmly, the jaws then yielding a little toward the center of the cylinder. The jaws first grasp the web transversely of its length, and in the further movement of the cylinders the nipping-surfaces *i i'* also engage opposite sides of the web at a short distance from the jaws, and hold the web transversely and parallel with the point or line at which the jaw held the web. Fig. 1 shows the jaws and nipping-surfaces in this position. Further movement of the cylinders from the position shown in Fig. 1 in the direction of the arrows will cause the arm *u* to strike cam *w*, the jaws will be made to approach the nipping-surfaces, and in so doing will carry the web at the point grasped by the jaws toward the end of the nipping-surfaces, they also firmly holding and grasping the web transversely. This movement of the jaws and paper toward the nipping-surface will, it is obvious, cause those portions of the paper between the lines at which it is held by the jaws and nipping-surfaces to bulge out or pucker, as shown at Fig. 6, and the gather or pucker so formed will enter the space in the cylinder *g* between the jaw *h'* and nipping-surface *i'*, when it will be grasped and held by the jaw so long as the arm *u* of the jaw is operated upon by the cam *w*. The paper so grasped will be folded transversely without the use of a blade, and, held by the jaw, will be carried by the cylinder *g* until released from the jaw by the action of the spring 2.

Assuming that the jaws, Fig. 1, are about to be operated to form a transverse fold, as described, after such fold is formed the folded part of the paper will be held and carried by the jaw of cylinder *g* until the member 12 of the severing mechanism meets and passes the serrated edge of the member *l*, when the web will be severed and the paper held at its folded part by the jaws will be carried forward until the jaw is made to release and discharge it on a suitable support below the cylinder.

Each cylinder may be provided with two or more sets of jaws, severing, holding, and nipping mechanism. By employing pins *x* on

the jaws *h* to enter openings in jaws *h'*, it is possible to operate both jaws in unison by operating only the shafts *t'* in the cylinder *g* positively; but it is obvious that the shaft of each jaw might be operated by an arm and cam and spring, or positively by a grooved cam, and it is also obvious that the pins might be upon jaws *h'* and the holes in jaws *h*.

In Fig. 1 the jaw and nipping-surface at the left of cylinder *e* have placed between them a spring-supported surface, 3, shown as a curved surface, to keep up the circle or periphery of the cylinder *e* when the jaw is moved back from the nipping-surface.

This surface 3 is not necessary for the successful operation of the folding mechanism; but it may be employed, if desired, to prevent the possibility of the transverse gather in the paper entering the space between the jaw and nipping-surface, of which it forms a part. This surface 3 will preferably be grooved transversely, or be made as a hollow roller, filled with holes to admit the passage of air, so that a vacuum cannot be formed near it to act to hold the paper in contact with cylinder *e*.

If desired, a blast of air, created in any proper way, may be introduced into the roller or pipe, (see Fig. 8,) and be discharged against the paper opposite the space between the jaws and nipping-surfaces, or into the recess in the cylinder *e*, containing the jaws, to assist in bulging out the paper from the cylinder *e* into the space between the jaw and nipping-surface of cylinder *g*.

When it is desired to deliver the sheet without a fold the cam *w* will be moved out of operative position, and the frame 4, (see Figs. 3 and 7,) carrying the cams 5, 6, and 7, will be moved toward the cylinder *g* by means of any suitable device, herein shown as a screw, 13. The cylinder *g* may be revolved, when cam *w* is lowered, without operating the jaws. As the cylinder *g* rotates, the rollers or studs *s* on the arms connected with shafts *r* strike the cams 5 6, causing the plates *p*, attached to the shafts, to be lifted, they thereby raising the pins or hooks *o*, so that they project or stand out more or less beyond the plate *p* and the periphery of the cylinder, and serve to bind the paper against the surface *l*. The edge of plate *p*, standing out from cylinder *g*, presses the severed end of the sheet against the cylinder *e*, thereby preventing its slipping back while being transferred from hooks *j* to hooks *o*. When delivering folded papers the hooks *j* hold the web until the hooks reach a position substantially as shown by the lower set of hooks of cylinder *e*, Fig. 1; but when the paper is being delivered unfolded the arm *m* of shaft *k* strikes cam 7, and the hooks *j* are withdrawn from the web just as the hooks *o*, lifted through the action of cam 5 and plate *p*, approach the web, as in Fig. 4. In this condition the hooks *o* enter the web and carry it around the under side of cylinder *g*. Each set of hooks *o* will enter the web of paper just back of the point where it is cut or separated by the severing devices *l* 12, and will hold the paper until the arm and roller or stud *s*, that operates the plate *p* of the set of hooks *o*, then engaging the web, meets cam 6, when the plate will be lifted far enough to completely remove the paper from hooks *o*.

