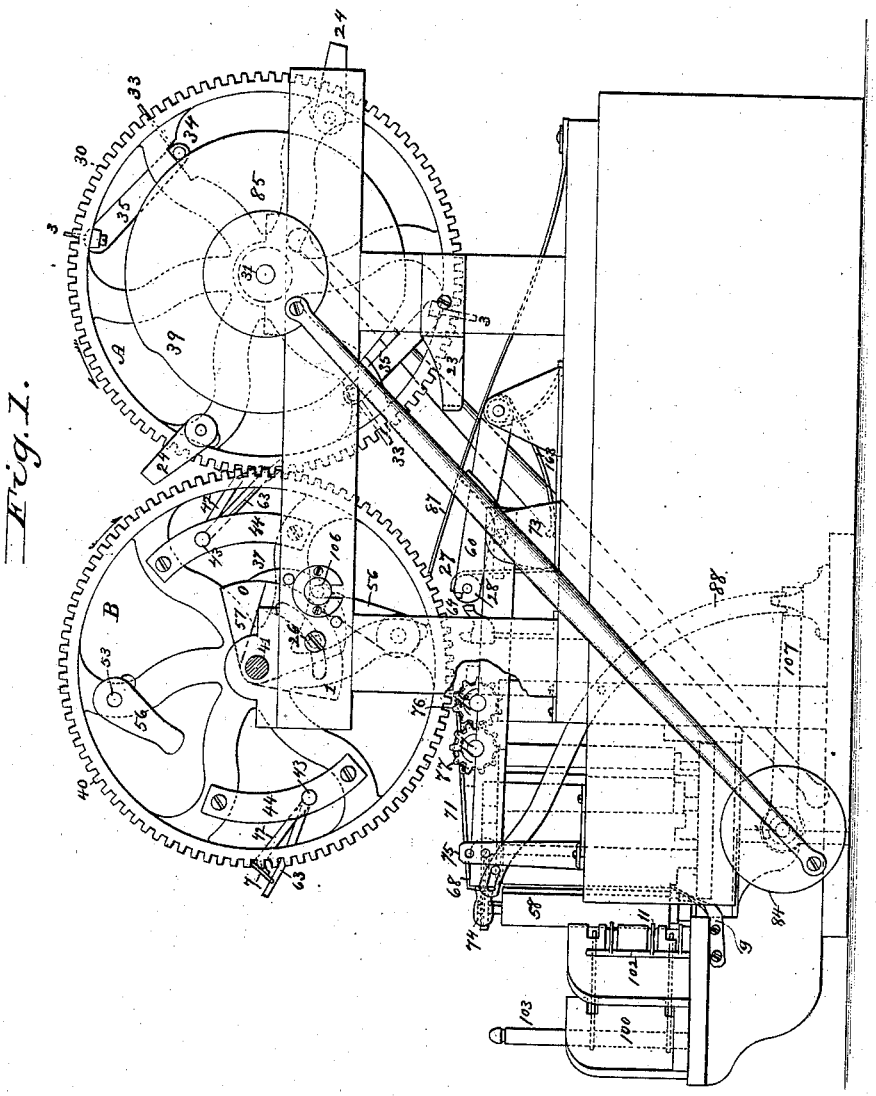
6 Sheets—Sheet 1.

L. C. CROWELL.

Sheet-Delivery Apparatus for Printing-Machines.

No. 217,071. Patented July 1, 1879.

Fig. 1.



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6 Sheets—Sheet 2.

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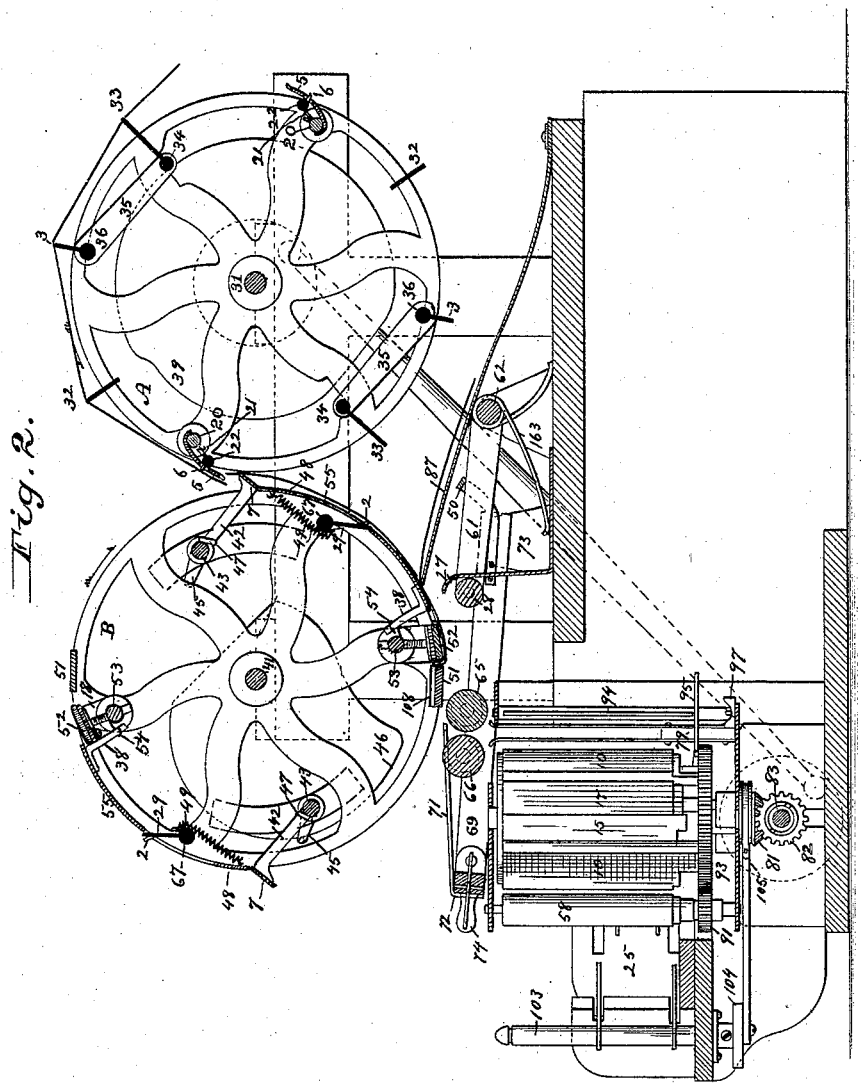
Sheet-Delivery Apparatus for Printing-Machines.

No. 217,071. Patented July 1, 1879.

Fig. 2.



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6 Sheets—Sheet 3.

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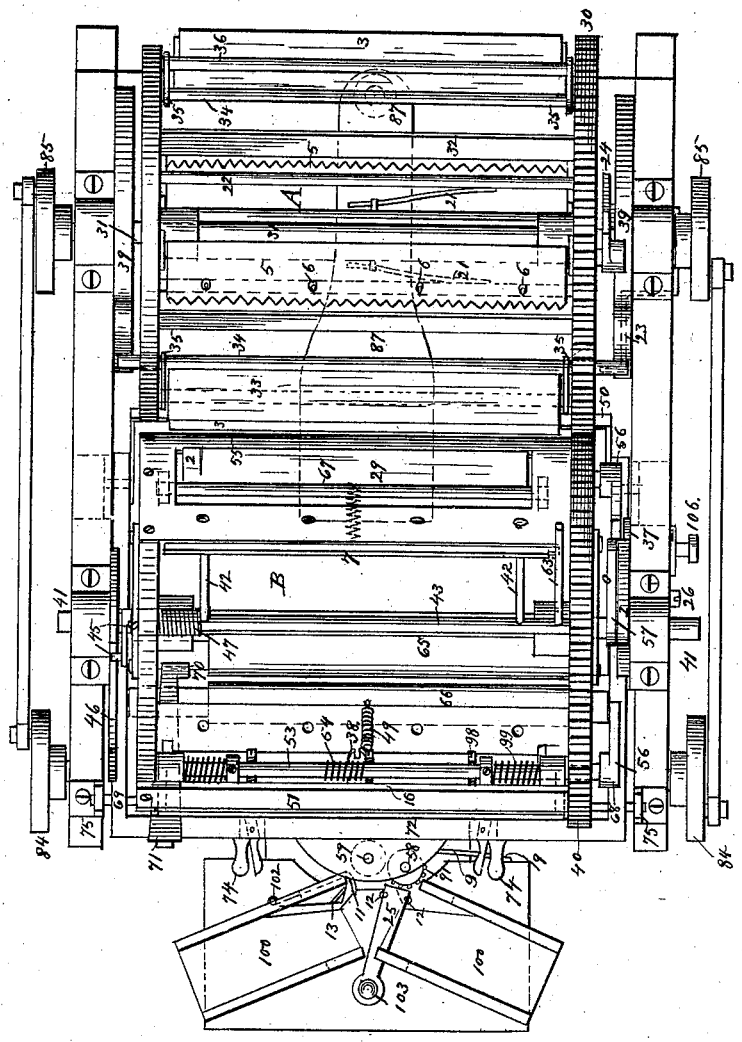
Sheet-Delivery Apparatus for Printing-Machines.

No. 217,071. Patented July 1, 1879.

Fig. 3.



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6 Sheets—Sheet 4.