To obviate any tendency of the paper to hug the periphery of the cylinder the plate *p* is provided with a slot, *x'*, through which air entering the space between the plate *p* and cylinder *g* will be discharged. The air, rushing through this slot and striking the paper, will assist its being detached from the cylinder. When a sheet is being delivered unfolded it is desirable to hold the back end of the sheet, carried by the pins *o* of cylinder *g*, during the operation of severing from the main portion of the web. To accomplish this the cylinder *e*, adjacent to each cutting member *l*, is provided with a spring-supported end-holding plate, 14, kept up by a spring, 15. (See dotted lines, Fig. 1.) The web is cut transversely by the members 12 and *l*, 12 acting to force the web past and below the serrated surface of *l*, the member 12 griping and holding the rear end of the severed sheet between itself and the end-holding plate, as at Fig. 4.

In case it were desired to construct a delivery mechanism to deliver the sheets unfolded, the circumference of cylinder *g* might be made to equal the length of three or more sheets, such as it may be desired to form from the web.

The ordinary blade used in folding-machines is liable to break the web when folding it. The jaws used with a folding-blade need an elastic or yielding covering, for in a rapidly-operating machine the metallic jaws, closing upon the blade, will otherwise frequently break the web.

The shape of the jaws *h h'* may be varied without departing from this invention, and, if desired, they may be operated by a grooved cam.

The invention, as herein represented, shows the jaws arranged to be moved opposite the direction of rotation of the cylinders, to gather the paper; but it is obvious that the nipping-surfaces might first engage the paper, as would be the case if the cylinders were turned backward, and that the jaws might have their motion accelerated after grasping the paper to carry it forward in the direction of rotation of the cylinders and toward the nipping-surfaces.

In this application I do not broadly claim the combination of folding and severing devices with the press, such combination being shown in an application now pending in the United States Patent Office.

The dotted lines in Fig. 2 represent the arrangement of printing and impression cylinders and inking-rollers. The cylinders 30 31 (the former only partially shown) are printing or type cylinders, 32 33 impression-cylinders,

and the rollers 34 35 are inking-rollers. In this arrangement the web would pass from 33 to the cylinder *e*.

To insure the delivery of the transverse bulge or gather made in the web to the jaw of cylinder *g*, an india-rubber tube, closed at its ends, provided with side openings, and placed with relation to jaw *h* of cylinder *e*, as shown in Fig. 10, may be employed. As the jaw is closed it will compress the tube and force the air outward between the jaw *h* and nipping-surface.

I claim—

1. The combination, with a rotating cylinder, its movable jaw and nipping-surface, of a second cylinder, provided with a jaw and nipping-surface to co-operate therewith, as described, to form a transverse gather across the web, and project the gather within the grasp of the jaw to fold the web without the employment of a blade, all substantially as described.

2. A rotating cylinder, a movable jaw, and nipping-surface, in combination with a second rotating cylinder, movable jaw, and nipping-surface, and with mechanism to operate the two jaws in unison to move the web of paper at the point grasped transversely by the jaws toward that portion of the web grasped by the nipping-surfaces, to form a transverse fold or gather, all substantially as described.

3. A rotating cylinder, a movable jaw, and nipping-surface, in combination with a yielding surface, 3, between the jaw and nipping-surface, to close the opening between the open jaw and nipping-surface, and prevent the transverse gather of the paper from entering between the jaw and nipping-surface, between which the surface 3 is located, all substantially as described.

4. A rotating cylinder and movable jaw, provided with an opening, in combination with a second rotating cylinder and movable jaw, provided with a pin to enter the opening in the opposing jaw, to insure the movement of the two jaws in unison, all substantially as described.

5. A rotating cylinder provided with a jaw and nipping-surface and web-holding hooks, in combination with a cylinder provided with a movable jaw, a nipping-surface, and with devices to close and open the jaw to grasp a gather formed transversely of the web, by positively carrying one portion of the web toward another portion thereof grasped by the nipping-surfaces, all substantially as described.

6. The cylinder, in combination with the set of hooks *o* and plate *p*, provided with a slot or opening, *x'*, substantially as described.

7. The combination, with two co-operating rotating cylinders, of mechanism to hold and carry the web forward, mechanism to form a transverse gather in the web by carrying one portion of the web grasped transversely by jaws toward another portion of the web grasped transversely by nipping-surfaces, and mechanism to sever the web, the mechanism being and to operate substantially as described.

8. In a delivery mechanism for a web-printing press, the combination, with two rotating cylinders, of jaws and web holding and carrying mechanism, and devices to operate them, to enable the same cylinders to either deliver a newspaper folded or straight, the mechanism being and operating substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
G. W. GREGORY,
S. B. KIDDER.