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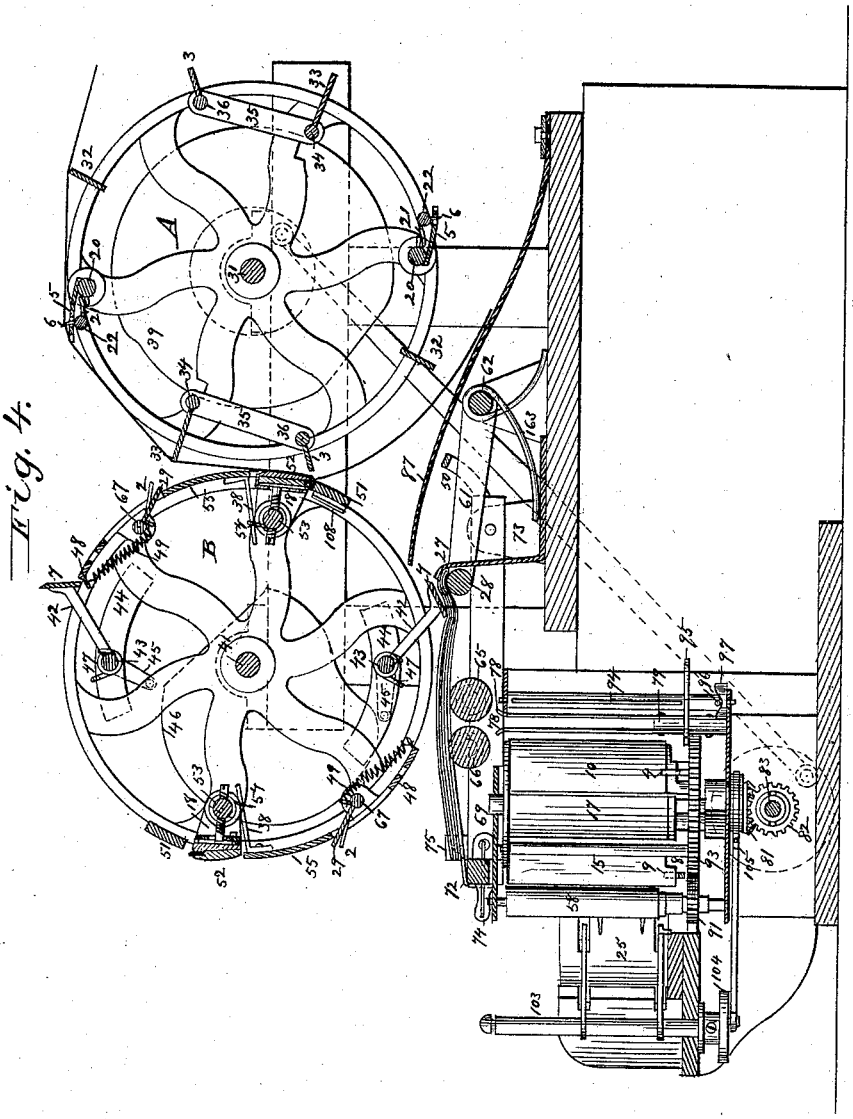
No. 217,071. Patented July 1, 1879.

Fig. 4.



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Sheet-Delivery Apparatus for Printing-Machines.

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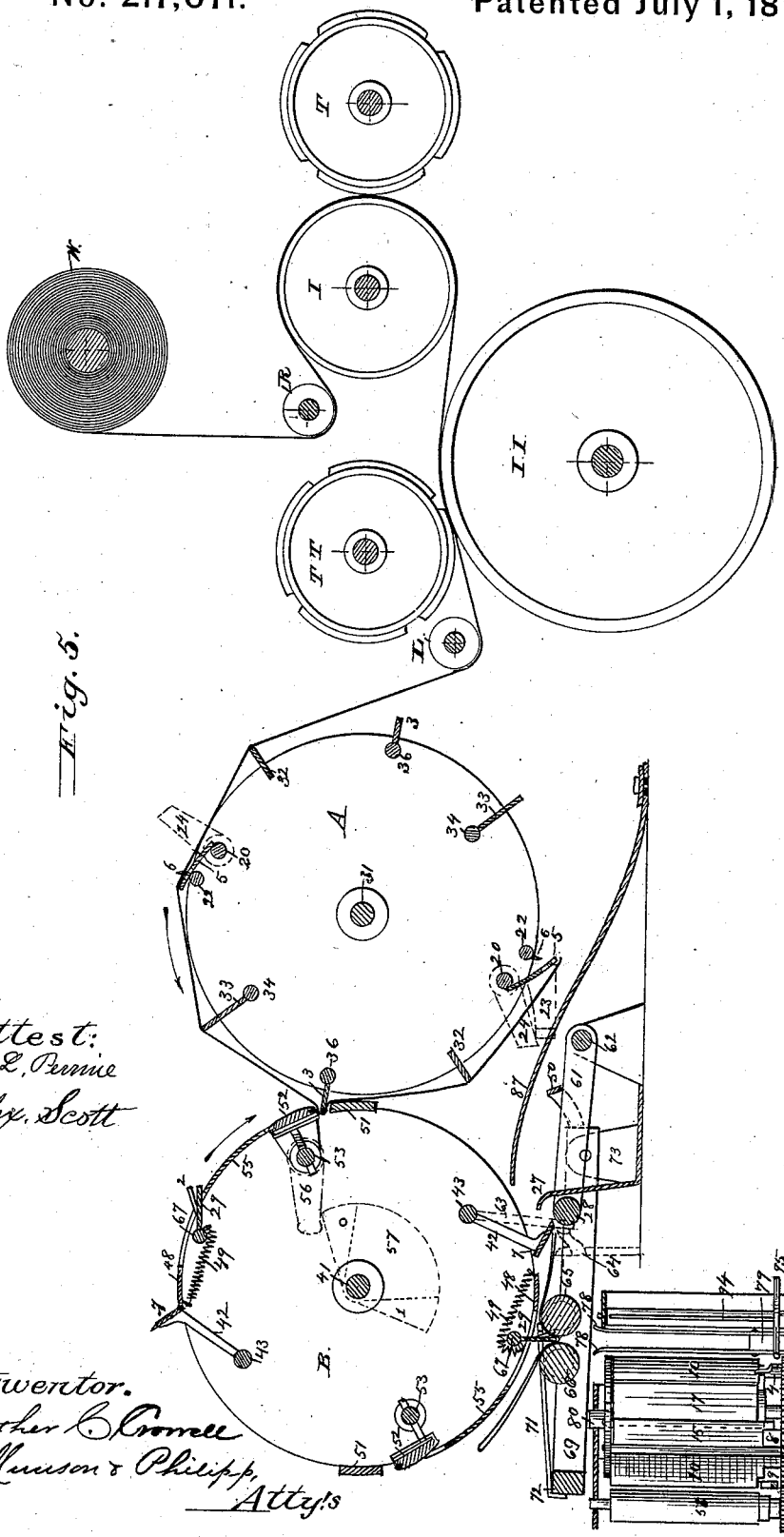

Fig. 5.

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Fig. 6.

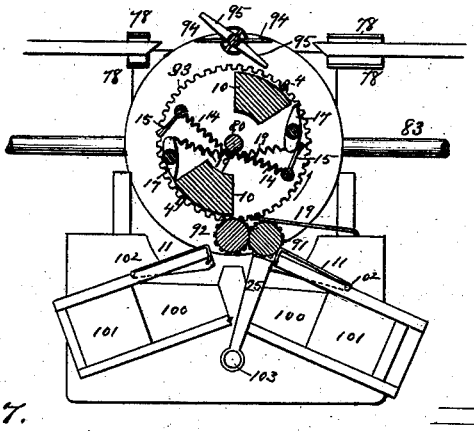


Fig. 7.

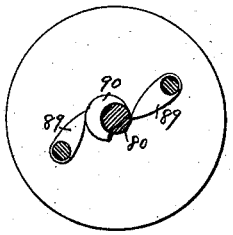


Fig. 9.

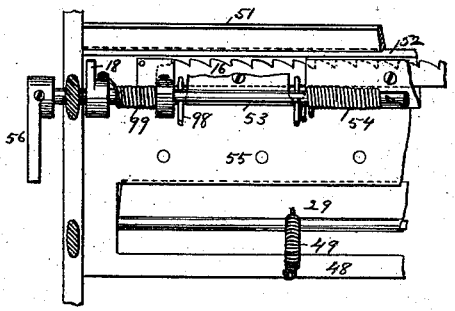
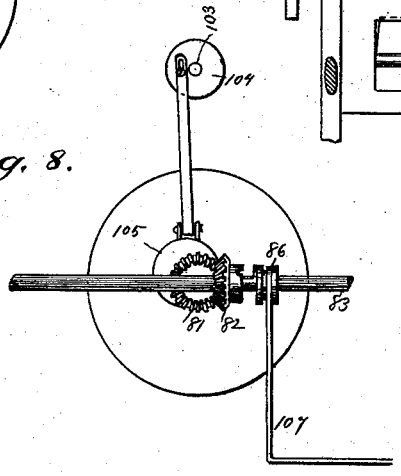


Fig. 8.



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UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BOSTON, MASSACHUSETTS, ASSIGNOR TO R. HOE & CO., OF NEW YORK CITY.

IMPROVEMENT IN SHEET-DELIVERY APPARATUS FOR PRINTING-MACHINES.

Specification forming part of Letters Patent No. **217,071**, dated July 1, 1879; application filed November 11, 1875.

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, of the city of Boston, county of Suffolk, and Commonwealth of Massachusetts, have invented certain new and useful Improvements in Sheet-Delivery Apparatus for Printing-Machines, of which the following specification, when taken in connection with the accompanying drawings, is such a full, clear, and exact description as will enable others skilled in the art to make and use the same.

In said drawings, Figure 1 represents a side elevation of my improved delivery apparatus; Fig. 2, a longitudinal sectional elevation; Fig. 3, a plan or top view; Fig. 4, a longitudinal sectional elevation with the mechanisms in the same positions as in Fig. 3; Fig. 5, a longitudinal sectional elevation, showing said delivery apparatus as combined with a web-perfecting printing-machine, and adapted to sever a web of paper passing therefrom into sheets, and to fold the same. Fig. 6 represents a cross-section taken through the vertical folding apparatus, Figs. 7 and 8 showing details of the same. Fig. 9 represents an enlarged detail view of the supplement cutting mechanism.

This invention relates to the means for delivering the product of web-printing machines, the mechanisms whereof being rotary in character are capable of operating at great speed. In such printing-machines a web or continuous length of paper led from a roll and passed once through the mechanisms is impressed or printed on opposite faces, and thus perfected, so that when cut or divided transversely perfect sheets having both sides printed will be constituted. In consequence of the great speed with which these machines operate, it is essential, in order to utilize their great capacity, that their delivery apparatus shall be capable of running at an equivalent speed, and operate to properly deliver the sheets as they are produced by the printing-machine. Such printing-machines are principally used in the production of newspapers, and the latter are almost universally folded one or more times for transportation or use, which folds are commonly accomplished by hand-labor or upon separate and slowly-operating hand-fed folding-machines.

It is therefore of the highest consequence, both as regards speed and cost of producing folded sheets, that their folds shall be imparted to them during the process of their production.

The object of my invention is not only to provide a rotating or web-perfecting printing-machine with a delivery apparatus capable of running at a speed equal to that of the printing-machine, but such a delivery apparatus also capacitated to impart to such sheets or newspapers one or more folds during the process of delivering them.

My invention consists in the combination, with a rotating mechanism for printing a web of paper and a severing mechanism for dividing the said web into sheets, of a rotating sheet-folding mechanism, and, in combination therewith, of a mechanism for controlling the severed end of the web and delivering it within the range of action of the folding mechanism.

It also embraces peculiar and novel structures in the folding apparatus, all of which will be hereinafter particularly described.

In order to a ready understanding of my invention, the structure and arrangement of the mechanisms will first be described, and then their operation upon a web of paper will be set forth.

The principal mechanisms of the delivery apparatus proper are supported by rotating cylinders or carriers A B, that are mounted upon parallel axes or shafts 31 41, and geared together by toothed wheels 30 40, which are mounted upon said shafts, the latter turning in suitable bearings of proper construction, provided in or attached to the frame-work.

The cylinder or carrier A is provided at opposite points with cutting-blades 5 5, preferably having serrated edges, which are hung so as to swing outward, being fixed upon shafts 20, that turn in the cylinder-heads. These cutting-blades, each of which constitutes one member of the web-severing mechanism, are held in their normal position, as in Fig. 3, by means of springs 21, that are fixed to rods 22, and bear underneath arms that project from the rear side of said blades. Said blades are swung outwardly at each rotation of the cylinder or carrier A by means of a tappet, 23,

attached to the side frame, with which rock-arms 24, carried by the blade-shafts 20, engage. These blades are perforated at proper points to pass over impaling-pins 6, that extend from the rods 22, which pins 6 thus project beyond the blades when they are in their normal positions. Equidistant from these cutting-blades 5, and at opposite points of the cylinder, it is provided with radially-projecting folding-blades 33, that are fixedly mounted by means of rods 36, that are secured in the heads of said cylinder or carrier.

Midway between the cutting-blades 5 and the folding-blades 3, and at opposite sides of said cylinder or carrier, it is provided with fixed and radially-projecting web-supporting bars 32; and midway between the folding-blades 3 and the cutting-blades 5, at points opposite those occupied by the bars 32, are slacker-bars 33. These slacker-bars 33 are fixed upon shafts 34, that are carried at the ends of arms 35, that swing upon the rods 36, which support the folding-blades 3. These slacker-bars are thus free to vibrate to and from the center of the cylinder, their position relative to its peripheral line being governed by means of the extended ends of their shafts 34, that protrude beyond the heads of the cylinder or carrier, and ride upon face-cams 39, that are fixed to the side frames.

The cylinder or carrier B is provided at opposite points with a swinging fly, which consists of a face-plate, 7, hung to arms 42, that project from a shaft, 43, journaled in plates 44, which constitute a part of the heads of this cylinder or carrier B. Each shaft 43 is provided with a spring, 47, secured to and coiled about it, and fastened at one end to one of said plates 44, in such a manner that the fly it supports is normally seated upon a cross-bar, 48, forming a part of the periphery of this cylinder or carrier, and provided with openings to receive the impaling-pins 6 as the cylinders or carriers revolve. In such position the face-plate 7 of each fly projects at an angle from the peripheral line of the cylinder in a proper position to move past the edge of the cutting-plates 5, thus acting as the opposing member of the web-severing mechanism, and in conjunction with the said cutting-blade 5 to sever the web, as will presently appear.

At points midway between those at which the plate 7 of each fly stands in its normal position this revolving cylinder or carrier B is provided with nipping mechanisms that cooperate with the folding-blades 3. Such nipping mechanisms each consist of a fixed jaw, 51, secured to the heads of the cylinder or carrier, and of a vibrating jaw, 52. These vibrating jaws are each mounted upon a shaft, 53, that is journaled in the cylinder or carrier head, and provided with a spring, 54, that is coiled about said shaft and fast at one end to a fixed arm, 38, projecting inwardly from the segment-plate 55, that forms part of the periphery of the cylinder or carrier and provides a pressing-surface, the purpose of which will be explained.

Each shaft 53 carries fast at one end a rock-arm, 56, that engages a face-cam, 57, and is thereby actuated to vibrate said jaw 52. This cam 57 is composed of two plates, 1 0, the one, 1, of which is fast in place, and the other, 0, of which may be swung upon the shaft 41, so as to extend the bearing-surface of said cam, and hold the vibrating jaw 52 closed a suitable period of time to properly release the folded sheet. Said cam-plate 0 is slotted to embrace a set-screw, 26, that holds this cam-plate in any position of its adjustment.

Each swinging fly co-operates with a sheet-holding-mechanism in accomplishing a flat delivery, as follows: Said sheet-holding mechanism consists of a plate rising vertically from the side frame, and provided with a curved lip, 27, at its upper end, under which is a roller, 28, that is journaled in arms 60 61, fast to a shaft, 62, which shaft rocks in bracket-arms, and is provided with a spring, 163, resting upon the bed-plate, whereby the roller is constantly pressed upward against said lip. The outer edge of the plate 7 of each swinging fly will, when said plate is held against the cross-bar 48 by means of the spring 47, just clear the edge of the lip 27 as the cylinder B is rotated. Each fly is, however, provided at one end with a rock-arm, 63, that extends at a proper angle from its shaft, so that it will, when the plate 7 of the fly reaches a point over the roller 28, engage with a tappet, 64, that rises from the bed-plate, and thus turn the fly outwardly, so that it will bear upon the top of the roller and depress the same. When, however, the cylinder rotates so far as to carry the rock-arm 63 clear of the tappet 64, during which movement the fly has made a semi-rotation, depressed the roller, and also risen with it, the fly will stand in its rearmost position, and if allowed at once to return to its normal position by means of its spring 47 it would (the cylinder at the same time rotating) interfere with the rollers 65 66, and also tend to disengage the sheet from the holding mechanism.

In order to sustain the fly in this rearward position, and near enough to the periphery of the cylinder B for its plate 7 to clear said rollers 65 66 and the sheet, the opposite end of the shaft 43 is provided with a rock-arm, 45, the stud or pin of which rides upon a face-cam, 46, fast to the side frame, and the positions of the arms 45 and 63 are such that, as the plate 7 leaves the roller 28 and the arm 63 is released from the tappet 64, the stud of the arm 45 engages the cam 46, and, following the same, holds the fly in its rearmost position and near the peripheral line of the cylinder, so that it may clear the sheet that has been lodged by it, and also escape the rollers 65 66. The face of this cam 46 is such that the fly, after passing said rollers and lodged sheet, is gradually returned to its foremost position, ready to be

again operated as a member of the severing mechanism and as a member of the flat delivery mechanism.

The cylinder B also carries at points between each set of nipping-jaws and each swinging fly pivoted or hinged folding-blades 29, each of which blades is fast upon a shaft, 67, that is pivoted in the heads of the cylinder B, and held in its closed or normal position by means of a spiral spring, 49, that is fastened at one end to the inner face of said folder, and at the other to the under side of the cross-bar 48. Each of these folding-blades is turned outward at proper times to co-operate with the folding-rollers 65 66, that are journaled in the side arms 68 69 of an adjustable frame, the means for accomplishing which is a finger, 2, projecting at one end of said blade, so as to properly engage a stop, 70, carried at one end of a bar, 71, that is fast to one side of said frame. This adjustable frame consists of the side arms 68 69, which are united by an end bar, 72, at one end, and pivoted to brackets 73 at the other, and its end bar 72 is provided with spring-bolts 74, which enter adjusting-holes in brackets 75, and by which the frame may be secured in a raised or depressed position.

When this frame is raised it holds the stop 70 in a position to be engaged by the finger 2 of the folding-blade 29, and it carries the pinion 76 of the two pinions, 76 77, whereby the folding-rollers 65 66 are geared together and driven in unison into gear with the toothed wheel 40 of the cylinder or carrier B, and by means of a cross-bar, 50, attached to its side arms and overlying the arms 60 61, supporting the roller 28, it depresses said roller, as in Fig. 2, so that it cannot rise under the action of the spring 163 and press the ends of the sheet between it and the lip 27 to arrest the movement of the same. When this frame is raised the once-folded sheet is a second time folded on a line parallel with its first fold by being forced into the nip of the folding-rollers 65 66 by the action of one of the folding-blades 29, as will be explained; and this folded sheet is thus delivered into a supporting-guide constituted by the vertical arms 78, thus standing upon a seat, 79, in a position to be operated upon, and further folded upon lines at right angles to its previous folds by the mechanisms of the vertical folding apparatus, which is arranged below the cylinder or carrier B, and with its mechanisms operating at right angles to those of the primary folding apparatus. This vertical folding apparatus consists of a rotating cylinder or carrier, the axial shaft 80 of which is provided with a bevel-wheel, 81, that engages a similar bevel-wheel, 82, on a cross-shaft, 83, that is revolved in proper time by means of crank-wheels 84, carried fast upon its ends, and connecting-rods pivoted to them and to crank-wheels 85, fast on the ends of the shaft 41 of the cylinder or carrier A.

In order that this vertical folding apparatus may not be uselessly revolved when flat delivery is being accomplished, the bevel-wheel 82 is made to run loosely upon it, and is coupled to said shaft by means of a clutch, 86, splined upon said shaft, and moved in coupling position with said bevel-wheel 82 by means of a shifting-lever, 107, that is preferably operated by the movements of the adjustable frame through the medium of a bell-crank, 88, that is connected to the side bar 68 by a slot and pin, Fig. 1. This cylinder or carrier is provided at opposite points with nipping mechanisms, that consist of stationary jaws 10, that are extended to form pressing-surfaces, and with vibrating jaws 17. The shafts of the vibrating jaws 17 are journaled in the heads of the cylinder or carrier, and project below the lower head thereof, where their ends are provided with rock-arms 89, that bear upon a face-cam, 90, that vibrates said jaws to close them at proper intervals, and at suitable times permit the springs 19, which connect the rear ends of said jaws behind their shafts with the central shaft 80, to open and hold open said vibrating jaws. This cylinder or carrier is also provided at points properly distant from the nipping-jaws with hinged folding-blades 15, the shafts of which are journaled in the cylinder-heads, and provided with arms, to which springs 14 are fastened and connected to the shaft of the carrier, so that these folding-blades will normally be held in a closed position just within the peripheral line of the cylinder or carrier. The lower ends of these folding-blades are cut away, as at 8, so that their full part will, as their carrier revolves, first engage a stop, 9, projecting from the end of a bar that is fast to the frame-work, and be swung outwardly to enter between folding-rollers 58 59, and then escape from said stop 9 by reason of the cut-away part 8 passing over said stop. These folding-rollers 58 59 are journaled in the frame-work, and are geared together so as to run in unison by means of toothed wheels 91 92, the latter deriving motion from a toothed wheel, 93, carried upon the shaft 80 at the lower end of the cylinder or carrier. At one side of this cylinder or carrier a double folding-blade, 94, is journaled in the frame-work, so that its blades may be projected between the arms 78 and enter between the nipping-jaws 17 10. The shaft of this folding-blade is provided near its lower end with rock-arms 95, that at suitable times are engaged by a stud, 4, projecting beyond the periphery of the cylinder or carrier, by the action of which said blade is partially rotated to enter between the nipping-jaws and be withdrawn therefrom. When withdrawn said blade is held in proper position to have one of its opposite rock-arms engaged by means of holding-pins 96 at the lower extremity of its shaft, which pins ride a double crown-cam, 97.

In front of the folding-rollers 58 59 are provided two angularly-arranged packing-boxes, 100, with their mouth ends just before the said folding-rollers, and in these packing-boxes a vibrating packer, 25, is arranged to so play

that it receives each alternate sheet emerging from between said rollers on opposite sides of it, and sweeps the same in succession into the packing-boxes 100, carrying the sheet past fixed projecting spring-fingers 11 and against sliding packing-heads 101, between which fingers and heads said sheets are retained in the boxes as the packer moves in the opposite direction. These fingers 11 might be rigid and project from a vertical shaft, 102, at the lower end of which is carried a rock-arm provided with a cam-piece, 13, that is engaged by a tappet, 12, on the foot of the packer 25, whereby the fingers are moved away to admit the sheet past them and returned to retain said sheet as the packer vibrates. This packer is vibrated by means of a shaft, 103, at the end of which is a crank-wheel, 104, whose crank-rod is reciprocated by an eccentric, 105, on the shaft 80 of the cylinder or carrier.

This folding delivering apparatus is mounted with the axes of the cylinders or carriers A B parallel with those of the impression-cylinders I I I and type-cylinders T T T of a rotating or web-perfecting printing-machine, so that the printed web passing from said printing-machine may be carried directly to said cylinders or carriers and within the range of action of their mechanisms. This combination with the printing mechanism is shown in Fig. 5, and it is to be understood that such figure illustrates one only of a great variety of web-perfecting printing-machines with any of which my delivery apparatus may be combined.

It being understood that the web of paper passing from the roll W and under a leading roller, R, is printed upon its opposite sides or perfected by passing between the impression-cylinder I and type-cylinder T, which print one side, and between the impression-cylinder I I and type-cylinder T T, which print the other side, and that, thus perfected, it is led under a roller, L, and introduced into the delivery mechanism by having its free forward or leading end impaled upon the pins 6, which act as a means of controlling said leading end and carrying it within the range of action of the mechanisms of the delivery apparatus, the manipulation of said perfected web by the delivery apparatus will be described.

For the present purposes of such description it will be assumed that the adjustable frame that carries the folding-rollers 65 66, is depressed, as in Figs. 1 and 4.

With the end of the web thus held upon the cylinder or carrier A by the pins 6, it will, as the said cylinder or carrier rotates, be stretched over the supporting-bars 32, folding-blades 3, and slacker-bars 33, successively, and, thus held, the web will be in this manner continuously laid upon the cylinder or carrier A, and be impaled by the pins 6 near each point of its ultimate severance, whereby its leading portion is cut off to form a sheet. As the cylinders or carriers A and B rotate in unison, and the folding-blade 3 is brought into co-operation with the jaws 51 52, it enters the web between said jaws while the latter one, 52, stands open, as in Fig. 5, during which action of the folding-blade the ends of the shaft of the slacker-bar 33, passing onto the low parts of the cams 39, withdraw said bar toward the center of the carrier A, and slacken the web to a sufficient extent to compensate for the portion doubled by the blade 3 between the jaws 51 52. The rock-arm 56 of the jaw 52 then engaging the cam 57 is rocked thereby, thus vibrating said jaw and closing it toward the fixed jaw 51, to seize or nip the doubled edge of the web, as in Fig. 4, while the folding-blade 3 is withdrawn from between said jaws, and the cutting-blade 5 is simultaneously swung outward by means of its rock-arm 24 engaging the tappet 23, Fig. 5, to release the leading end of the web or strip the same from off the holding-pins, as in Fig. 4. The jaws 51 52, held closed by the cam 57, carry the web by the doubled edge of it that is nipped between them onward toward the folding-rollers 65 66, the free end of said web being thereby drawn onward over a spring pressing-plate, 87, and lapped and pressed upon the body of the web by said plate bearing it against the pressing-surface 55. (See Fig. 2.) When the cylinders or carriers have so far rotated as to bring a fly into co-operative position with the edge of a cutting-blade, 5, the plate 7 of such fly will press the body of the web past the serrated edge of said cutting-blade and cause the severance of the web in a transverse line, thus detaching a sheet from the web and providing said web with a new leading end, which being held upon the pins 6 remains within the control thereof, whereby its onward movement to have the operations just described repeated upon it is insured.

The detached sheet still held by the nipping-jaws is carried onward until its rearmost edges, now lapped together, just overlie the lip 27, whereupon the plate 7 of the fly passing over the edge of said lip is detained and turned outward and rearward by its arm 63 engaging the tappet 64, thus clamping the rear edges of said sheet upon the roller 28 and forcing said roller downward far enough to carry the extremities of the sheet past the edge of the lip 27, and then rising and passing off said roller, leaving said edges held between the roller and lip, as in Fig 4.

At the moment the plate 7 thus clamps the rear edges of the sheet the arm 56 of the vibrating jaw 52 passes off from the cam 57, and thus allows the jaw 52 to open and release the doubled edge of the sheet, the forward portion of which sheet then drops down onto the rollers 65 66, where it is held by the roller 28 and lip 27.

As successive sheets are thus folded and laid flat in a pile they are from time to time removed.

The sheets as thus manipulated will be single sheets once folded. They may, if desired, be converted into unfolded half-sheets or supplements by putting into operation a supple-

ment-cutting apparatus, which is constructed as follows: The shaft 53 of the vibrating jaw 52 carries arms 98, to the outer ends of which is attached a cutting-blade, 16, which is guided in an opening made for its reception in said jaw, and these arms 98 are connected by means of springs 99, coiled about the shaft 53, with the arms 18, by which the jaws are fixed to said shaft.

The jaw 52 is thus so connected to its shaft by these springs 99 that when the shaft has been rocked far enough to close said jaw upon the fixed jaw 51 said shaft may be further moved to reciprocate the blade 16 past the inner face of the jaw 51, and thus cut off the doubled edge of the sheet clamped by said jaws, thereby converting the single folded sheet into two single half-sheets.

The additional throw of the rock-arms 56 is accomplished at will by means of a curved segment cam-piece, 37, that is capable of moving laterally upon guide-pins by means of an adjusting-screw, 106, whereby said cam-piece may be moved inwardly to enlarge the face of the cam 57, so that it shall impart a sufficient throw to the arm 56, and thus both close the jaw and move the cutting-blade 16.

At the lower side of the cylinder B is shown a modified form of cutter, which, instead of co-operating with the jaw 51 as its edge, has connected with it a spring-blade, 108, that is fast at one end only, and extends diagonally across the edge of the cutting-blade 16, and, being a spring-blade, it hugs the edge of the blade 16, and thereby produces a shearing cut.

If it is desired to impart additional folds to the once-folded sheet, this may be accomplished by raising the adjustable frame, as before described, whereby the rollers 65 66 are properly raised, the bar 71 is lifted to carry the stop 70 into position to operate the folding-blades 29, and the roller 28 is depressed, so that the tails of the once-folded sheets may not be seized and held between said roller and the lip 27.

Thus adjusted, the finger 2 on the folding-blade 29 will engage the stop 70 and be turned outward, and thereby be caused to enter the once-folded sheet upon a line parallel with its first fold into the nip of the rollers 65 66, and this will be accomplished just immediately before the forward end of such sheet is released by the nipping-jaws 51 52. The folding-blade having entered the sheet into the rollers, and said rollers having nipped the same, the blade will be withdrawn from the rollers, while the sheet will be carried through them and delivered between the guide-arms 78, when it will stand vertically upon the rest 79 in a proper position to be doubled at right angles to its former folds by the action of the folding-blade 94, which will enter it into the nipping-jaws 10 17, which will carry it before the folding-rollers 91 92, through which it will be again folded by the folding-blade 15 and delivered before the packer 25, to be packed in the box 100, as before explained.

What is claimed is—

1. The combination of a rotary mechanism for printing a web of paper, a web-severing mechanism for dividing it into sheets, and a rotating sheet-folding mechanism, all substantially as described.

2. The combination of a mechanism for printing a web of paper, a mechanism for severing said web into sheets, a mechanism for controlling the severed end of the web and delivering it to the folding mechanism, and a rotating sheet-folding mechanism, all substantially as described.

3. A folding-blade mounted in a revolving carrier, in combination with folding-rollers, into whose nip or bite it doubles and delivers the sheet, 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,

W. J. PRATT.